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JUN 23 2020

DEPARTMENT OF DESIGN AND CONSTRUCTION

CITY AND COUNTY OF HONOLULU

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CDD-B 20-815941

June 15, 2020

Mr. Keith Kawaoka, Acting Director
Office of Environmental Quality Control (OEQC)
Department of Health
State of Hawaii
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Mr. Kawaoka:

SUBJECT: Chapter 343, Hawaii Revised Statutes (HRS) Draft Environmental Assessment (DEA)
Farrington Highway Improvements
Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, Oahu, Hawaii)

With this letter, the City and County of Honolulu, Department of Design and Construction (DDC), hereby transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the Farrington Highway Improvements from Kapolei Golf Course Road to Fort Weaver Road, Ewa District on the Island of Oahu, for publication in the June 23, 2020 edition of *The Environmental Notice*.

We are transmitting a completed OEQC Publication Form, a shapefile for the action location boundary, and an electronic (searchable) PDF copy of the DEA via the OEQC online submittal form.

Should you have any questions, please contact Charmaine Tadjvar of the Civil Division at 768-8820 or our consultant, Tracy Camuso of G70, at 523-5866 or by email at tracyc@g70.design.

Sincerely,

FOR Mark Yonamine, P.E.
Director

CT:HK:pto
Enclosures
cc: G70 (w/o enclosures)

20-290

From: webmaster@hawaii.gov
To: HI Office of Environmental Quality Control
Subject: New online submission for The Environmental Notice
Date: Tuesday, June 16, 2020 3:55:54 PM

Action Name

Farrington Highway Improvements (Kapolei Golf Course Road to Fort Weaver Road)

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

ʻEwa, Oʻahu

Tax Map Key(s) (TMK(s))

Multiple

Action type

Agency

Other required permits and approvals

Letter of Map Revision (LOMOR), Clean Water Act Section 404 and Section 401, National Pollutant Discharge Elimination System (NPDES), Disability and Access Communication Board (DCAB), Stream Channel Alteration Permit, Section 106 National Historic Preservation Act (NHPA) and HRS 6E, Historic American Buildings Survey (HABS)/ Historic American Engineering Record (HAER) Documentation, work within Utility Energy Corridor, Intersection Work within the ROW, Grading, Excavation, and Stockpiling Permit, Site Development Permit, Street Usage Permit, Traffic Signalization Approval, Trunk Water Transmission Line Approval

Proposing/determining agency

City and County of Honolulu Department of Design and Construction (DDC) – Civil Division

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United States
Map It

Was this submittal prepared by a consultant?

Yes

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Honolulu, HI 96813
United States
Map It

Action summary

Improvements to Farrington Highway are being proposed to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation along an approximately three-mile section of Farrington Highway in the ‘Ewa region. The project is planned to improve the two-lane section of Farrington Highway, between Kapolei Golf Course Road and Old Fort Weaver Road, to a four-lane roadway, as well as installation of a new roadbed, curbs, gutters, sidewalks, and a landscaped median strip. The project will require relocation of transmission and distribution utilities to accommodate improvements, along with new bridge construction and drainage improvements. The ‘Ewa region is outgrowing existing infrastructure and will require upgrades to meet planning and design standards. The project will meet these demands through improvements to the transportation and utility infrastructure.

Reasons supporting determination

Refer to Chapter 5.0 of the EA

Attached documents (signed agency letter & EA/EIS)

- OEQC-transmittal_Draft-EA-Publication.pdf
- FarringtonHighwayImprovements_DraftEA_June2020.pdf

Action location map

- FarringtonHwyProjectArea.zip

Authorized individual

Tracy Camuso

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this

submission.

FARRINGTON HIGHWAY IMPROVEMENTS

DRAFT ENVIRONMENTAL ASSESSMENT

KAPOLEI GOLF COURSE ROAD TO FORT WEAVER ROAD
KAPOLEI, O'AHU, HAWAI'I

APPLICANT:

PREPARED BY:

111 S. KING STREET, SUITE170
HONOLULU, HI 96813

JUNE 2020

FARRINGTON HIGHWAY IMPROVEMENTS

Kapolei Golf Course Road to Fort Weaver Road
Kapolei, Oʻahu, Hawaiʻi

Draft Environmental Assessment

This environmental document is prepared in accordance with the requirements of Chapter 343, Hawaiʻi Revised Statutes and Hawaiʻi Administrative Rules, Title 11-200.1, Department of Health.

Proposing Agency:

City and County of Honolulu
Department of Design and Construction
650 South King Street, 11th Floor
Honolulu, Hawaii 96813

Prepared by:

Architecture . Planning . Civil Engineering
111 South King Street, Suite 170
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JUNE 2020

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ABBREVIATIONS

AECOS	AECOS, Inc
ALISH	Agricultural Lands Important to the State of Hawai‘i
BMP	Best Management Practice
BWS	Board of Water Supply
Charter	Charter Communications
CIA	Cultural Impact Assessment
City	City and County of Honolulu
CSH	Cultural Surveys Hawai‘i
cy	cubic yards
CZM	Coastal Zone Management
dBA	Decibels
DBEDT	Department of Business, Economic Development, and Tourism
DCAB	Disability and Access Communication Board
DDC	Department of Design and Construction
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Recourses
DNL	Day-Night Average Sound Levels
D&O	Decision and Order
DOH	Department of Health
DOT	Department of Transportation
DP	Development Plan
DPP	Department of Planning and Permitting
DR Horton	DR Horton, Inc., Schuler Division
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact

ft	foot/feet
GHG	Greenhouse Gases
GP	Grace Pacific Corporation
GPS	Global Positioning System
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HAR	Hawai‘i Administrative Rules
HART	Honolulu Authority for Rapid Transit
HECo	Hawaiian Electric Company
HEER	Hazard Evaluation and Emergency Response Office
HFD	Honolulu Fire Department
HPD	Honolulu Police Department
HRS	Hawai‘i Revised Statutes
HTCOM	Hawaiian Telecom
HTIC	Hawai‘i Tokai International College
IBC	International Building Code
ITS	Intelligent Transportation System
JTS	Joint Trunking System
kV	kiloVolt
LID	Low Impact Development
LOS	Level-of-service
LRFI	Literature Review and Field Inspection
LSB	Land Study Bureau
LTS	Level of Traffic Stress
LUC	Land Use Commission
LUO	Land Use Ordinance
LUST	Leaking Underground Storage Tank
mph	miles per hour
MOE	Measures of Effectiveness
MSL	Mean Sea Level
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OEQC	Office of Environmental Quality Control

PUC	Primary Urban Center
QMC-WO	Queens Medical Center West Oʻahu
OHA	Office of Hawaiian Affairs
OIBC	Oʻahu Island Burial Council
OMPO	Oʻahu Metropolitan Planning Organization
ORTP	Oʻahu Regional Transportation Plan
OTWC	Oceanic Time Warner Cable
PEQI	Pedestrian Environmental Quality Index
PIM	Public Infrastructure Map
PUC	Primary Urban Center
QMC-WO	Queen's Medical Center West Oʻahu
ROH	Revised Ordinances of Honolulu
ROW	Right-of-Way
SEC	State Energy Corridor
sf	square feet
SFP	State Functional Plans
SHPD	State Historic Preservation Division
SHWS	State Hazardous Waste Site
SLR	Sea Level Rise
SLUBA	State Land Use Boundary Amendment
SLXRA	Sea Level Rise Exposure Area
SMA	Special Management Area
SOBA	Southern Oʻahu Basal Aquifer
TCQSM	Transit Capacity and Quality of Service Manual
TIAR	Transportation Impact Analysis Report
TMK	Tax Map Key
TOD	Transit-Oriented Development
UDP	Urban Design Plan
UH	University of Hawaiʻi
UHWO	University of Hawaiʻi, West Oʻahu
USFWS	Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tanks
V/C	Volume to Capacity Ratio

Executive Summary

In accordance with the requirements of Chapter 343, Hawai‘i Revised Statutes (HRS), and Hawai‘i Administrative Rules (HAR), Title 11-200.1, Department of Health (DOH) an Environmental Assessment (EA) has been prepared for the Farrington Highway Improvements project as it is located on City and State lands and utilizes City and State funds.

The purpose of the Farrington Highway Improvements project is to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation options along an approximately three-mile section of Farrington Highway in the ‘Ewa region. The project is planned to improve the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. This section of the roadway is the final remaining portion of Farrington Highway between Kapolei and Waipahu, that is currently un-improved, with no sidewalks, curbs, gutters, medians, turn lanes, or bike lanes. Considered as a secondary route connecting the two regions, this section of roadway serves as a potential bottleneck between Kapolei and Waipahu, where Farrington Highway currently consists of four lanes. It also serves the last portion of the ‘Ewa region that primarily remains undeveloped in terms of existing land use, consisting of large sections of agricultural use and some limited light industrial uses.

The Farrington Highway Improvements project includes widening of the roadway as well as installation of a new roadbed, low impact development (LID) drainage infrastructure, curbs, gutters, sidewalks, bridges, culverts, potential stream channel hardening, utility relocations, bike lanes, and a landscaped median strip. A future phase of the project may consist of providing two additional travel lanes, one in each direction, for a total of six lanes. Preliminary designs for the future roadway will utilize the median and planter area within the planned project right-of-way (ROW) to support the expansion.

No significant adverse environmental impacts are anticipated from the construction or operation of the planned improvements. While short-term construction related impacts may occur to air quality and the acoustic environment, impacts will be mitigated with the implementation of Best Management Practices (BMPs) and compliance with applicable State DOH regulations. A Grading Permit and National Pollutant Discharge Elimination System (NPDES) permit will be obtained for construction and erosion control measures will be implemented as outlined in the City’s Rules Relating to Water Quality.

The planned roadway improvements will have a minimal effect on views within the corridor as no structures are being proposed. Significant adverse impacts to rare, threatened, or endangered species or habitat areas are not expected to occur as a result of the project. Archaeological and historic resources identified within the project area will be surveyed and documented, in consultation with the State Historic Preservation Division (SHPD) and compliance with the HRS 6E review process.

The Farrington Highway Improvements project is anticipated to generate beneficial cumulative impacts for the regional traffic flow and multimodal connectivity. The improved roadway infrastructure will help to offset the traffic impacts of growth in the area resulting from existing and planned developments. The project will improve sub-regional mobility and result in less congestion within the regional transportation network. In addition, the improvements will support planned multimodal infrastructure such as bike and pedestrian facilities and access to the mass transit system in East Kapolei, as outlined in regional planning and guidance documents.

Chapter 1

Introduction

Chapter 1

Introduction

1.1 Project Information Summary

Type of Application:	Environmental Assessment to meet the requirements of Hawai‘i Revised Statutes (HRS) Chapter 343
Name of Action:	Farrington Highway Improvements - Kapolei Golf Course Road to Fort Weaver Road
Proposing Agency:	City and County of Honolulu (City) Department of Design and Construction (DDC) 650 South King Street, 11th Floor Honolulu, HI 96813 Contact: Charmaine Tadjvar, Project Manager Phone: (808) 768-8388
Agent:	Group 70 International, Inc. dba G70 111 South King Street, Suite 170 Honolulu, HI 96813 Contact: Tracy Camuso, AICP, Associate Principal Telephone: 808-523-5866
CH. 343, HRS Trigger:	Use of City and State Lands and Use of City and State Funds
Project Location:	The roadway section is located on Farrington Highway, between Fort Weaver Road and Kapolei Golf Course Road, in Kapolei, Island of O‘ahu, Hawai‘i (*Figure 1-1*).
Tax Map Key (TMK):	Multiple (*Figure 1-2*)
Land Ownership:	State of Hawai‘i, City and County of Honolulu, private lands, and public and private utilities
Land Area:	The alignment is approximately 3.1 miles or 16,294 linear feet (ft).
State Land Use District:	Agriculture and Urban Districts *(Figure 1-3)*

City/County Zoning:	The existing Farrington Highway roadway parcel is not zoned. The alignment borders the following zoning districts: AG-1 (Restricted Agricultural District), AG-2 (General Agricultural District), BMX-3, (Community Business Mixed Use District), and A-2 (Medium Density Apartment District) *(Figure 1-4)*
City/County 'Ewa Development Plan:	Urban Land Use Map: Residential and Low-Density Apartment, Medium Density Apartment/Commercial Mixed Use, Public Institution Public Facilities Map: Urban, Agriculture and Preservation Areas (*Figure 1-5 and 1-6*)
Special Management Area (SMA):	Not located in SMA *(Figure 1-7)*
Flood Zone:	Zone A, X, AE, AEF, D *(Figure 3-7)*
Tsunami Zone:	Not located in the Tsunami Inundation Zone *(Figure 3-8)*
Anticipated Determination:	Finding of No Significant Impact (FONSI)

1.2 Overview of the Planned Project

The 'Ewa region is steadily urbanizing and slowly outgrowing existing infrastructure. The remaining undeveloped areas, particularly along Farrington Highway between Kapolei Golf Course Road and Fort Weaver Road, are slated for development by both public and private agencies. As such, roadways within the regional and sub-regional network are expected to experience an increase in multimodal transportation demand, and these roadways will require upgrades to meet applicable planning and design standards.

Improvements to Farrington Highway are being proposed to proactively enhance sub-regional roadway connectivity and mobility. The planned improvements will increase roadway capacity to support growing demands anticipated from future developments, accommodate multimodal transportation options, including but not limited to sidewalks, bus stops, bike lanes, or future rail transit systems.

Farrington Highway Route 93 traverses leeward O'ahu connecting 'Ewa and the Wai'anae coast. It is a major east-west arterial route between Waipahu and Kapolei, frequently traveled as an alternative route to the H-1 freeway. The State of Hawai'i and the City have ownership of the roadway alignment, and maintenance is provided by the City.

1.3 Purpose and Need for the Proposed Project

The purpose of the Farrington Highway Improvements project is to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation options along an approximately three-mile section of Farrington Highway in the 'Ewa region. The location of this section is shown in *Figure 1-1.*

1.3.1 Implement Approved Plans and Meet Future Transportation Demands

The area around Farrington Highway between Kapolei Golf Course Road and Fort Weaver Road is currently undeveloped. However, there are many planned developments emerging along the corridor include educational, commercial, residential, resort and industrial projects in this growing region of Oʻahu. Major projects in the region include the University of Hawaiʻi West Oʻahu (UHWO), DR Horton, Inc., Schuler Division's (DR Horton) Hoʻopili master planned community, Department of Hawaiian Home Lands (DHHL) East Kapolei residential and commercial developments, Ko ʻOlina Resort, Kalaeloa Harbor, Royal Kunia Phase II, and a collection of Kapolei Property Development projects including Kapolei West, Kapolei Harborside, and Makaīwa Hills.

With the area's expected growth in population and employment comes an increase in vehicle traffic and the need to plan appropriately to meet growing transportation demands. Future transportation demands are evaluated by both State and County-level planning agencies and their studies manifest in the form of transportation plans and recommended priority project lists. Legislation and adopted transportation plans often serve as the local authority for implementing and funding transportation projects. On Oʻahu, the State of Hawaiʻi Department of Transportation (DOT) and the City share the responsibility of implementing adopted transportation plans and developing major roadways. The Farrington Highway Improvements project is listed as a planned project and/or is consistent with the objectives of the following relevant long-range planning and policy documents:

- City and County of Honolulu General Plan (Revised 2017)
- Hawaiʻi 2050 Sustainability Plan (2008)
- ʻEwa Development Plan (July 2013)
- ʻEwa Highway Master Plan (2011)
- Oʻahu Metropolitan Planning Organization (OMPO) Oʻahu Regional Transportation Plan 2040 (April 2016)
- Transportation for Oʻahu Plan 2025 (April 2001)
- ʻEwa Roadway Connectivity Study (2009)

1.3.2 Respond to Regional Land Use and Economic Development Changes

The Oʻahu General Plan directs population growth and development activity to the Primary Urban Center (PUC) and ʻEwa Development Plan (DP) areas over the next 25 years. The ʻEwa DP implements the General Plan for the ʻEwa region. The DP designates ʻEwa as a Secondary Urban Center for Oʻahu to relieve development pressures on Oʻahu's rural areas and to provide diverse housing types not available in the PUC. The Secondary Urban Center includes the anchor City of Kapolei and many other master planned developments including UHWO, DR Horton's Hoʻopili, DHHL East Kapolei Developments, Ko ʻOlina, Kalaeloa, Royal Kunia Phase II, Kapolei West, Kapolei Harborside, and Makaiwa Hills. Some of these developments are currently underway, such Hoʻopili, which will provide 11,750 residential units and approximately 3.76 million square feet (sf) of business/commercial and light industrial space. This master planned community is scheduled for completion in 2035 and will require necessary infrastructure to support the developed expansion of the area.

The ‘Ewa region has been and will continue to be the location for rapid population growth for the island. ‘Ewa has experienced dramatic population growth over the past 20 years. Between 2000 and 2010 the population grew by nearly 50%, and the trend is anticipated to continue with the population anticipated to increase 70% between 2010 and 2040 (*Table 1-1*).

Table 1-1 Historic and Projected ‘Ewa Population Growth

Population	2000 (actual)	2010	2020	2035	% Change 2000-2010	% Change 2010-2040
‘Ewa Region	68,696	101,397	148,384	172,679	47%	70%

Source: ‘Ewa Transportation Impact Fee 2020 Update: Final Compilation Report; ‘Ewa Watershed Management Plan: Public Review Draft, 2017; Central O‘ahu Transportation Study: Final Report with Recommendations, December 2019

Employment in the ‘Ewa region has increased at a substantial rate, more than doubling in ten years between 2000 and 2010. The ‘Ewa population is projected to continue to grow in the following 15 years between 2020 and 2035 (*Table 1-2*).

Table 1-2 Historic and Projected ‘Ewa Employment Growth

Employment	2000 (actual)	2010	2020	2035	% Change 2000-2010	% Change 2010-2040
‘Ewa Region	19,938	43,440	76,741	115,778	117%	166%

Source: ‘Ewa Transportation Impact Fee 2020 Update; O‘ahu Regional Transportation Plan 2040; Population and Economic Projections for the State of Hawa‘i 2040

The planned improvements to Farrington Highway will provide necessary regional infrastructure improvements to increase roadway capacity and serve the growing number residents and employees anticipated beyond 2035 in the 'Ewa region.

1.3.3 Improve Sub-Regional Mobility

Farrington Highway will serve as an east-west arterial to Kapolei Parkway, Kūalaka'i Parkway, Renton Road/Roosevelt Avenue and provide interconnectivity between north/south roadways and access to planned developments. These additional roadway connections and additional intersection improvements will improve sub-regional mobility and efficiency, and relieve congestion within the sub-regional transportation network.

1.3.4 Increase Multimodal Transportation

Rapid population growth and rapid development sets the stage for an equally rapid increase in passenger and freight travel. An integrated and efficient multimodal transportation system contributes to the overall quality of life of passengers through increased safety, economic productivity, and environmental preservation. The proposed Farrington Highway Improvements project will assist with implementing planned multimodal infrastructure (pedestrian, bicycle, vehicle, bus, and rail transit facilities) such as those referenced in the following regional planning and guidance documents.

- Bike Plan Hawai‘i (2003)
- Kapolei Area Bikeway Plan (1991)
- O‘ahu Bike Plan (2019)
- East Kapolei Neighborhood TOD Plan - Public Review Draft #2 (2020)
- Complete Streets (HRS Section 264-20.5)

1.4 Purpose of the Environmental Assessment

In accordance with the requirements of Chapter 343, HRS, and Hawai‘i Administrative Rules (HAR), Title 11-200.1, Department of Health (DOH) an Environmental Assessment (EA) has been prepared as the planned project is located on City and State lands and utilizes City and State funds. The EA examines the potential environmental impacts of the Farrington Highway Improvements project and seeks agency and public comment on subject areas that should be addressed. The DDC is the approving agency for this EA.

This EA is presented in eight sections and includes the following: a detailed summary and project description; a description of alternatives; a list of necessary permits and approvals; a description of the environmental setting; a section that identifies potential impacts and proposed mitigating measures on identified natural, cultural, and socioeconomic resources as well as existing infrastructure; a discussion of the project’s relationship to State and County land use plans and policies; the findings supporting the anticipated determination; a list of preparers of the EA, a list of references used in developing the EA; and a list of agencies, organizations, and individuals that participated in the pre-consultation and draft phases of the EA.

Upon publication of the Draft EA, a 30-day review period of the Draft EA will commence at which time public comments will be received and addressed to the extent feasible within the project scope. A Final EA will be prepared, highlighting key areas of the document that are revised, updated, or modified based upon information received during the public comment period.

No significant adverse environmental impacts are anticipated from the construction or operation of the planned improvements associated with the project. Upon acceptance of the Final EA, it is anticipated that DDC will issue a FONSI.

1.5 Approvals and Permits

The following permits and approvals listed in *Table 1-3* may be required from federal, State, and City agencies to implement the proposed action:

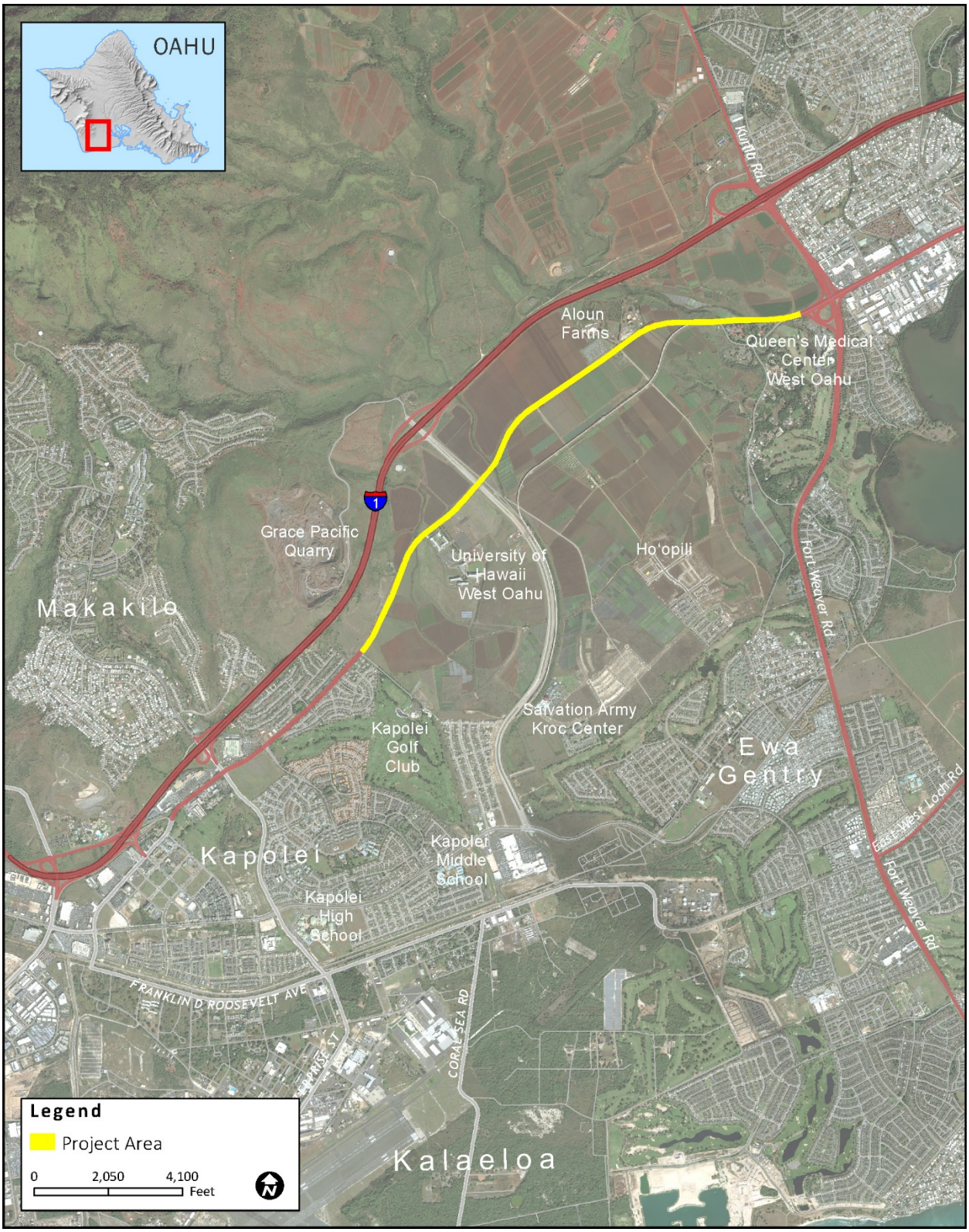
Table 1-3 List of Required Government Permits and Approvals

Agency	Permit or Approval
Federal	
Federal Emergency Management Agency (FEMA)	Conditional Letter Of Map Revision (CLOMR) and Letter Of Map Revision (LOMR)
U.S. Army Corps of Engineer	Clean Water Act Section 404 Permit

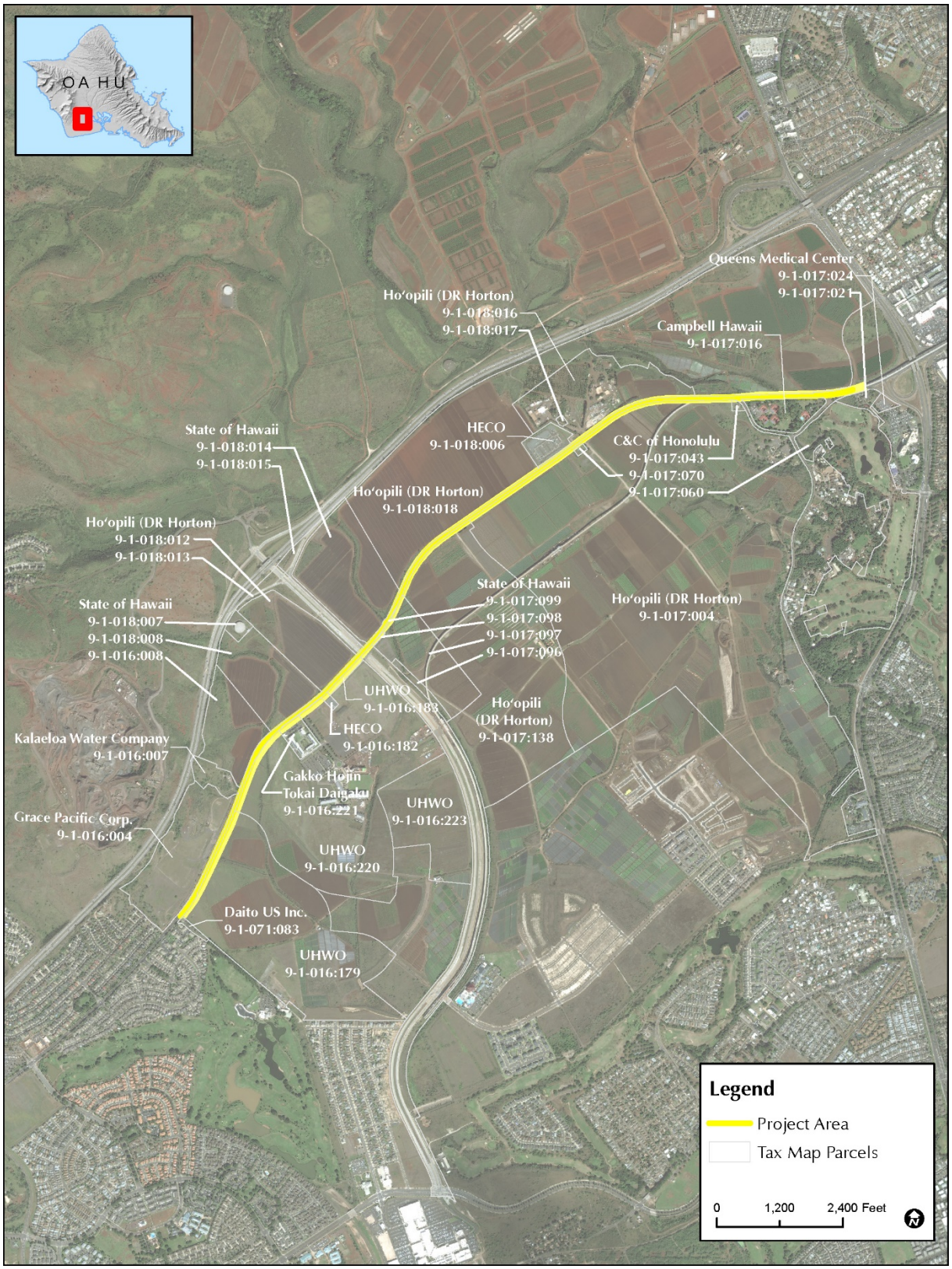
Table 1-3 (cont.) List of Required Government Permits and Approvals	
Agency	**Permit or Approval**
State	
Department of Health	Clean Water Act Section 401 Permit
Department of Health	National Pollutant Discharge Elimination System (NPDES) Permits
Department of Health	Noise Permit (and noise variance if nighttime construction is anticipated)
Department of Health	Disability and Access Communication Board (DCAB) review for ADA compliance
Department of Land and Natural Resources (DLNR), Commission on Water Resource Management	Stream Channel Alteration Permit
DLNR State Historic Preservation Division	Section 106 National Historic Preservation Act and Hawai‘i Revised Statutes, 6E Compliance
DLNR State Historic Preservation Division	Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) Documentation for Historic Bridges
Department of Transportation, Harbors Division	Work within Utility Corridor
Department of Transportation, Highways Division	Intersection Work within the Right-of-Way
City and County of Honolulu	
Department of Planning and Permitting	Grading, Excavation and Stockpiling Permit
Department of Planning and Permitting	Site Development Permit
Department of Transportation Services	Street Usage Permit
Department of Transportation Services	Traffic Signalization Approval
Honolulu Board of Water Supply	Trunk Water Transmission Line Approval
Private Utilities	
Hawaii Gas	Work within Utility Corridor
Hawaiian Electric	Work within Utility Corridor
PAR Hawaii	Work within Utility Corridor

1.6 Agencies, Organizations and Individuals Contacted during the Pre-consultation Process

A Pre-Consultation Memo and Participant Letter was distributed on August 25, 2017 to initiate the environmental review process. A list of agencies and other parties that were presented notice of the proposed project or were contacted during the pre-consultation and draft period of the EA is provided in *Chapter 8.0* of this document. Additionally, a listing of agencies that were provided an opportunity to review the EA is also provided in *Chapter 8.0*.

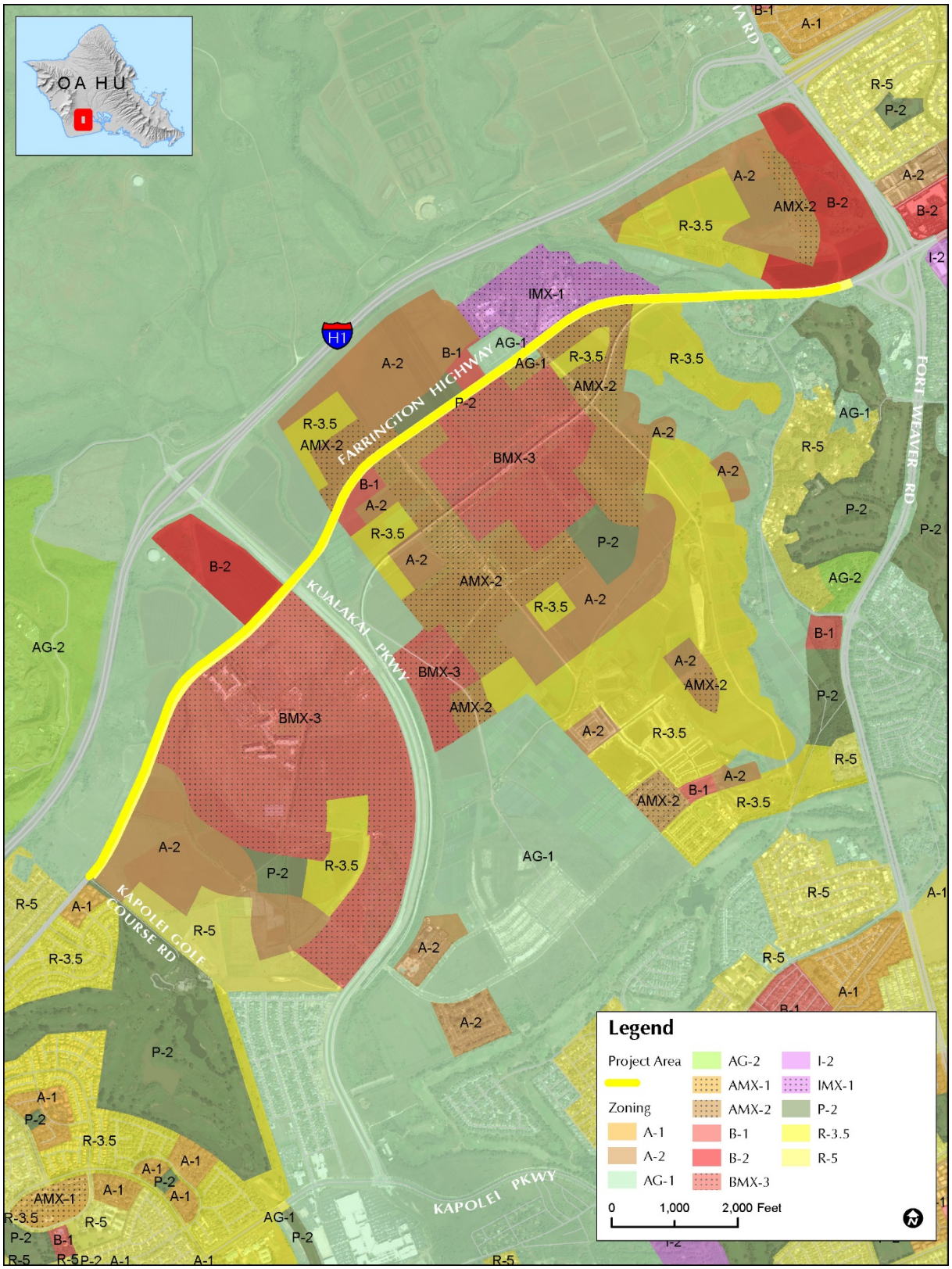


Project Location **Figure 1-1**

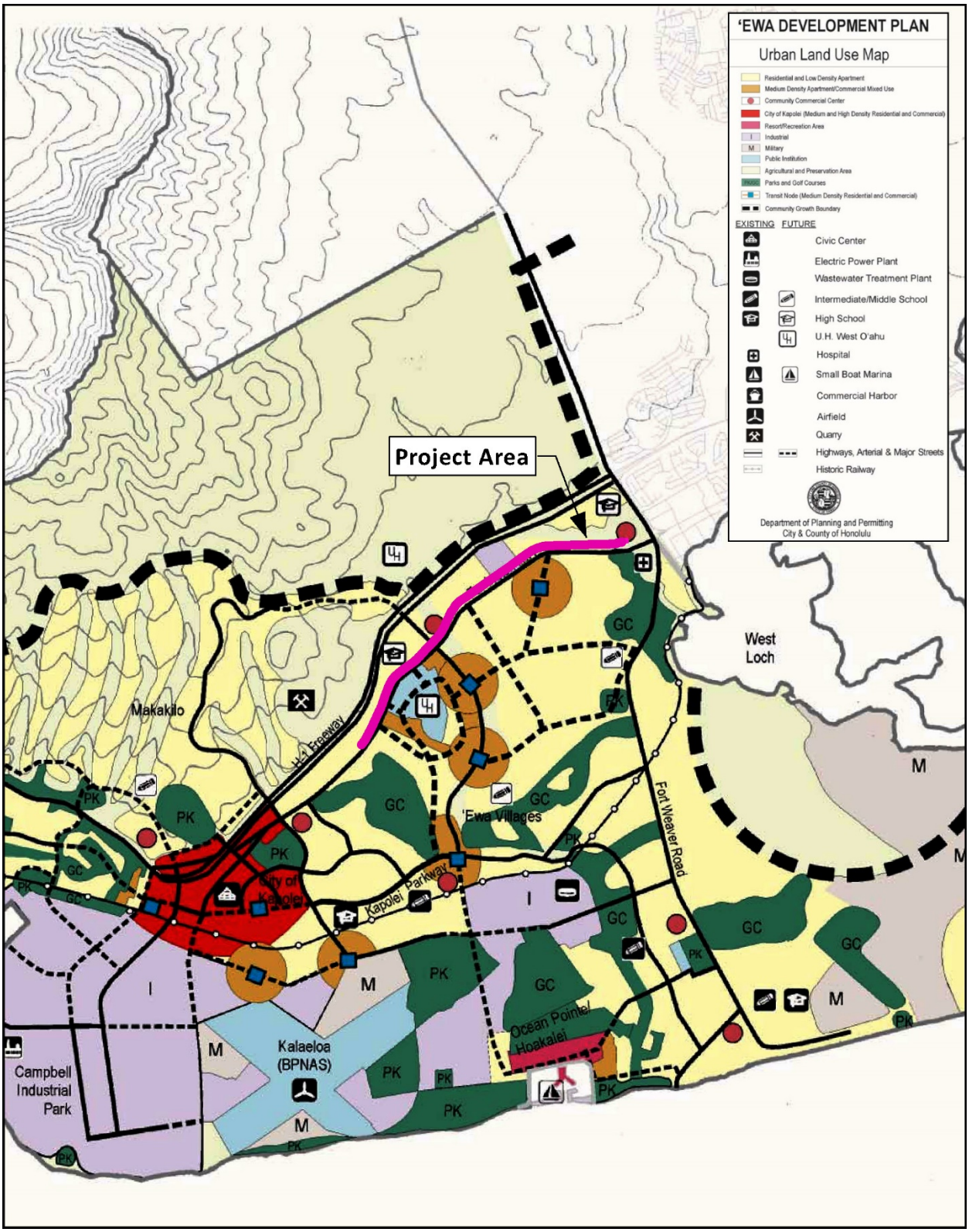


Tax Map Key **Figure 1-2**

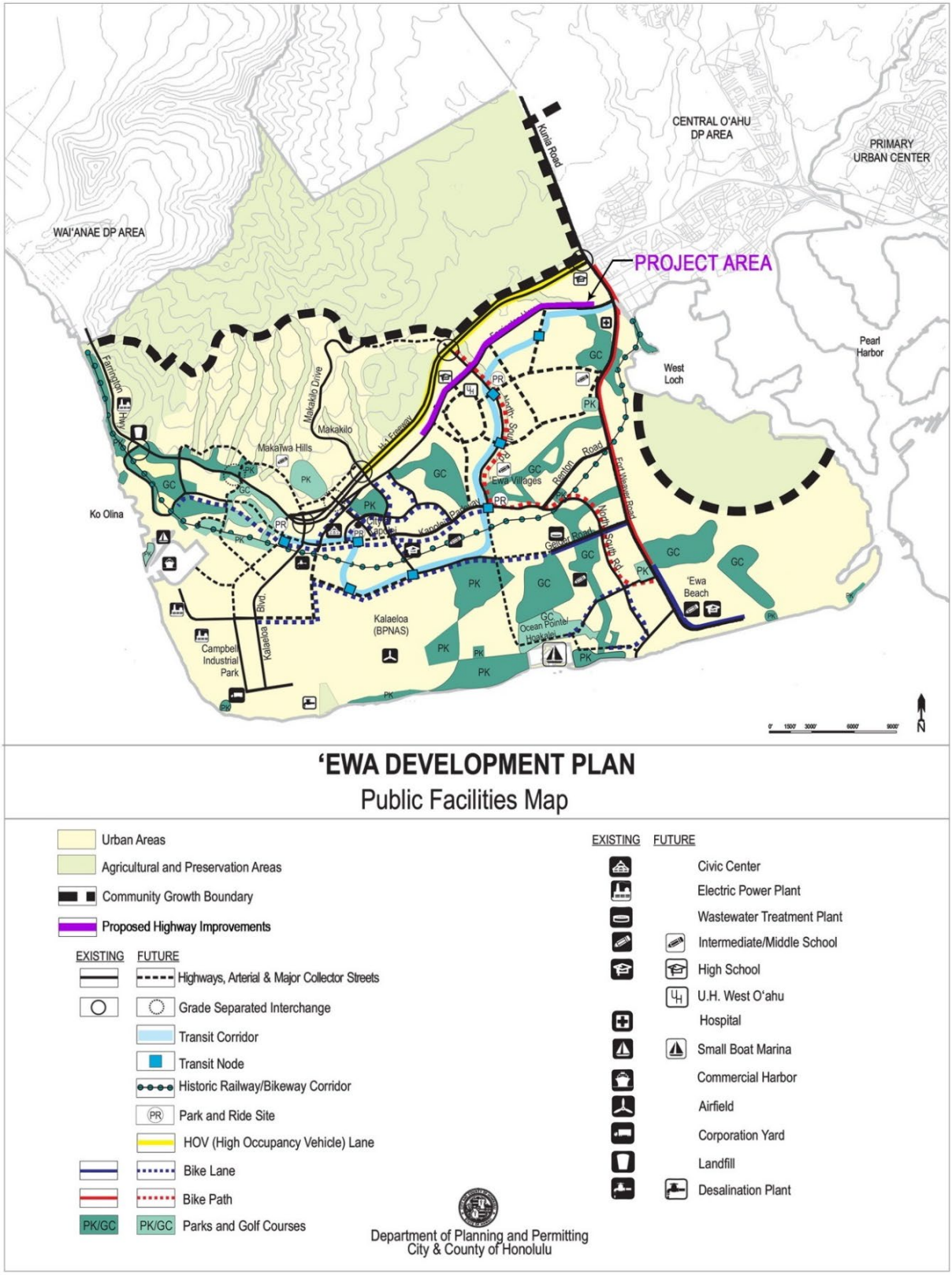
State Land Use District **Figure 1-3**



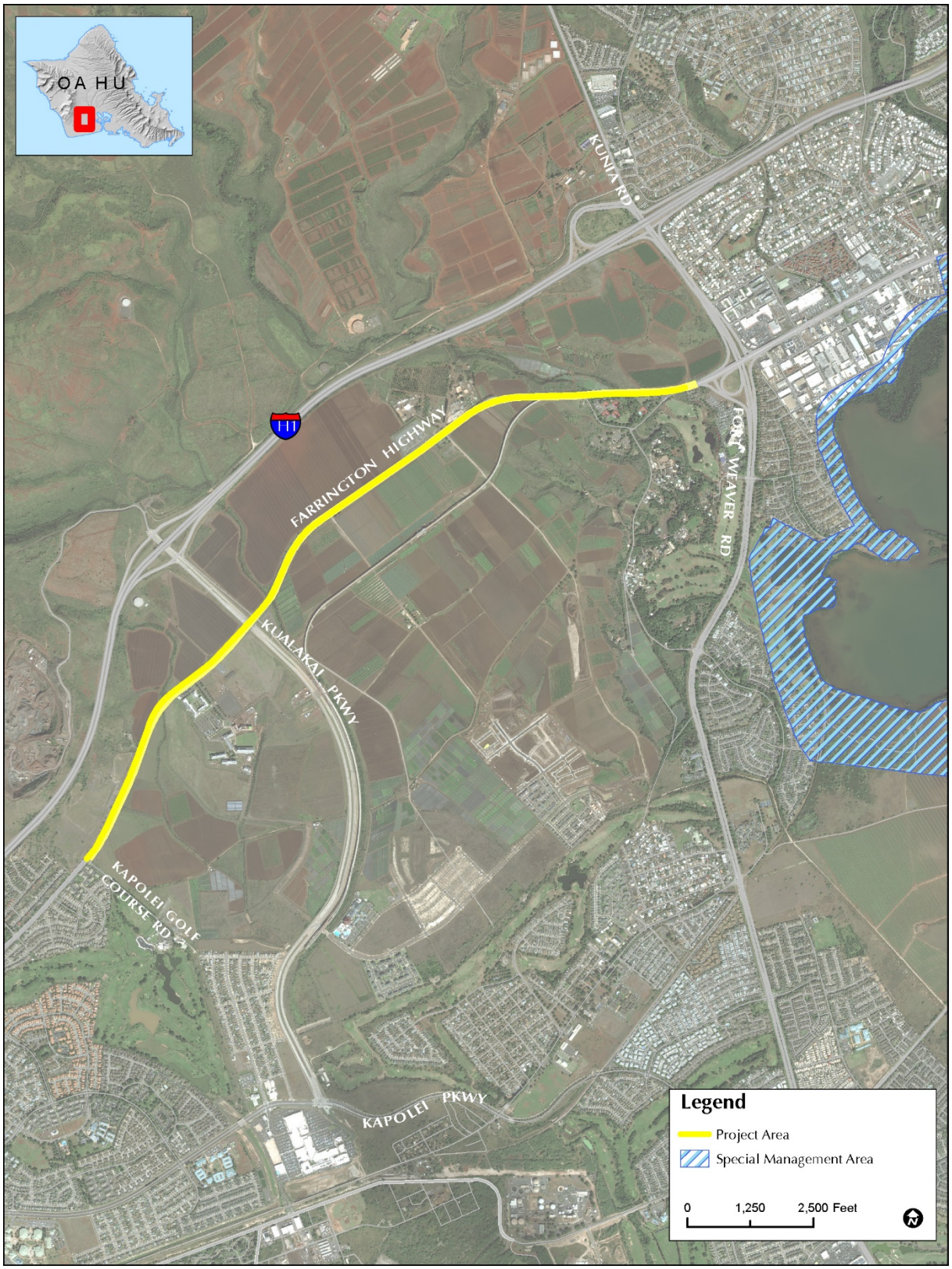
City and County of Honolulu Zoning **Figure 1-4**



City and County of Honolulu, 'Ewa Development Plan (2013) Land Use Map **Figure 1-5**



City and County of Honolulu, 'Ewa Development Plan (2013) Public Facilities Map **Figure 1-6**



City and County of Honolulu Special Management Area **Figure 1-7**

Chapter 2

Description of the Project

Chapter 2

Description of the Project

2.1 Project Location and Characteristics

Location

Farrington Highway Route 93 traverses leeward Oʻahu connecting ʻEwa and the Waiʻanae coast. It is a major east-west urban minor arterial route between Waipahu and Kapolei, frequently traveled as an alternative route to H-1. The study limits for the project focuses on Farrington Highway between Kapolei and Waipahu, specifically from Fort Barrette Road in Kapolei to the ʻEwa side of the Fort Weaver Road grade separated intersection ramps. The project's study limits are focused on Farrington Highway due to both its regional and sub-regional importance. Within the study limits, the narrow two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road limits both sub-regional connectivity and mobility, as the roadway does not comply with current City design standards.

Ownership

Farrington Highway is owned and maintained by the City; and the State of Hawaiʻi owns and maintains Kūalakaʻi intersection and Fort Weaver Interchange. Ongoing discussions between the City and the State DOT may result in a future change of ownership of Farrington Highway.

While the Farrington Highway Improvements project is being proposed by the City, if State funds do become available, the project may be completed by the State DOT.

Adjacent Land Uses

In between Kapolei and Waipahu, approximately three miles of Farrington Highway consists of a two-lane undivided and un-improved roadway. The majority of the area adjacent to this section of roadway is undeveloped or used primarily for agriculture and light industry. Utilization of this roadway is typically limited to sub-regional traffic serving these developments, including a quarry, agricultural operations, Phase 1 of the UHWO, and construction relating to the Honolulu Authority Rapid Transit (HART) rail development, and the DR Horton Hoʻopili community.

2.2 Existing Conditions

Farrington Highway is a major east-west transportation facility that is traveled as a secondary route between Kapolei and Waipahu, in lieu of the Interstate H-1 Freeway. While Farrington Highway connects regions throughout leeward Oʻahu, it also functions as a sub-regional arterial and connector that provides access within the cities of Kapolei and Waipahu. Farrington Highway intersects with many north-south roadways along its route, including Fort Barrette Road, Kealanani Avenue, Kūalakaʻi Parkway, and Fort Weaver Road. These roadways form a network of vehicular thoroughfares in the Kapolei region, linking residential, commercial, educational, and industrial land uses in their neighborhoods, and provide interconnectivity on a regional, sub-regional, and local scale.

The configuration of Farrington Highway in leeward O‘ahu varies from point to point. Within Kapolei and Waipahu, Farrington Highway consists of four asphalt-paved travel lanes (two in each direction), with medians, turn pockets, or turn lanes in some locations. Sidewalks, curbs, gutters, and planter strips line one or both sides of the roadway. Bus stops are provided at regular intervals. In addition, bike lanes are provided along Farrington Highway in Kapolei.

Between Kapolei and Waipahu, a large section of Farrington Highway narrows to a two-lane, un-improved and undivided roadway that primarily serves agricultural land. Historically, Farrington Highway served as an agricultural roadway for the sugar cane plantation. Over the years, this section of the original roadway was improved with asphalt pavement, striping, streetlights, and bus stops. This roadway does not include sidewalks, curbs, gutters, a median, turn lanes, or bike lanes.

2.3 Proposed Project and Alternatives Considered

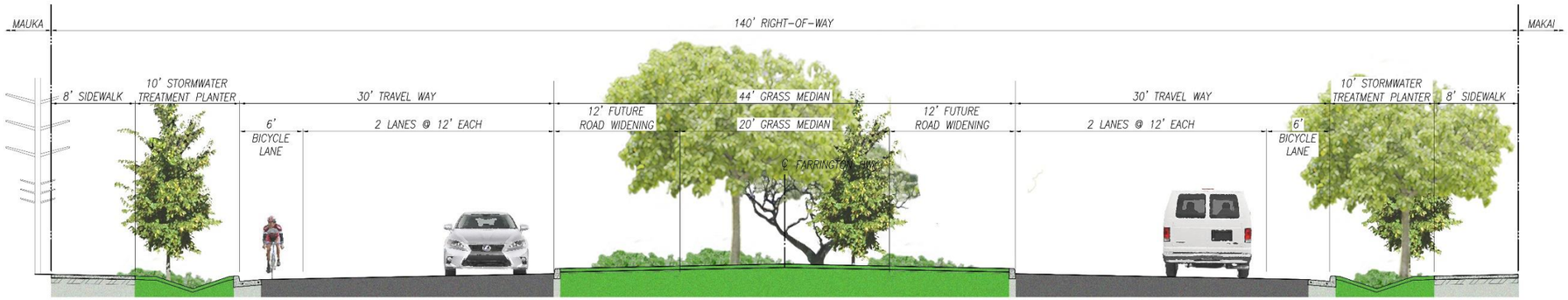
2.3.1 Proposed Project

The Farrington Highway Improvements project is planned to improve the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. This approximately three-mile section of roadway is the final remaining portion of Farrington Highway between Kapolei and Waipahu, that is currently un-improved, with no sidewalks, curbs, gutters, medians, turn lanes, or bike lanes. Considered as a secondary route connecting the two regions, this section of roadway serves as a potential bottleneck between Kapolei and Waipahu, where Farrington Highway currently consists of four lanes. It also serves the last portion of the ‘Ewa region that primarily remains undeveloped in terms of existing land use, consisting of large sections of agricultural use and some limited light industrial uses.

The project includes widening of the roadway as well as installation of a new roadbed, low impact development (LID) drainage infrastructure, curbs, gutters, sidewalks, bridges, culverts, potential stream channel hardening, utility relocations, bike lanes, and a landscaped median strip. The project will provide additional vehicular capacity through improvements to the transportation and utility infrastructure, and meet current State roadway standards. The project will serve the anticipated growth from planned projects in the area, such as the UHWO, the Ho‘opili master-planned community, DHHL East Kapolei Developments, and the HART rapid transit system. Additionally, a multimodal analysis will consider all users of the transportation facility.

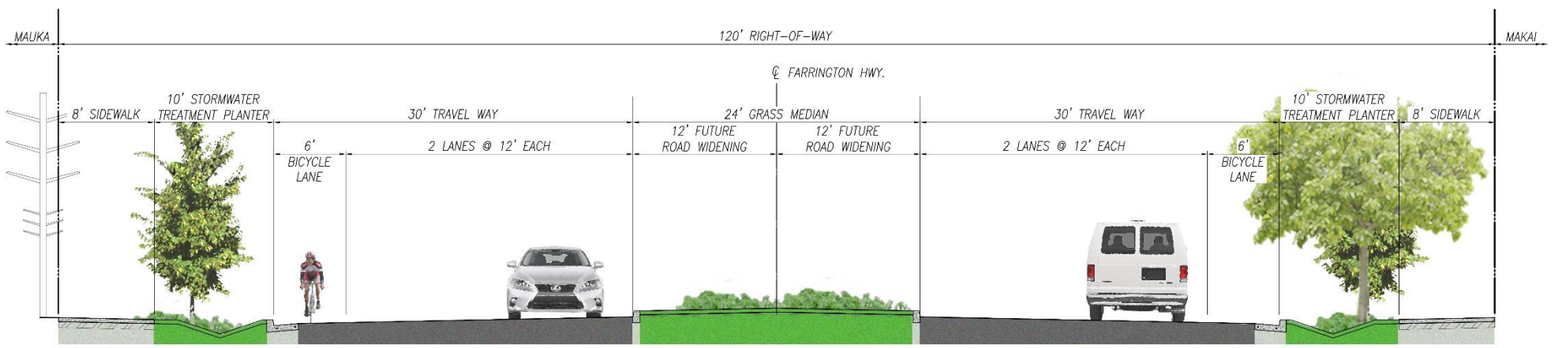
The project is constrained by existing infrastructure including above-ground power transmission lines, an electrical substation, two Board of Water Supply (BWS) pump stations, water transmission lines, the State’s Energy Corridor, other underground transmission and distribution utilities, structures, bridges, and roadway culverts. Additional constraints include the narrow and varying width of the existing right-of-way (ROW) and efforts to protect in-place the existing Kahi Mohala Behavioral Health Facility and Sullivan Care Center at Queens Medical Center West O‘ahu (QMC-WO), Hawai‘i Tokai International College (HTIC) and the UHWO. The project must also accommodate the existing HART Railway Alignment along Farrington Highway fronting Ho‘opili and Kahi Mohala.

The Farrington Highway project area will be located within a typical 140-foot ROW and 120-foot ROW in some stretches, such as the BWS Farrington Booster Pump Station. The planned typical section of the roadway is shown in *Figure 2-1*. The project is designed as a four-lane divided roadway with east-bound and west-bound roadbeds separated by a 44-foot wide raised landscaped median. The landscaped median will provide an aesthetically pleasing urban arterial and is designed to accommodate future road widening. At intersections where double-left turns are anticipated, the median is planned to be four-feet wide. The proposed site plans for the roadway improvements are shown in *Figure 2-2*.



SECTION 1 - 4-LANE 140-FT WIDE RIGHT-OF-WAY

SCALE: 1" = 5'



SECTION 2 - 4-LANE 120-FT WIDE RIGHT-OF-WAY

SCALE: 1" = 5'

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI, 'EWA, O'AHU, HAWAI'I

TYPICAL SECTION 1 & 2

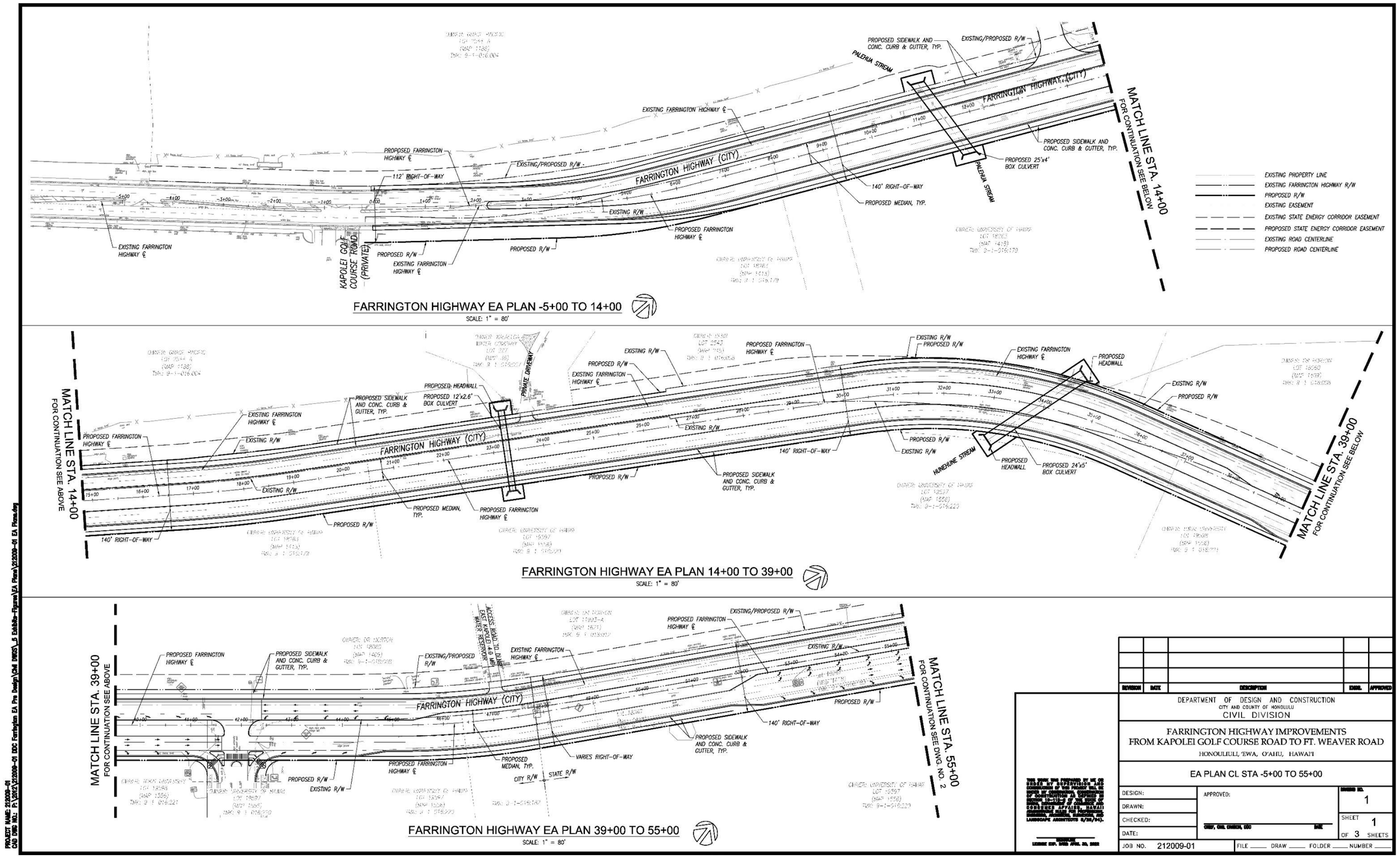
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
JOB NO. 212009-01
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE
DRAWING NO. C-002
SHEET 2 OF 48 SHEETS
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Old DWGS_5 EA\Alts-Figures\EA Plans\212009-01 EA Typ Sections.dwg

DRAFT DRAFT DRAFT

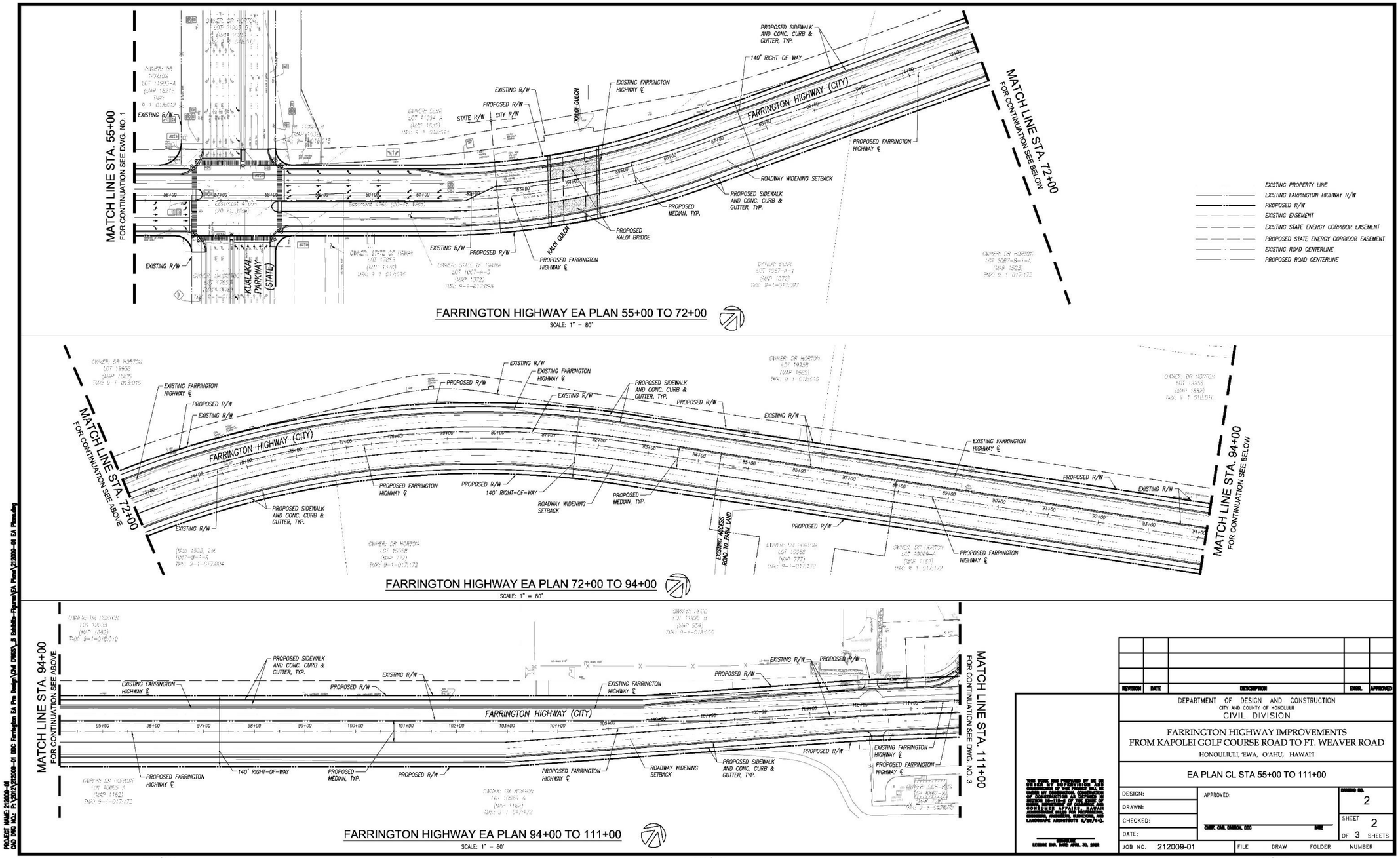
Typical Roadway Section

Figure 2-1



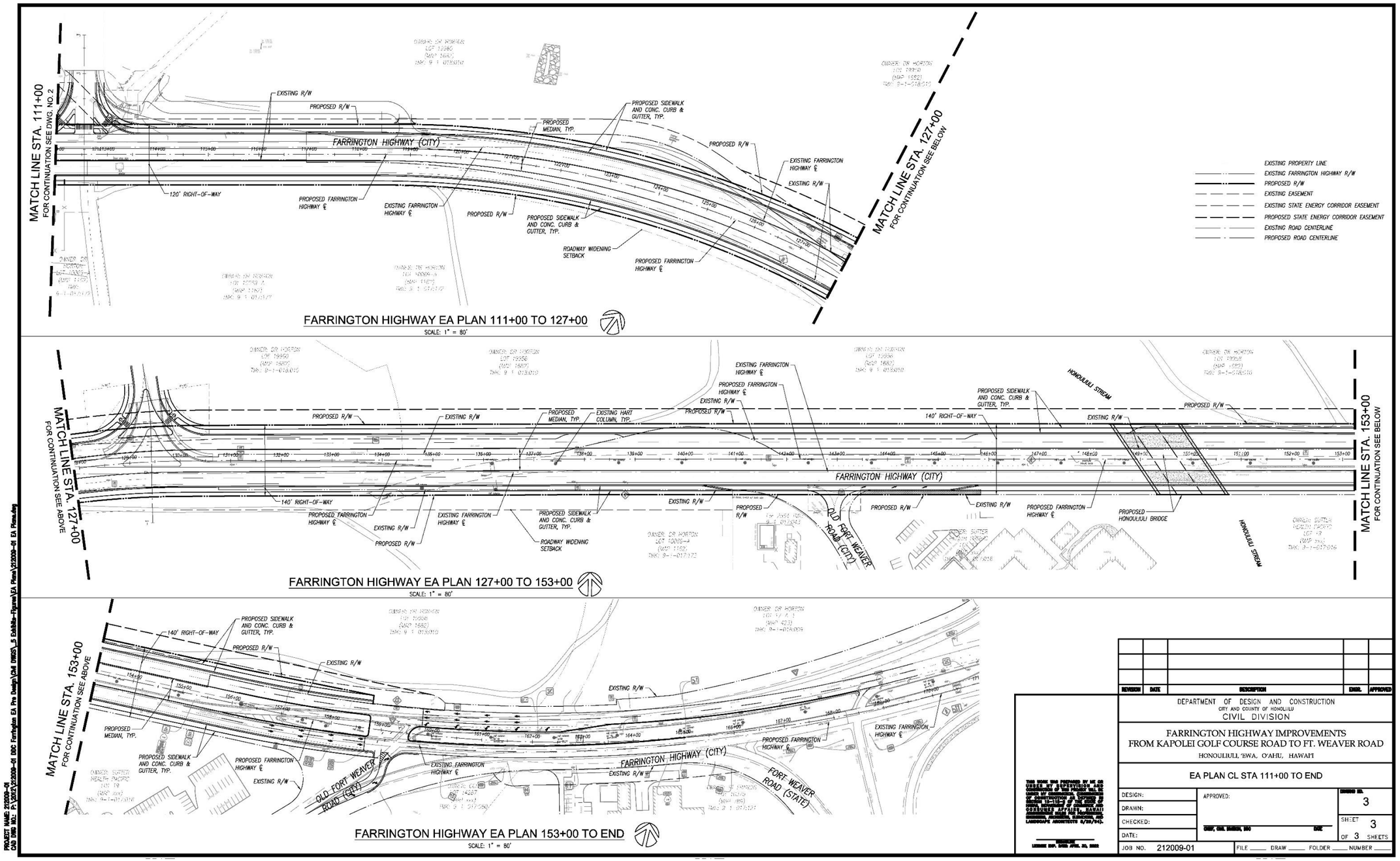
Proposed Site Plan

Figure 2-2 (Part 1)



Proposed Site Plan

Figure 2-2 (Part 2)



Proposed Site Plan

Figure 2-2 (Part 3)

Each roadbed in the project area will be 30-feet wide between curb faces, allowing an inside 12-foot lane, a 12-foot outside lane, and a 4-foot bike lane next to a 2-foot gutter. The roadway design will provide 8-foot sidewalks on both sides of Farrington Highway, and incorporate a drainage system as part of the planned project. There will also be 10-foot landscaped planters on both sides of Farrington Highway.

The existing pavement and base may be recycled into a low strength cement which would minimize off-site hauling and disposal, and the need for bringing new base material to the project site. Construction of the roadway may include the use of concrete pavement to promote less rolling resistance, fuel use, and less air pollutants. Increased thickness of the pavement may be applied to support future restoration. Concrete materials may also include structural microfibers and CO2 storage. Additional design details relating to construction of the roadway will continue to be refined as the project progresses. The roadway section is designed to be in general compliance with the State of Hawai‘i’s requirements, the American Association of State Highway Transportation Officials requirements, and the Transportation Research Board Access Management Manual guidance.

The planned four-lane roadway will follow the alignment of the existing roadway to minimize ROW impacts to adjacent property owners. Most of the existing mauka ROW will be maintained and widening of the road will primarily occur makai of the existing roadway. This design will allow for the preservation and protection of several existing utilities and design constraints, including the State’s Energy Corridor, and Hawaiian Electric Company’s (HECo) large diameter steel electrical transmission poles.

Curves along the alignment will be lengthened in certain locations to provide greater sight distance and improve traffic safety. Existing access points and driveways along Farrington Highway will be adjusted to meet the planned roadway section. Plans for future access points and intersections for the approved residential land use changes along this route will be addressed as these future development projects advance toward construction. The minimum distance requirements for intersections will be consistent with the Transportation Research Board’s Access Management Manual.

Drainage culverts along Farrington Highway will be replaced, to convey off-site runoff mauka of the roadway and prevent flooding of the roadway. Utilities will also be relocated, as required, to install the planned improvements. At the bridge locations, utilities may remain in-place, buried under the stream, or carried under the bridge decking. Bridges within the project area will likely need to be demolished and reconstructed to provide for the additional roadway width. Accordingly, coordination with the SHPD will be carried out in compliance with federal and State historic preservation laws.

At the intersection with Kūalaka‘i Parkway, Farrington Highway will consist of two designated left turn lanes, two through lanes, and one right turn only lane in both directions. Kūalaka‘i Parkway at the intersection will be restriped from one left turn lane to two designated left turn lanes in both directions. Kūalaka‘i Parkway will consist of three through lanes and a designated right turn lane. There will be no additional improvements to Kūalaka‘i Parkway.

The project improvements will meet traffic mitigation requirements identified in City planning studies, various development plans, as well as the Transportation Impact Analysis Report (TIAR).

Future Phase (Year 2035)

The future phase of Farrington Highway may consist of widening two additional travel lanes, one in each direction, for a total of six lanes. The future phase should not require additional ROW width for the straight roadway segments or require an increased footprint. However, at the intersection areas, additional ROW may be needed. Preliminary designs for the future roadway will utilize the median and planter area within the planned project ROW to support the expansion.

The future phase of Farrington Highway is expected to serve additional growth in the ‘Ewa region through 2035 and beyond. By the year 2035, several of the significant master planned developments in the region will be completed, including the full buildout of DR Horton Hoʻopili community which will provide 11,750 residential units and approximately 3.76 million square feet (sf) of business/commercial and light industrial space. The future phase of Farrington Highway will also help to support roadway infrastructure requirements conditioned under the State Land Use Commission (LUC) Decision & Order (D&O) (Docket A06-771) for the Hoʻopili Development, as part of the approved State Land Use Boundary Amendment (SLUBA) in 2012. DR Horton is also obligated to comply with transportation-related conditions in the 2015 Change of Zoning approval and unilateral agreement executed with the City (Ordinance 15-13). Development of the six-lane roadway will be coordinated with appropriate State and City agencies to ensure planning and construction adequately support the long-range needs of the ‘Ewa region. *Section 3.15 (Roadways and Traffic)* of the EA provides a detailed examination of traffic conditions for the planned project as a four-lane roadway and the 2035 future phase (six-lane roadway). As the ‘Ewa region and Secondary Urban Center continues to expand, full buildout of the Farrington Highway future phase will provide the necessary regional infrastructure to support regional needs.

2.3.2 Alternatives Considered

No Build Alternative

Future improvements to Farrington Highway have been identified within various long-range planning documents related to the development in ‘Ewa, including the Oʻahu Regional Transportation Plan (ORTP) 2040 and ‘Ewa Development Plan (July 2013).The No-Build Alternative assumes that no improvements to Farrington Highway would occur and that it would remain as a two-lane roadway in its current condition. The No-Build Alternative would not improve the capacity of Farrington Highway for future demand generated by adjoining developments. In addition, approved master planned projects such as the DR Horton Hoʻopili community would not satisfy roadway infrastructure requirements, as conditioned under the State LUC D&O (Docket A06-771). The phased development of Hoʻopili (11,750 residential units and approximately 3.76 million sf of commercial and light industrial space) and other projects being developed in this region would not be supported with an adequate transportation system.

Under the No-Build Alternative, the planned four-lane expansion of Farrington Highway would not occur. In addition, the future phase six-lane roadway expansion would not occur, and the infrastructure needed to accommodate the expected growth for the ‘Ewa region by 2035 would not be met. The existing roadway and intersection at Kūalakai Parkway would continue to operate at LOS F and would not meet the State DOT’s recommended LOS D for transportation facilities. Farrington Highway would not be upgraded to meet applicable planning and design standards to support the regional and sub-regional roadway network required to accommodate increased multimodal transportation needs of the area. As such, the No-Build Alternative is not considered a reasonable or desirable alternative.

Modified Roadway Design Alternative

The Modified Roadway Design Alternative consists of a standard City Subdivision Rules and Regulations ROW and roadway section ROW, for this portion of Farrington Highway. Under this alternative, the roadway would have similar horizontal and vertical geometric alignments as the planned project, with the same ROW width to follow the City's Subdivision Rules and Regulations, as modified to comply with Complete Streets Standards. There would be adjustments made to the dimensions of standard travel lanes, shoulders, bike lanes, and the landscaped median, as shown below in *Table 2-1*. Considerations for complete streets and multimodal transportation would be included in the project design. The Modified Roadway Design Alternative would consist of reconstruction of the roadway pavement, installation of drainage infrastructure, reconstruction of two bridges at the stream crossings, curb and gutter improvements, intersection improvements, utility relocations, and new street lighting and traffic signal improvements.

Table 2-1 Modified Roadway Design

Feature	Proposed Improvements Alternative	Modified Roadway Design Alternative
No. of Lanes (Planned Project)	4	4
No. of Lanes (Future Phase)	6	6
Lane Width	12 foot	10 feet (with 2-foot edge stripe or gutter)
Planter Width	10 feet	10 feet
Bike Lane	6 feet (including 2-foot gutter)	7 feet (each side, separated from the vehicular traffic)
Sidewalk Width	8 feet	6 to 8 feet
Curb & Gutter Width	2 feet	2 feet
Median Width	44 feet	44 feet
ROW Width	140 feet	140 feet

As noted above, the total width of the roadway section typically will not vary, but the features will differ in lane widths, bike lanes, and sidewalks. Nearby constraints along the corridor, such as the BWS pumping stations and the HECo 'Ewa Nui Switching Station, would be comparable to the planned project as the overall roadway section will be the same with a varied ROW.

Under the Modified Roadway Design Alternative, the Kūalaka'i Parkway intersection with Farrington Highway would be grade-separated (compressed diamond configuration) to provide better level of service (LOS) for vehicular traffic, meeting the DOT preferred LOS D operation, improved capacity, and controlled turning movements. During the future phase expansion of Farrington Highway to a six-lane road, this configuration would be planned to pass over the existing six-lane Kūalaka'i Parkway. Ramp terminals along Farrington Highway would be signalized while on-ramps would merge and combine with existing traffic lanes on Kūalaka'i Parkway.

Several concepts for a future phase grade-separated intersection design at Kūalaka'i Parkway and Farrington Highway were considered to meet the DOT's preferred LOS D operation. However, the grade

separated intersection designs would require significant property acquisitions to accommodate the diamond-configured on-ramps and off-ramps. The ramps would also affect adjacent property owners and limit access to adjacent properties as the ramp lengths would block driveway access to each property. The proximity of the new grade-separated intersection to the H-1 Freeway would also require difficult weaving patterns with vehicles merging onto Kūalakaʻi Parkway. Finally, the cost to develop the grade separated intersection would be substantially higher than the planned project of an at-grade intersection. For these reasons, the Modified Roadway Design Alternative was eliminated from further consideration.

The Farrington Highway Improvements project will accept a lower LOS for vehicular traffic at Kūalakai Parkway in lieu of the Modified Roadway Design Alternative. This intersection is expected to operate at LOS F with the construction of an at-grade intersection for the planned project and future phase six-lane roadway expansion. While the planned at-grade intersection design may not meet the State DOT's recommended LOS D for transportation facilities, it will provide additional capacity and mitigation that would not otherwise be provided.

Delayed Construction Alternative

Under this alternative, construction of the Farrington Highway improvements to a four-lane roadway would be delayed and planned to occur at a later time. This alternative would keep Farrington Highway as a two-lane roadway in its current condition until a later date when the planning and design would commence. The existing roadway and intersection at Kūalakai Parkway would continue to operate at LOS F and would not meet the State DOT's recommended LOS D for transportation facilities. A delay in construction of the project would also not meet the pressing transportation demands anticipated to be generated by the planned developments in this area, such as DR Horton's Hoʻopili, the UHWO expansion, and the DHHL residential and commercial developments.

Hoʻopili is currently being developed in phases, with over 500 homes occupied as of May 2020. It is anticipated that Hoʻopili will reach full buildout of 11,750 homes by 2035, which will result in a substantial population increase and greater use of Farrington Highway. Should construction of Farrington Highway improvements be delayed under this alternative, the completion of Phase I of the Hoʻopili project would be adversely impacted as transportation roadway capacity would be overwhelmed and function at a poor level of service. In addition, the Delayed Construction Alternative could potentially also impact Hoʻopili's construction phasing and planned full buildout schedule.

This alternative was eliminated from further consideration as the delayed construction of improvements to Farrington Highway would not meet the transportation demands from adjoining developments in a timely manner and would result in significant adverse impacts to traffic operations in the area. In addition, the future phase of the roadway expansion to a six-lane roadway would also be delayed, thereby increasing cumulative traffic-related impacts in the ʻEwa region.

2.4 Land Acquisition

The City will need to acquire property along the Farrington Highway frontage to implement the project. The Farrington Highway roadway improvements will be typically 140-feet wide, with variations in ROW width at specific locations along the project area, requiring approximately 51 acres to accommodate the ROW for over 3.1 miles. The landowners adjacent to the Farrington Highway project that will be affected by the increased ROW are shown in *Table 2-2*. Discussions are underway to negotiate acquisition with landowners, defining the area limits based on the final design and existing ROW width of Farrington Highway.

Table 2-2 Land Acquisition		
Tax Map Key	**Landowner**	**Land Area (acres)**
9-1-017:004	Hoʻopili (DR Horton)	1.28
9-1-017:172	Hoʻopili (DR Horton)	8.35
9-1-018:008	Hoʻopili (DR Horton)	0.02
9-1-018:010	Hoʻopili (DR Horton)	4.14
9-1-018:012	Hoʻopili (DR Horton)	0.01
9-1-018:018	Hoʻopili (DR Horton)	0.01
9-1-017:016	Sutter Health Pacific	0.06
9-1-017:043	City and County of Honolulu	0.02
9-1-017:070	City and County of Honolulu	0.05
9-1-018:015	State of Hawaiʻi	0.01
9-1-016:008	State of Hawaiʻi	0.08
9-1-017:096	State of Hawaiʻi	0.55
9-1-017:097	State of Hawaiʻi	1.65
9-1-017:098	State of Hawaiʻi	0.36
9-1-017:099	State of Hawaiʻi	0.27
9-1-016:182	Hawaiian Electric Company	0.50
9-1-016:183	University of Hawaiʻi, West Oʻahu	1.36
9-1-016:220	University of Hawaiʻi, West Oʻahu	3.74
9-1-016:179	University of Hawaiʻi, West Oʻahu	3.86
9-1-016:221	Gakko Hojin Tokai Daigaku	0.81
9-1-016:007	Kalaeloa Water Company	0.01
9-1-016:004	Grace Pacific	0.07

2.5 Summary of Project Schedule, Cost and Funding

The Farrington Highway Improvements project is anticipated to be jointly funded by the State, City, and private developers. The total cost of the project is estimated at approximately $90 million. Construction of the project is anticipated to begin in 2021.

Chapter 3

Description of the Environmental Setting, Potential Impacts and Mitigation Measures

Chapter 3

Description of the Environmental Setting, Potential Impacts, and Mitigation Measures

This chapter describes the existing environmental setting and identifies possible impacts of the planned project. Strategies to mitigate those potential impacts are also identified.

3.1 Land Uses

Existing Conditions

The Farrington Highway improvement corridor is generally located west of Fort Weaver Road; east of Kapolei Golf Course Road; north of the UHWO campus, HTIC, Kahi Mohala Behavioral Health Facility and West Loch Golf Course; and south of Grace Pacific Makakilo Quarry and the H-1 Freeway. The roadway corridor traverses Kūalakaʻi Parkway, Department of Land and Natural Resources (DLNR) holdings and DR Horton's Hoʻopili mixed-use development, portions which currently remain in are agriculture pending future phase build-out. Site photographs and adjacent land photos are provided in *Figure 3-1*. The landowners located adjacent to the project area are identified in *Figure 1-2*.

Lands in the project vicinity have been used for agriculture since the late 1800s. In 1877, James Campbell acquired 41,000 acres at Honouliuli, west of Pearl Harbor. With the discovery of ample artesian water, these lands were transformed into sugar cane plantations. After a century of sugar production, the sugar plantation was fallowed after the final harvest in 1995, due to the declining economic viability of sugar operations. Since 1995, these lands have been leased for diversified commercial agricultural production and have been slowly transitioning to residential, commercial and institutional uses.

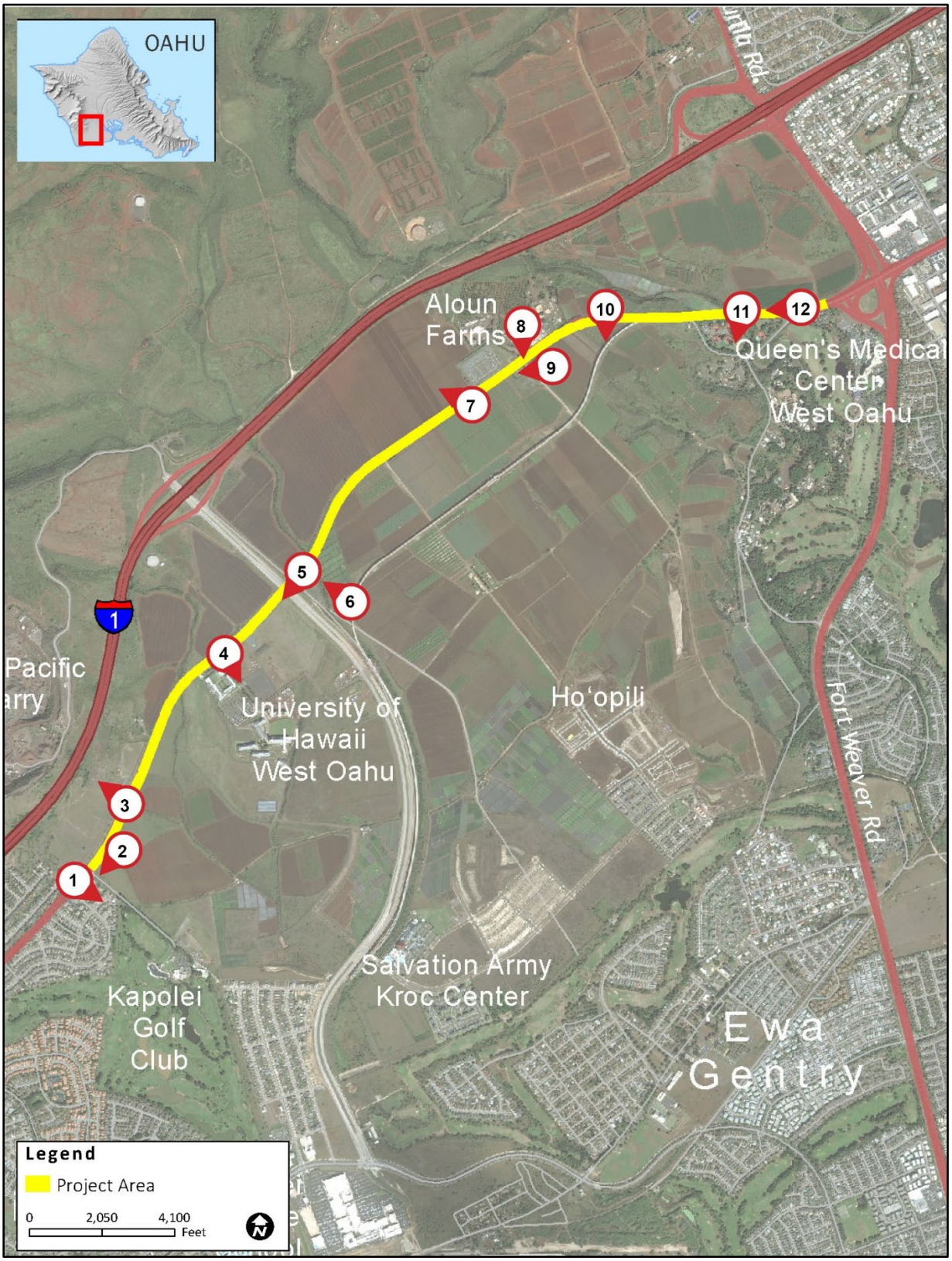
Existing conditions in the roadway improvement area and vicinity include:

- Kapolei Golf Club Residential – Multi-family residential community adjacent to the Kapolei Golf Course. Residences located south of the western terminus of the project area.
- Grace Pacific Makakilo Quarry - Grace Pacific LLC is a leading company in the Hawaiʻi paving and construction services industry. Grace Pacific's Makakilo Quarry, mauka of the western portion of the project area, produces over a million tons of aggregate each year.
- University of Hawaiʻi, West Oʻahu (UHWO) – UHWO is one of ten branches in the University of Hawaiʻi (UH) system. The West Oʻahu main campus opened in August of 2012 and is the only four-year university in West Oʻahu.

- **Hawai‘i Tokai International College (HTIC)** – HTIC is an American two-year, liberal arts college located on six acres of land within the UHWO campus. The new campus opened in 2014.
- **Commercial Agricultural Operations** – Aloun Farms leases farmland for agricultural production from DR Horton and conducts commercial agricultural sales operations at a small stand mauka of Farrington Highway.
- **State Energy Corridor** (SEC) - The SEC consists of a 30-foot wide utility area and easement in which underground natural gas and fuel oil transmission lines are routed from the industrial areas within Kapolei to the PUC in Honolulu. The corridor is primarily parallel to the mauka edge of the existing Farrington Highway ROW for the entire length of the planned improvements project.
- **Kahi Mohala Behavioral Health Facility** – Kahi Mohala is an 88-bed freestanding, community-based, not for profit psychiatric hospital, located on 14.5 acres, adjacent and makai of the western portion of the Farrington Highway improvements area.
- **West Loch Golf Course** – City-owned 18-hole golf course on the edge of the West Loch of Pearl Harbor. The course is located south of the eastern project area terminus.
- **Utilities** – Many local utility companies HECo, BWS, Hawaii Gas, Hawaiian Telcom (HTCOM), Oceanic Time Warner Cable (OTWC), and AT&T have infrastructure in the project area. Utilities are located on utility poles or in the SEC.

The lands surrounding the Farrington Highway study area are mostly classified as State Urban District. Planned land uses in the project vicinity include:

- **Ho‘opili** - DR Horton, Inc., Schuler Division (DR Horton) obtained final land use approvals in 2015 for the development of approximately 1,280 acres of undeveloped land in East Kapolei for the Ho‘opili residential, mixed-use community. Ho‘opili is developing approximately 11,750 new single- and multi-family residential units, with mixed-use regional and neighborhood commercial areas, a light industrial area, recreational facilities (e.g., parks, open spaces), elementary, middle and high schools, and community facilities. Over 200 acres will remain in commercial agricultural use, in addition to residential crop production and community gardens. Ho‘opili is roughly located south of H1 Freeway, East of Kūalaka‘i Parkway, west of Kunia Road and north of ‘Ewa Villages residential area. The Farrington Highway Improvements project area runs through the Ho‘opili community.
- **DHHL East Kapolei I (Kanehili) –** DHHL is developing 403 residential homes on a 92-acre parcel adjacent to the UHWO campus, between Kapolei Golf Course Road and Kūalaka‘i Parkway. The development would also include space for commercial, office, and public uses.
- **DHHL East Kapolei II (Kauluokahai) –** This 318-acre parcel is located between the UHWO campus and Kūalaka‘i Parkway. Approximately 1,000 single-family residential lots and 2,000 and multi-family residential units are planned for East Kapolei II (Kauluokahai).
- **State Department of Land and Natural Resources (DLNR) Lands –** DLNR owns three parcels in the Farrington Highway project area: A 66-acre parcel on the northeast quadrant of the intersection of Farrington Highway and Kūalaka‘i Parkway, a 36-acre parcel on the southeast quadrant of the intersection of Farrington Highway and Kūalaka‘i Parkway, and a 43-acre parcel in the northwest quadrant of the intersection of Farrington Highway and Kūalaka‘i Parkway, just west of Ho‘opili parcel A. There are no formal plans for these parcels, however, DLNR may consider industrial mixed-use development.



Site Photos and Photo Key **Figure 3-1**

1. Kapolei Golf Club Entrance Signage and Residences

2. Farrington Highway: Looking west past Kapolei Golf Course

3. Grace Pacific Lower Quarry Operations

4. University of Hawai‘i, West O‘ahu

5. Farrington Highway and Kūalaka‘i Parkway Intersection

6. Farrington Highway: Bridge over Kalo‘i Gulch

7. Looking northwest towards Aloun Farms

8. BWS Pump Station

9. HECo Substation, looking west

10. Looking SW towards UHWO/rail columns

11. Kahi Mohala Behavioral Health Facility

12. Farrington Highway: Bridge over Honouliuli Stream, looking east

Potential Impacts and Mitigation Measures

The project area is within the O‘ahu’s Urban Growth Boundary, an area dedicated to focused growth in accordance with regional planning documents including the General Plan of the City, the ‘Ewa DP, and the Kapolei Long Range Master Plan. These plans foresee East Kapolei developing as a balanced community component of the Kapolei Region, providing a full range of urban services, housing, jobs, businesses, and public facilities consistent with a vital live-work urban center. Over the next few decades, East Kapolei will continue to develop this community vision along with mixed-use transit-oriented developments. The planned project roadway improvements will support this anticipated growth and the need for upgraded roadways infrastructure.

Short-Term/Construction Period

Existing adjacent land uses such as UHWO, HTIC, Grace Pacific Makakilo Quarry, Kahi Mohala, West Loch Golf Course and residential areas near Kapolei Golf Course Road may experience temporary construction-related impacts, however, these impacts are anticipated to be minor and associated mitigation measures will be implemented, as discussed in *Section 3.1*.

Construction of the project will also displace and require relocation for some utilities. Existing on-site land uses including the Energy Corridor, HECo, and BWS will be affected, however, proposed relocation plans are expected to mitigate impacts.

Long-Term/Operations Period

The project is compatible with existing and proposed surrounding land uses. Traffic congestion relief is a long-term positive impact anticipated to benefit adjacent land uses.

Property acquisition of unimproved lands is not anticipated to impact existing farming operations near Farrington Highway, most of which are approved for future phases of urban development. Unimproved agricultural lands in DR Horton’s 1,280-acre Ho‘opili community are being phased out as their mixed-use project is being progressively built out. The TIAR prepared for Ho‘opili assumes that Farrington Highway will be widened to at least four lanes in accordance with the 2040 ORTP, and is further recommended for widening to three lanes in each direction between Kūalaka‘i Parkway and Fort Weaver Road. Implementation of the project roadway improvements are planned for within various transportation and development plans as a future improvement within the overall transportation network.

The City will need to acquire property along the Farrington Highway frontage to implement the project. The roadway improvements require approximately 51 acres to accommodate a typical 140-foot wide ROW for over 3.1 miles. The landowners adjacent to the Farrington Highway project will be affected by the increased ROW. Discussions to negotiate acquisition with landowners and being coordinated to review the area limits based on the final design of the roadway. Although negotiations are pending, no significant impacts are anticipated.

With the continued coordination with surrounding land uses and developments, and implementation of mitigation measures associated with construction, the planned project is consistent with existing and proposed surrounding land uses. No significant adverse impacts are anticipated.

3.2 Topography

Existing Conditions

The Island of O‘ahu was created through several stages of activity emanating from two volcanic domes. Through various stages of eruptions, erosion and land movement, the volcanic forms became the Wai‘anae and Ko‘olau mountain ranges. These large land masses emerged together, forming the island and causing submergence to occur.

The site is relatively flat with gentle slopes adequate for drainage. The topography of the site ranges from approximately 90 feet (ft) above mean sea level (MSL) at the eastern terminus of the project area to approximately 170 ft MSL in the center of the project area *(Figure 3-2).* The project area slopes range between zero and 10 percent with an average slope of approximately six percent.

Probable Impacts and Mitigation Measures

Construction of the project may result in soil erosion and is considered a potential short-term construction related impact. A Grading Permit is required by the City Department of Planning and Permitting (DPP) for projects that exceed 50 cubic yards (cy) of grading. The exact excavation and fill quantities will be determined by geotechnical and civil engineers during the project design phase. A Grading Permit from the DPP will be required along with National Pollutant Discharge Elimination System (NPDES) permit from the State DOH. Temporary erosion control measures will also be implemented as outlined in the City’s Rules Related to Water Quality, December 2018.

Grading will emulate existing conditions to minimize impacts on surrounding properties, the public roadways adjacent to the planned project, and the existing drainage systems owned by the City and County of Honolulu outside the limits of the property. For areas that require extensive grading, retaining walls may be used to reduce the grade change footprint area.

The planned project construction of the four-lane roadway will adhere to federal, State, and County regulations. Erosion control measures will be implemented and a City Grading Permit and NPDES Permit will be obtained. With implementation of these mitigation measures, no adverse impacts to topography are anticipated.

Potential impacts to topography as part of the future phase expansion of Farrington Highway to a six-lane roadway will likely result in similar construction related impacts, however, all applicable permits will be obtained, and regulations will be met. The future expansion of the road will be designed to fit within the existing footprint of the planned four-lane roadway project.

3.3 Soils

Existing Conditions

The project area is located in the ‘Ewa Plain on the on the southwestern flank of the Wai‘anae Volcano. Eroded sediment, coral, and algae form the ‘Ewa Plain and serves as the “caprock” over the Southern O‘ahu Basal Aquifer (SOBA). The project area consists of seven soil types (*Table 3-1 and Figure 3-3*). Kunia Silty Clay and Honouliuli Clay are the predominant soil types, comprising approximately 50 percent of the central project area. These soil types are classified as not highly erodible land. Soils in the eastern portion of the project alignment are primarily classified as Waipahu Silty Clay, while the western portion of the project alignment is mostly comprised of ‘Ewa Silty Clay Loam. The project area

includes the existing Farrington Highway alignment and a portion of the adjacent lands. The adjacent lands are developed with both urban uses and agricultural production.

Table 3-1 Prominent Soil Types in the Project Area

Soil	Soil Type	Runoff	Erosion
‘Ewa Silty Clay Loam, 3-6 % slopes (EaB)	Clay loam	Slow	Slight
‘Ewa Stony Silty Clay Loam, 6-12% slopes (EwC)	Stony silty clay	Slow to medium	Slight to moderate
Kawaihapai Clay Loam, 0-2% slopes (KlA)	Clay loam	Slow	Slight
Kunia Silty Clay, 0-3% slopes (KyA)	Silty clay loam	Very slow	Slight
Honouliuli Clay, 0-2 % slopes (HxA)	Clay	Slow	Slight
Waialua Silty Clay, 0-3% slopes (WkA)	Silty Clay	Slow	Slight
Waipahu Silty Clay, 0-2 % slopes (WzA)	Silty Clay	Slow to very slow	None to slight
Waipahu Silty Clay, 6-12 % slopes (WzC)	Silty Clay	Medium	Moderate

Source: U.S. Department of Agriculture, Natural Resource Conservation Service

Agricultural Lands of Importance to the State of Hawai‘i (ALISH) Classification

The agricultural utility of land in Hawai‘i was assessed and mapped in the 1970s by the former U.S. Soil Conservation Service in the ALISH map series. Three categories of agricultural land were identified in the mapping: Prime, Unique, and Other. Prime Agricultural Land represents the class of greatest importance and Other Agricultural Land the least. A majority of the project area is classified as Prime Agricultural Land. (*Figure 3-4*).

Overall Productivity Rating – Land Study Bureau (LSB) Rating

In 1972, the UH Land Study Bureau (LSB) developed the Overall Productivity Rating, which classifies soils according to five levels, with A representing the class of highest productivity and E the lowest. About 60% of the project area have soils rated A, the remaining soils are rated B, with the exception of a small band that is rated E. (*Figure 3-5*).

Land Capability Grouping - Natural Resources Conservation Service (NRCS) Rating

The 1972 Land Capability Grouping by the U.S. Department of Agriculture, NRCS rates soils according to eight levels, ranging from the highest classification level I to the lowest VIII. Soil classifications in the project area include ratings of I, IIe and IIIe (irrigated).

Project area soils are highly rated for agricultural production, however, in June 2012, the State of Hawai‘i Land Use Commission granted reclassification of the 1,280-acres associated with the Ho‘opili development from State Agriculture lands to State Urban lands. A Change of Zoning to residential and business zoning districts was approved in 2015. For the planned Farrington Highway project, this indicates the majority of the soils surrounding the project alignment have been designated for urban development, regardless of their soil classifications.

Probable Impacts and Mitigation Measures

Short-Term/Construction Period

Project construction will involve earth disturbance activities including grading, clearing and grubbing, excavation, and trenching. Excavation and/or embankment will be required to construct the roadway infrastructure including grading and preparation of the roadway subgrade and installation of base course material. Other excavation and trenching will be required to construct drainage infrastructure and relocate underground other utilities that conflict with the proposed roadway construction. Although existing grades will be maintained where possible, the improvement of the roadway will require areas of cut and fill along the entire project alignment as the existing site slopes slightly from mauka to makai. Earth disturbance has the potential to impact air quality through fugitive dust and water quality through erosion and storm water runoff.

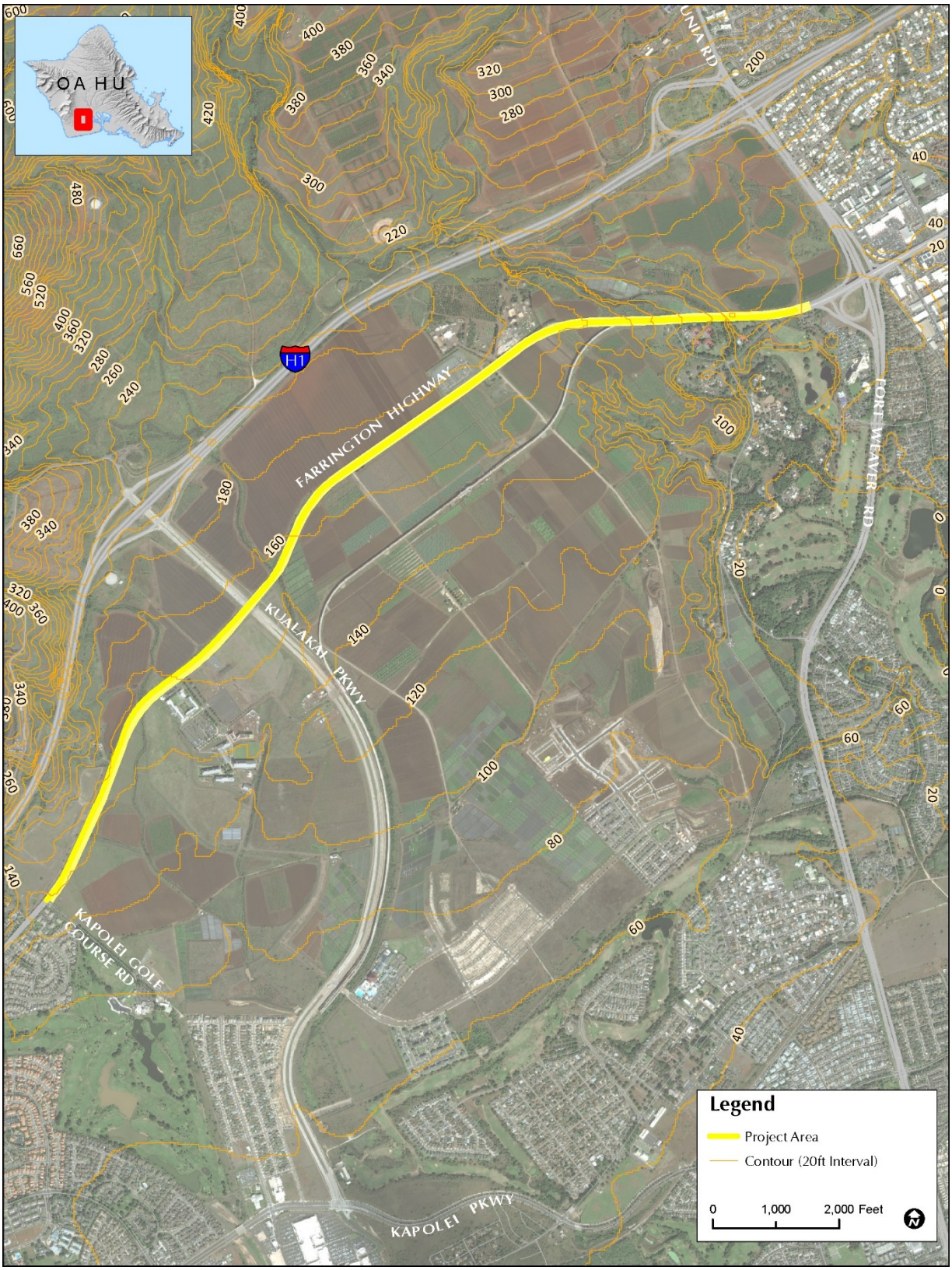
Grading activities for the project development will comply with the City's grading ordinance. A Grading Permit and a NPDES permit will be required prior to construction to address non-point source discharges. All construction activities will comply with the relevant provisions regulating Fugitive Dust set forth under Section 11-60.1-33, HAR. Proposed LID features will provide better control and management of surface runoff during intense storms. LID is a storm water management strategy that thoughtfully incorporates on-site, natural, storm water control features for the infiltration, evapotranspiration, treatment and use of rainwater.

Farming activities are anticipated to continue through project construction. Farm vehicles currently transit Farrington Highway in the vicinity of the crop processing and distribution facility mauka of the roadway. The project improvements are not expected to result in significant adverse impacts to existing crop production; however, minor impacts to farming operations may occur if the crossing of Farrington Highway is temporarily obstructed during construction. To mitigate potential related impacts, a Construction Staging and Phasing Plan will be prepared to allow for crossing of farm vehicles during project construction. No significant adverse impacts are anticipated.

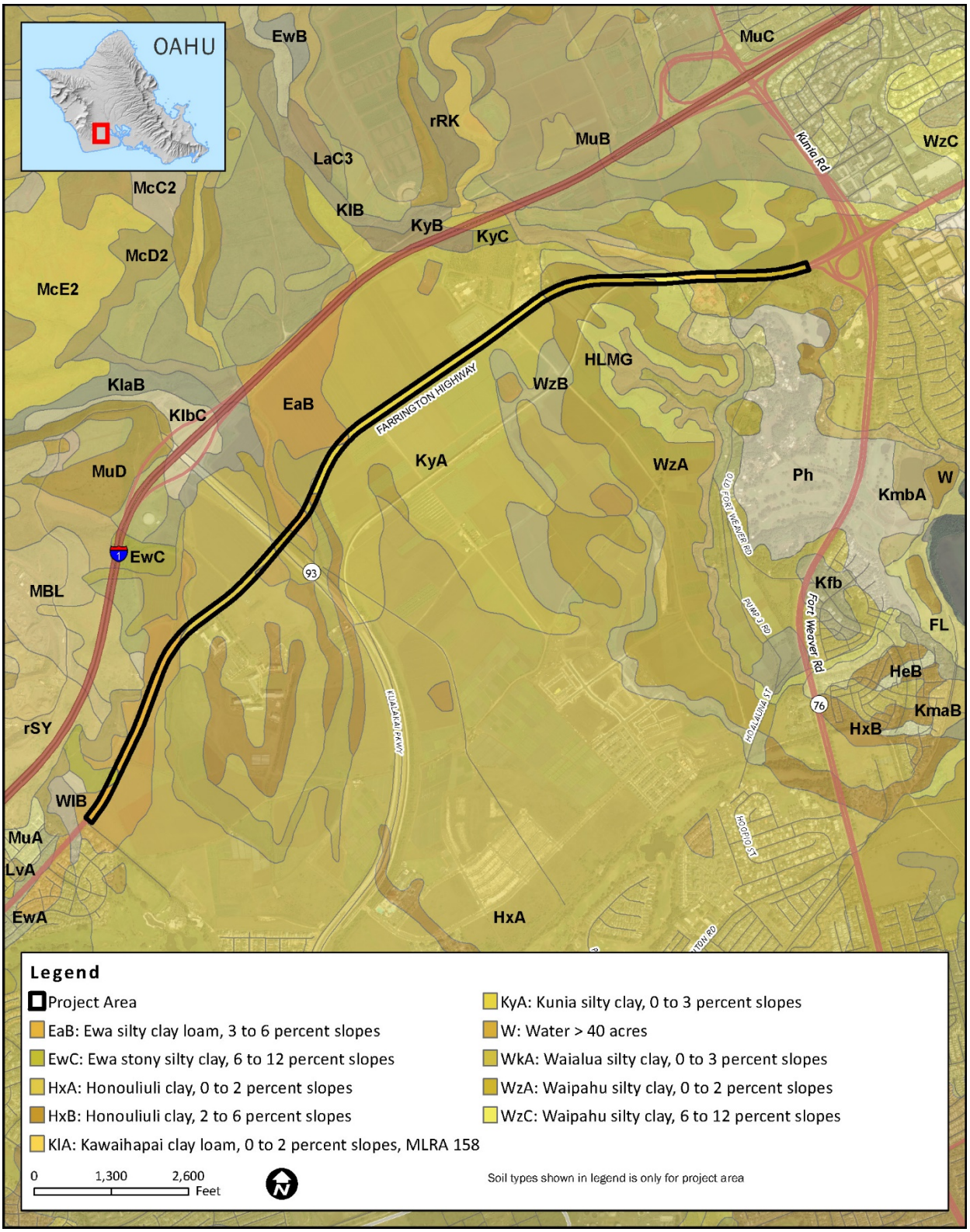
During the future phase (six-lane) expansion of Farrington Highway soils will be affected, as the project will require earth disturbance activities. However, the future expansion of the road will be designed to fit within the existing footprint of the planned four-lane roadway which will result in less impacts to undisturbed areas. Construction during this phase of the project will adhere to applicable rules and regulations.

Long-Term/Operations Period

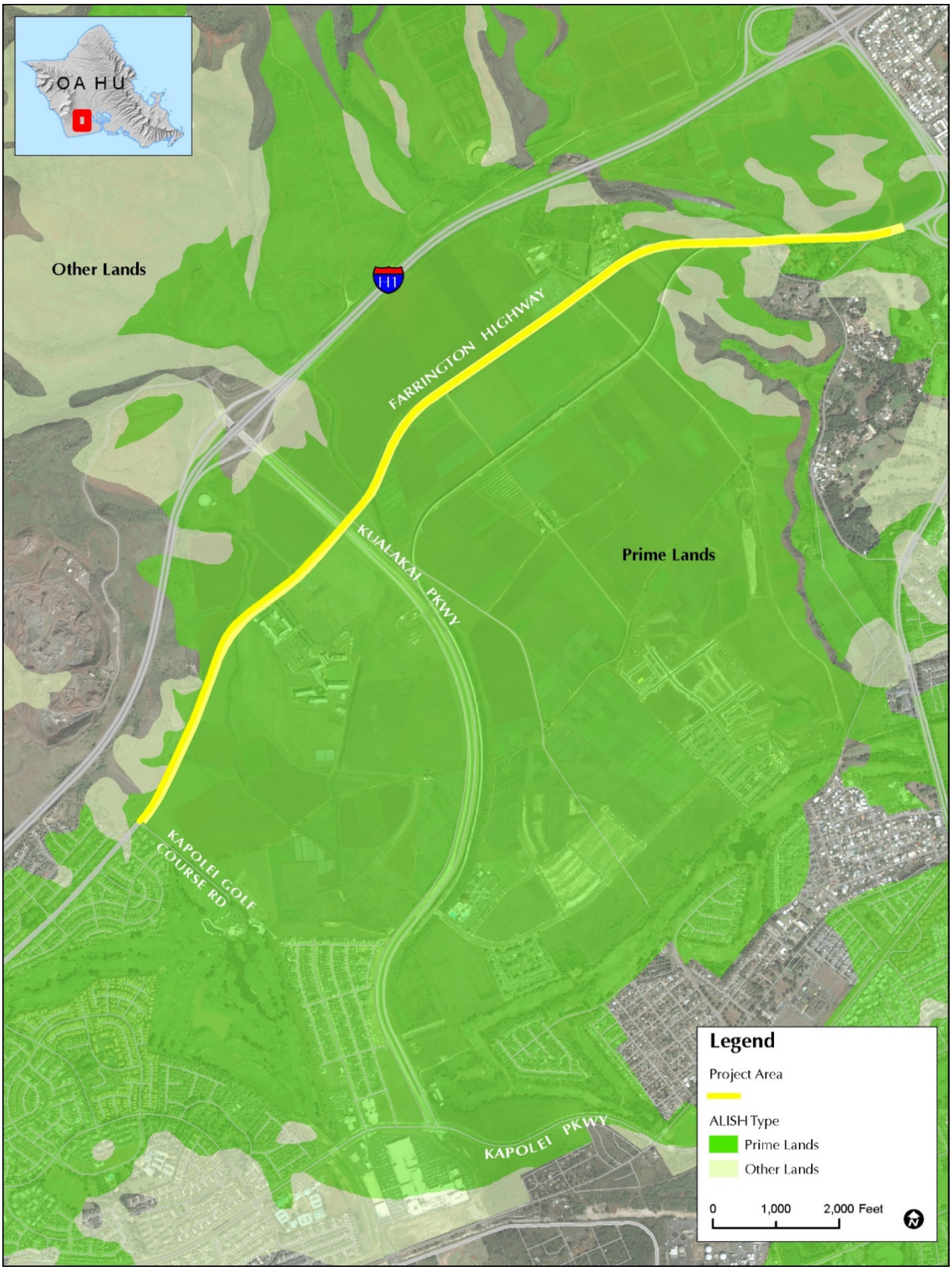
No long-term impacts on soils are anticipated, as the project area for both the planned four-lane roadway and future six-lane expansion is primarily classified for urban development.



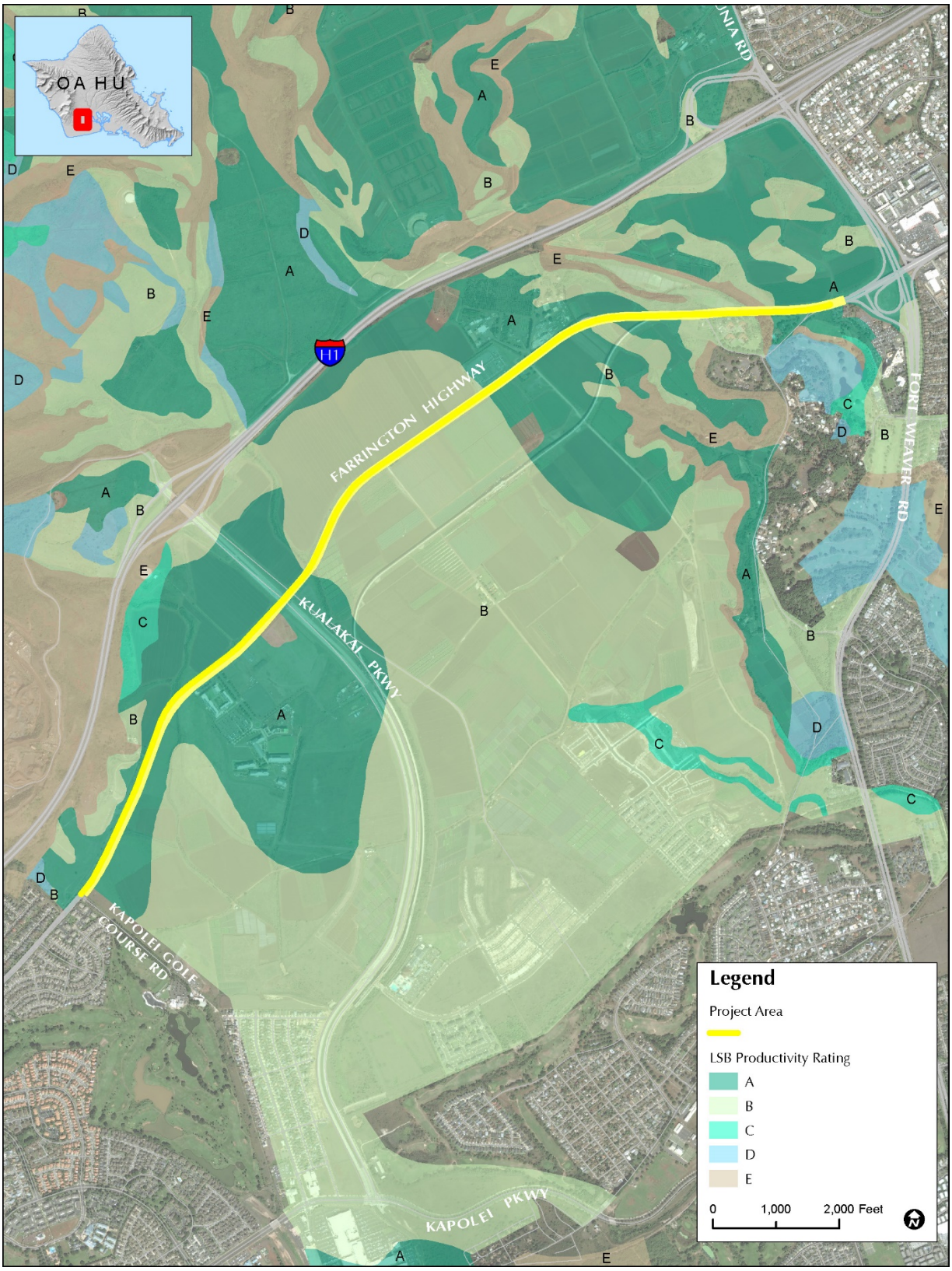
Topography Map **Figure 3-2**



NRCS Soils Map **Figure 3-3**



ALISH Classification **Figure 3-4**



Land Study Bureau Soil Ratings **Figure 3-5**

3.4 Climate

Existing Conditions

The project is located in the semi-arid ‘Ewa region, which is one of the sunniest areas on O’ahu. Rainfall is light, averaging approximately 17.91 inches per year. Most of the total annual precipitation occurs during the winter storm season, between October and March, while the summer months are hot and dry. Average low temperature is approximately 67.6 degrees Fahrenheit (°F) in winter and average high temperature is approximately 84°F in the summer.

Steady northeast tradewinds prevail during the spring and summer months; during the fall, the tradewinds tend to give way to light and variable winds throughout the winter. Low-velocity surface winds of less than 10 miles per hour occur frequently. Storms are infrequent and generally occur during the winter months, although tropical storms and hurricanes occasionally approach the island between June and November.

Probable Impacts and Mitigation Measures

The development of the planned project will have no effect on climate conditions. No mitigation measures are required.

Impacts to climate conditions are also unlikely to occur as part of the future development phase of Farrington Highway to a six-lane roadway.

3.5 Natural Hazards

Existing Conditions

The island of O‘ahu is susceptible to potential natural hazards, such as hurricanes, tropical storm, high winds, climate change and sea level rise (SLR), flooding and tsunami inundation, earthquakes, and wildfires. The island’s unique geographical challenges, aging infrastructure, and fragile logistics system require collaborative efforts to manage complex natural hazard related issues.

Hurricanes, Tropical Storms and High Winds

In Hawai‘i, northeast tradewinds predominate throughout most of the year and generally range in velocity between 10 and 20 miles per hour (mph) with tradewinds of 40-60 mph periodically occurring. Hurricanes are characterized by strong tropical winds with sustained wind speeds greater than 74 miles per hour and by widespread heavy rains in excess of six inches. Heavy rains may result in destructive flooding and strong winds can produce microbursts and mini-swirls (localized wind bursts that can reach speeds of greater than 200 mph). Hurricanes are classified according to “Category”: Category 1 hurricanes have wind speeds between 74 to 95 mph; Category 2 hurricanes have winds between 96 to 110 mph; Category 3 have wind speeds of 111 to 129 mph; Category 4 have wind speeds from 130 to 156 mph; and, Category 5 hurricanes have wind speeds exceeding 157 mph. The weather associated with hurricanes and tropical storms can lead to storm surge, which is an abnormal rise of water generated by a storm.

Hurricanes occasionally approach the Hawaiian Islands, but rarely reach the islands with hurricane force wind speeds. The first officially recognized hurricane in Hawaiian waters was Hurricane Hiki in August 1950. Since that time, five hurricanes have caused serious damage in Hawaiʻi: Nina (1957), Dot (1959), ʻIwa (1982), Estelle (1986), and ʻIniki (1992). It is difficult to predict when these natural occurrences may occur, but it is reasonable to expect that future events will take place and may increase in frequency due to global climate change.

Climate Change and Sea Level Rise

Rapid anthropogenic climate change is a well-established fact within the scientific community. As a result of climate change, oceans are warming and acidifying, ice sheets and glaciers are melting, and sea levels are rising. Rising sea levels caused by storms will leave developed areas near coastal areas vulnerable to coastal erosion and sea water innundation. Chronic coastal flooding is occurring now, and over the next 30 to 70 years the flooding is expected to increase with SLR, impacting homes and businesses located near the shoreline.

The *Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report* published in December 2017 by the Hawaiʻi Climate Change Mitigation and Adaptation Commission provides a basis for recommendations on reducing exposure and increasing adaptability to the impacts of SLR resulting from human-generated greenhouse gas (GHG) emissions. Research within the report notes that the intensity and frequency of natural disasters have increased and provides projections of areas along the coast that are vulnerable to SLR. The report found that for Oʻahu, with no mitigative actions, 3.2 feet of SLR and its associated erosion, flooding, and waves will have significant impacts to the island's land, building and land values, residents, structures, and major roadways. Rising sea levels will increase the probability of coastal flooding and erosion, which could damage coastal infrastructure. Additional publications from the City Climate Change Commission: *Sea Level Rise Guidance* and the *Climate Change Brief* also affirmed that a 3.2-foot SLR scenario by the end of the century is a reasonable benchmark for planning purposes.

The planned project is not located along coastal areas and outside of the SLRXA, as indicated in the Hawaiʻi Sea Level Rise Viewer (*Figure 3-6*).

Flooding and Tsunami Inundation

Based on the Federal Emergency Management Agency's (FEMA) *Flood Insurance Rate Map* the project area is located primarily in Flood Zone D which indicates areas with possible but undetermined flood hazards (*Table 3-2*). Additional flood zones X, A, AE, and AEF are located on the eastern portion of the project area in the vicinity of Honouliuli Stream (*Figure 3-7*). Flood zones A, AE and AEF are areas within the 100-year flood area.

Table 3-2 FEMA Flood Zones

Flood Zone	Description
D	Undetermined flood hazard
X	Outside of the 0.2% annual chance floodplain
A	100-year flood, no base flood elevation determined
AE	100-year flood, base flood elevation determined
AEF	Floodway area within AE

The project is not located within the tsunami evacuation zone or extreme tsunami evacuation zone (*Figure 3-8*). Elevations at the site range from approximately 90 ft to 170 ft above MSL, with maximum slopes approximately 10 percent.

Earthquakes

Earthquakes in the Hawaiian Islands fall into three main categories: volcanic, tectonic, and mantle. The majority of earthquakes in Hawaiʻi occur on and around the Island of Hawaiʻi, especially in the southern districts of the island where the most active volcanoes in the State – Kilauea, Mauna Loa, and Loihi – are located. The last major earthquake felt on Oʻahu was the Honomu Earthquake in 1973, which resulted in minor cosmetic damage to structures.

The potential impacts of global climate change on earthquake probability are unknown. Secondary impacts of earthquakes could be magnified by climate change, as rising air temperatures facilitate soil breakdown and intense rainstorms cause greater erosion or greater susceptibility to infrastructure failure.

Wildfires

The Hawaiian Islands are also vulnerable to wildland fires, especially during the summer months from prolonged drought and/or high winds. The greatest danger of fire is where developed, urbanized areas border densely vegetated areas. Overgrown vegetation close to homes, pockets of open space within subdivisions, and an increase of non-native high fire-intensity plants around developed areas pose increasing threats to commercial, community, environmental, and residential resources. A great majority of wildfires are human caused (intentionally caused or by negligence) and often start along roadsides. Wildfires can and do also occur naturally.

Probable Impacts and Mitigation Measures

The project improvements to Farrington Highway will not increase risks to human health or result in property damage due to natural hazards.

Hurricanes, Tropical Storms and High Winds

The effects of past storm events have caused minimal to no damage in the project area. The future threat of hurricanes to the island cannot be calculated, although the frequency of hurricane threats may increase with climate change and warming ocean waters, and the resulting rise in sea level. While waves generated by these storm events can cause coastal erosion and flooding, the project area is not located adjacent to coastal areas. If a hurricane, tropical storm, or high winds occur during construction, activities would cease, and equipment will be secured in work areas. Construction of the project will be designed to meet all applicable building code requirements.

Climate Change and Sea Level Rise

Climate change and SLR, and associated coastal impacts are a concern for the State of Hawaiʻi and the world, requiring a global response. Construction of the project would not result or constitute a source of impact to the climate of the region. The project area is furthermore located outside of a modelled sea level rise inundation zone as defined by the Sea Level Rise Exposure Area (SLRXA). The project design will include installation of LID improvements and Best Management Practices (BMPs) where practical and feasible to improve surface and ground water quality and manage storm water quantity. The planned project will maximize pervious and landscaped areas within the site to the extent

practicable. Dry swales, rain gardens, and infiltration trenches will be utilized for LID. As a result, storm runoff will be detained onsite to attenuate the peak runoff flow.

Flooding and Tsunami Inundation

Tsunami conditions impose no constraints on the planned project. The majority of the project area is located in Flood Zone D, which is defined as an undetermined flood hazard area. Zone X includes areas of minimal hazard from the principal source of flood in the area, and the Flood Insurance Program does not have regulations for development within this district. Small portions of the project improvements are located in Flood Zones A, AE and AEF. Construction in these zones will adhere to City Land Use Ordinance (LUO) Section 21-9.10 Flood Hazard Districts and will obtain applicable permits for construction.

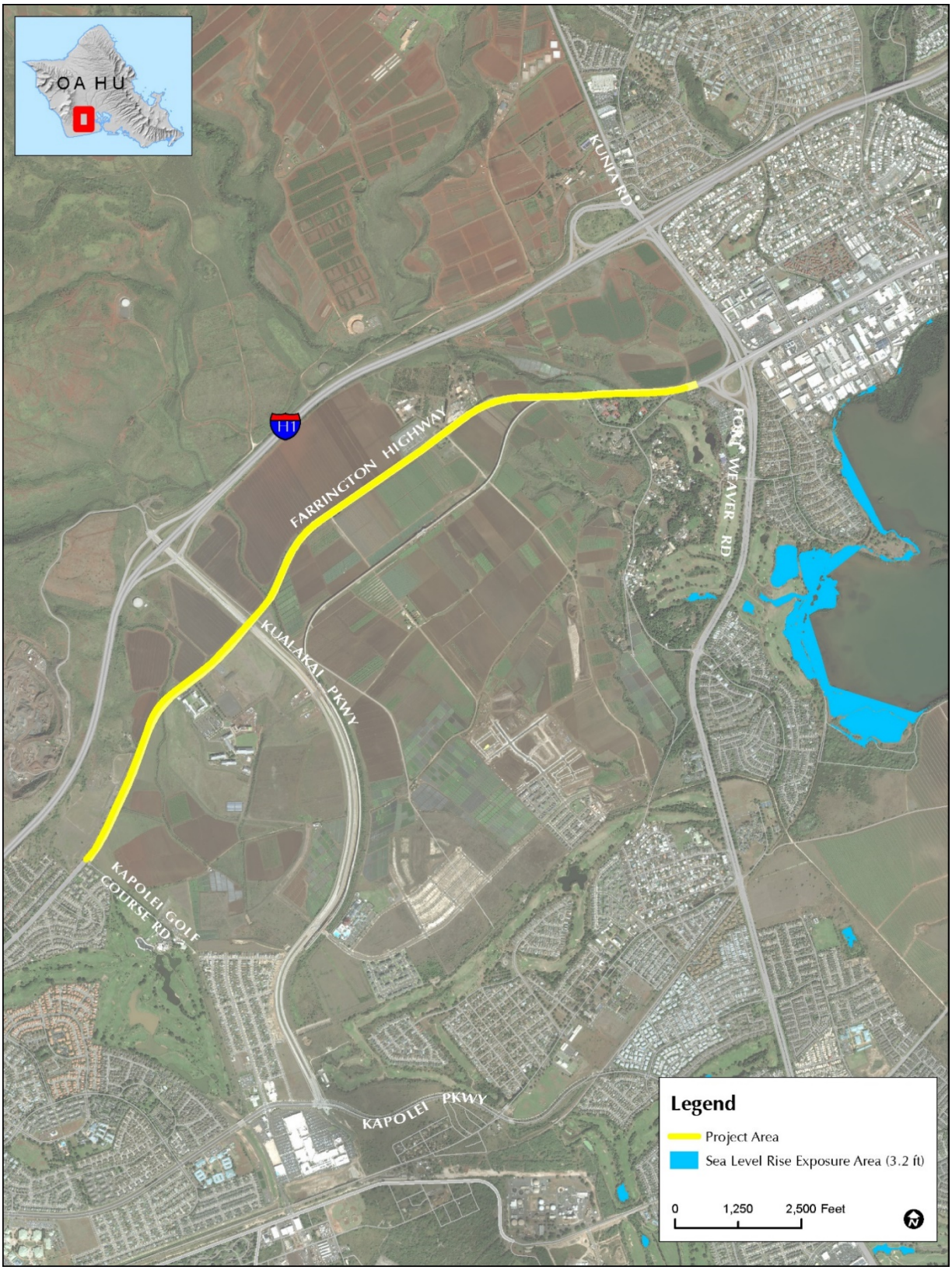
Earthquakes

Construction of the planned project is not expected to be adversely affected by seismic activity as the improved roadway would be constructed for a long-term design life in accordance with the International Building Code (IBC) seismic design standards and City building code standards, which provides minimum design criteria to address potential for damage due to seismic disturbances.

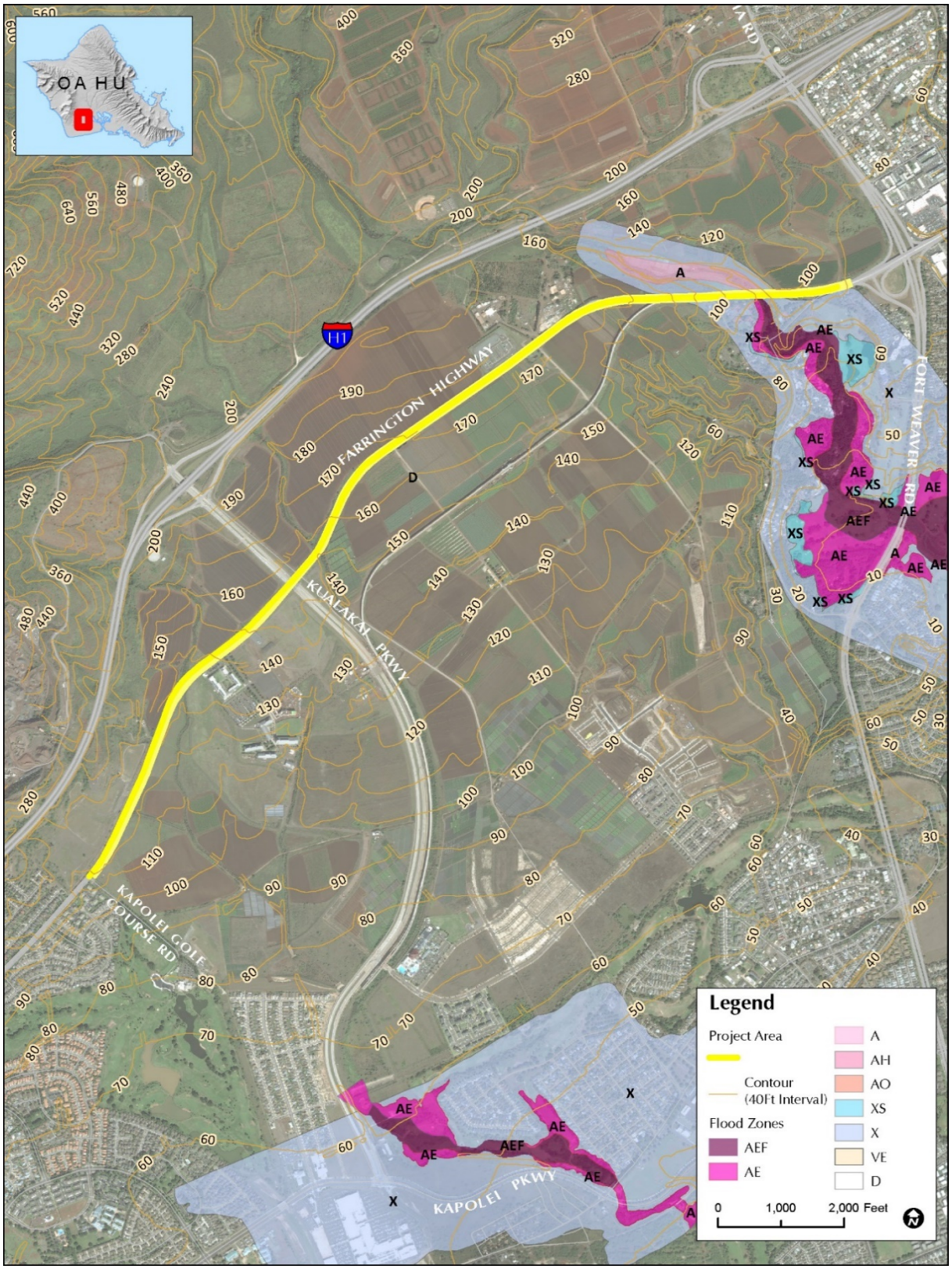
Wildfires

The project area will expand an existing roadway and will not be located directly adjacent to areas having overgrown vegetation, therefore no adverse impacts due to construction or long-term operation of the project are anticipated, and no mitigation measures are required.

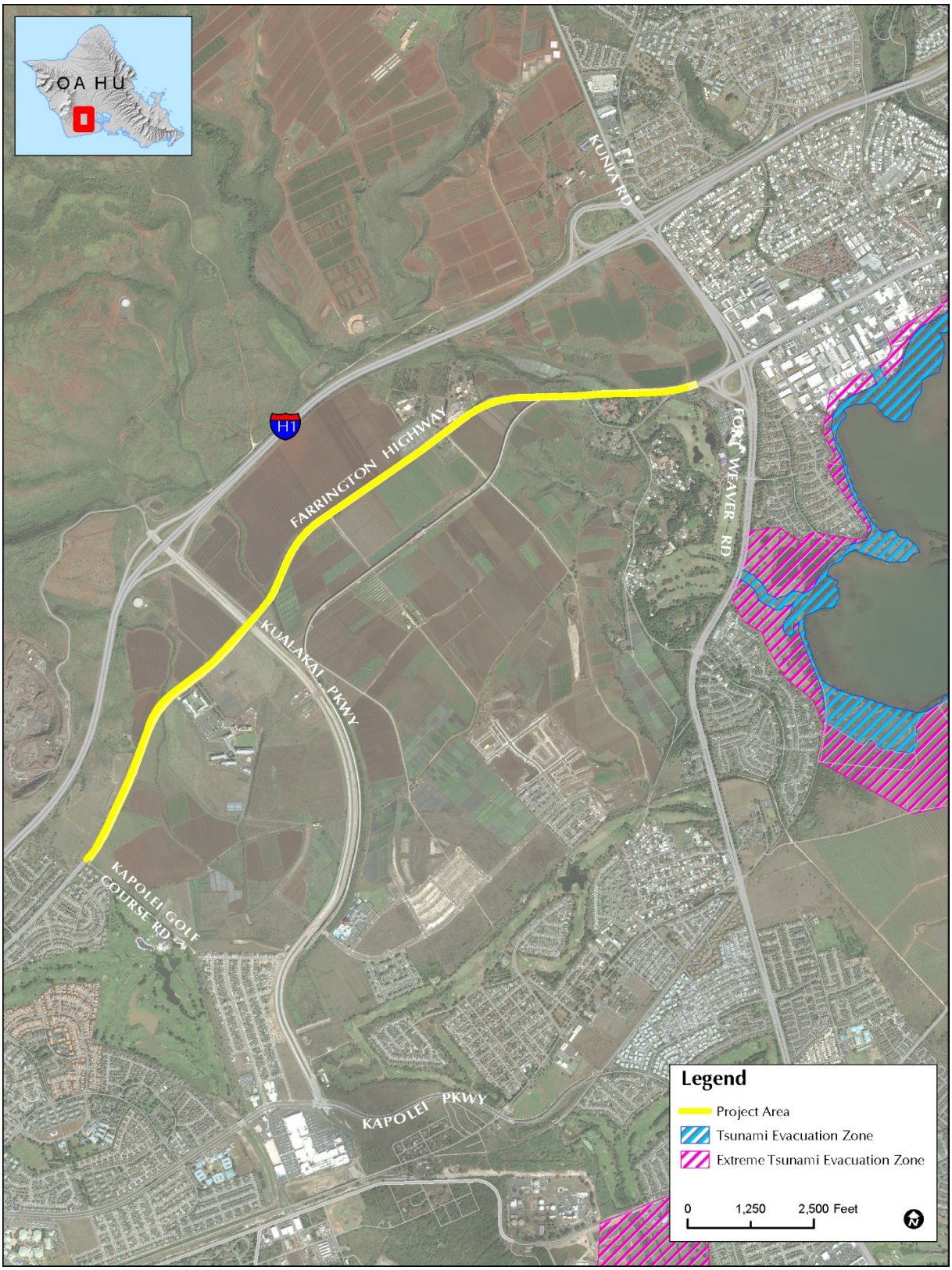
Development of the planned six-lane expansion to accommodate anticipated growth in 2035, will not be constrained by natural hazards described above. The future phase expansion of the roadway will be designed to fit within the existing footprint of the planned four-lane roadway project. All construction that occurs during this time will comply with applicable county rules and regulations, including flood hazard districts.



Sea Level Rise Exposure Area **Figure 3-6**



FEMA Flood Zone Map **Figure 3-7**



Tsunami and Extreme Tsunami Evacuation Zone Map **Figure 3-8**

3.6 Water Resources and Water Quality

3.6.1 Surface Water Quality

Existing Conditions

Generally, surface water quality in Hawaiʻi is excellent. However, both stream and coastal waters are susceptible to point-source (from a discrete or distinct source) and non-point source (from a diffuse or widely spread, scattered unconcentrated source) pollution.

There are no wetlands or tidal waters present in the project area. The road crosses four separate "streams" (from east to west): Honouliuli, Kaloʻi, Hunehune, and Palehua. Honouliuli is generally a dry (intermittent) stream with a stream bed and banks that flows into West Loch, Pearl Harbor. Kaloʻi, Hunehune, and Palehua are highly modified channels that connect the gulches to agricultural ditches. These ditches eventually terminate downslope on the ʻEwa Plain, without reaching the Pacific Ocean. Palehua drains the Grace Pacific facility on the north side of Farrington Highway, and connects to Hunehune, a short distance south of the roadway. Hunehune flows southward then southeastward where it joins the lower remnant of Kaloʻi; and these combined drainageways feed into a retention basin on the west side of Kūalakaʻi Parkway. The upper part of Kaloʻi is diverted into a large drainage feature that parallels Kūalakaʻi Parkway, terminating in a retention basin. Since these features are confined to man-made channels through the agricultural landscape, they terminate far short of the Pacific Ocean shore (a jurisdictional water), and only infrequently carry runoff.

Probable Impacts and Mitigation Measures

Short-Term/Construction-Period

Construction of the project could result in minor impacts to surface water quality. However, BMPs such as silt fencing, filter socks, and other siltation-reducing devices will be implemented to mitigate potential impacts during construction. The project will obtain a Grading Permit from the City and an NPDES Permit for Discharge of Storm Water Associated with Construction Activity and General Coverage from the State DOH, Clean Water Branch. The proposed improvements will comply with *Chapter 11-55, Water Pollution Control, HAR, DOH*, and a Notice of Intent (NOI) will be submitted. Separate dewatering and hydrotesting permits from the DOH may also be obtained as needed.

When the future phase of Farrington Highway to a six-lane roadway is developed, similar construction related minor impacts to surface water quality will likely occur. However, BMPs such as those mentioned above will be implemented to minimize potential impacts. A detailed evaluation of impacts associated with this future phase of the roadway will be conducted as part of the planning and design process.

Long-Term/Operation-Period Impacts

The project will increase the roadway surface area from the existing condition of 405,500 sf to a future condition of 1,284,100 sf. Therefore, the volume of surface runoff generated from the improved roadway will be substantially greater than the volume of existing surface runoff. Storm water sheet flows off-site, travels makai via natural drainage ways, or drains to existing on-site drainage facilities. Existing storm water drainage methods are anticipated to accommodate the increase in storm water runoff quantity, however, the increase in impervious surface area may further degrade the quality of storm water runoff. Potential stream channel hardening or lining may also be required at bridge or utility crossings at natural water courses, to provide scour protection and stream bed stabilization.

Responsible storm water management in the form of LID concepts will be incorporated into project design. LID features may reduce off-site runoff, improve water quality, provide groundwater recharge, and mitigate the impacts of increased runoff and storm water pollution. Examples of LID designs include drainage to landscaped areas, rain gardens, permeable surfaces, and using plants as ground cover. LID designs ultimately reduce the quantity of storm-related pollutants entering drainage ways and surface waters. The project will implement LID features to mitigate post-development runoff impacts. Potential LID features may include:

- Source Control (including stenciling inlets, etc.)
- Infiltration (Basin or Trenches, Galleries, etc.)
- Vegetated Swales
- Tree-box Filters
- Mechanical Treatment (water quality manholes)

With the incorporation of LID mitigation measures in the planned project and the future related expansion of the roadway, and compliance with NPDES and County Grading permitting conditions, the project is anticipated to generate limited potential adverse effects to surface water quality.

3.6.2 Groundwater Quality

Existing Conditions

The U.S. Environmental Protection Agency (EPA) can designate an aquifer as "sole source" when it provides more than 50% of a community's drinking water. The project is located within the EPA's O'ahu Sole Source Aquifer Designated Area. The SOBA is located in porous basalt below the caprock. The caprock prevents the seaward flow of groundwater and thins further from the shoreline until it ends at varying distances inland. According to Akinaka & Associates, Ltd. (2001), the caprock is located approximately 1,500 ft seaward of Farrington Highway.

Probable Impacts and Mitigation Measures

The project improvements may result in minor short-term construction impacts and long-term operational impacts. In the short-term, construction activities will involve grading and transport of materials. Pollutants associated with soil and other materials being moved could be directed into groundwater resources through storm runoff. In the long-term, accidental spills or release of hazardous materials could occur along the improved roadway.

With the implementation of runoff control measures required by the NPDES permit, County Grading permit, and LID features, discussed in *Section 3.6.1*, storm water pollutants are not anticipated to permeate into the SOBA aquifer. In the unlikely event of hazardous material spills, appropriate steps will be taken to notify the proper authorities. The project will meet State DOH Hazard Evaluation and Emergency Response Office (HEER) Immediate Notification Requirements. The DOH and Honolulu Fire Department (HFD) may oversee and coordinate remediation and containment efforts following a spill. During construction, spill prevention measures will also be included in the project's BMPs. With incorporation of proposed mitigation measures, significant impacts on groundwater quality are not anticipated to occur as a result of the planned project.

Future expansion of Farrington Highway to a six-lane roadway may likely result in similar minor impacts to groundwater quality as those identified above. BMPs will be implemented to the extent practicable at the appropriate time and a detailed review of the project design plans and mitigation will be coordinated.

3.7 Biological Resources

A Natural Resources Survey for the project area was prepared by AECOS, Inc. (AECOS) and is included as *Appendix B*. The purpose of survey was to document the presence or absence of important biological resources and, particularly, the presence or absence of species listed as threatened or endangered in federal and State statutes. On June 7, 2013 AECOS conducted an on-site biological survey by walking the entire length of the project area. A follow-on survey was conducted on May 1, 2018 to determine whether flora had changed significantly over time.

Existing Conditions

The vegetation in the Farrington Highway ROW comprises mostly of ruderal weeds, grasses and scattered shrubs on soil berms. The project area consists of landscaping in developed areas, and either cultivated crops or extensive weeds in agricultural areas. Areas that remain undisturbed are mostly limited to the dry gulches, where shrubs and small trees predominate.

A total of 116 plant classifications were surveyed within the project area. Of these, 11 species are native to the Hawaiian Islands, three are thought to be early Polynesian introductions and 20 are regarded as ornamentals. Considering the list of indigenous and endemic species encountered during the survey, only four are present in the project area outside of having been planted as ornamentals. These plants include the maʻo (*Abutilon incanum*) *pōpolo* (*Solanum americanum*), *ʻuhaloa* (*Waltheria incica*), and a sedge (*Cyperus polystachyos*), all relatively common species in lowland dry areas. In two places of the project area, native plants were used extensively in landscaping: 1) the entrance to the Kapolei Golf Course and, 2) the new entrance road into the UH West Hawaiʻi campus. These two areas account for the majority (7 species) of native plant species recorded during the survey.

With one exception, none of the plants encountered in the survey was found to be under protected status. A cluster of *Hibicus clayi* (no Hawaiian name) plants was observed at a single location fronting the Grace Pacific lower quarry entrance. This plant is protected under the Endangered Species Act (ESA; USFWS, 1994). A high berm separates the quarry from Farrington Highway. The berm is surrounded by various shrubs and trees (mostly oleander [*Nerium oleander*] and hau [*Hibiscus tiliaceus ornamental cultivar*]). A broad, flat or low-sloping area extends from the base of the berm to the roadway verge. Within this area to the east of the quarry entrance is a planting of the listed hibiscus invaded by several *koa haole* shrubs. Counting basal stems suggests there may be as many as 9 individual hibiscus planted in a circle no more than 6 ft (2 m) across. The shrubs are around 5 ft (1.5 m) tall. Clearly this native, endemic to Kauaʻi, was planted at this location; the species is not part of the native flora of Oʻahu.

A follow up survey was conducted on May 1, 2018 to determine that the flora assemblage along the project area did not change significantly since 2013. For this survey, pedestrian transects were concentrated in several specific areas where native flora was determined previously to have been present. Much of the project area remained consistent with the original survey findings, however, the cluster of *Hibicus clayi* (no Hawaiian name) plants previously identified near the Grace Pacific lower quarry entrance were not present, likely removed by landscape maintenance operations.

Avian Resources

Avian diversity and densities were in keeping with the highly disturbed nature of the habitats present in the area, and the location of the ‘Ewa Plain. During the course of the survey, 25 avian species representing 14 separate families were detected, all of which are alien to the Hawaiian Islands. Three species, the Java Sparrow (*Padda oryzivora*), Common Waxbill (*Estrilda astrild*) and Zebra Dove (*Geopilia striata*) accounted for slightly more than half of the total number of birds recorded. During the 2018 follow-on reconnaissance survey, all but one of the 25 species were recorded from the 2013 survey: Red-Avadavat (*Amandava amandava*). In addition, the Rose-ringed Parakeet (*Psittacula krameria*), a bird not seen in 2013 was recorded in the 2018 survey.

No avian species proposed for listing or listed under the federal endangered species act of 1973, as amended or the State of Hawai‘i, HRS 195D, were recorded during the survey (DLNR, 1998; USFWS; 2005a, b, 2013). No migratory shorebirds were recorded and none were thought to be expected due to the timing of the survey. The Pacific Golden-Plover (*Pluvialis fulva*) which is an indigenous migratory shorebird species is regularly recorded in the area between September and late April of each year as they nest in the high Artic during the late spring and summer months. Although no seabirds were also detected, several seabird species potentially overfly the site on occasion in low numbers. The primary cause of mortality in resident seabirds is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is the second most significant cause of mortality in locally nesting seabird species in Hawai‘i. Nocturnally flying seabirds, especially fledging on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, these young birds may collide with manmade structures, and if not killed outright, dazed or injured birds become easy targets of opportunity for feral mammals. Of the resident seabird species present on O‘ahu, no known nesting colonies occur within proximity of the project corridor.

The O‘ahu population of White-tern (*Gygis alba*) is listed as an endangered species by the State of Hawai‘i; it is not listed under federal statute. This species was not recorded during the survey, nor was it expected.

Mammalian Resources

The findings of the mammalian survey are consistent with the results of several other recent faunal surveys conducted in similar habitats and the highly disturbed habitats present in the project area. Three terrestrial mammalian species were detected within the project area, including one dog (*Canis f. familiaris*), two small Indian mongoose (*Herpestes a. auropunctatus*) and one cat (*Felis catus*). Although no rodents were detected, it is likely that rats and mice use various resources found within the general project area on a seasonal basis.

No mammalian species currently protected or proposed for protection under either the federal or State of Hawai‘i endangered species programs were detected during the course of this survey, nor were any expected. Given the paucity of documented records of Hawaiian hoary bat from the ‘Ewa Plain, the chance that hoary bat uses resources in the project area is extremely low. Additionally, there are minimal suitable roosting sites within the planned project area.

Jurisdictional Waters

Neither wetlands nor tidal waters are present in the project area. The road crosses four separate “streams” (from east to west): Honouliuli, Kalo‘i, Hunehune, and Palehua. Honouliuli is a normally dry (intermittent) stream with a stream bed and banks that flow eventually into West Loch, Pearl Harbor.

Kalo‘i, Hunehune, and Palehua are highly modified channels that connect the gulches to agricultural ditches, which eventually terminate downslope of the ‘Ewa Plain without reaching the Pacific Ocean.

Palehua drains the Grace Pacific facility on the north side of Farrington Highway, and connects to Hunehune a short distance south of the roadway. Hunehune flows southward then southeastward where it joins the lower remnant of Kalo‘i, and their combined drainage ways feed into a retention basin on the west side of Kualaka‘i Parkway. The upper part of Kalo‘i is diverted into a large drainage feature that parallels Kualaka‘i Parkway, terminating in a retention basin. Since these features are confined to man-made channels through the agricultural landscape, they terminate far short of the Pacific Ocean (jurisdictional water) and infrequently carry runoff, they are not considered jurisdictional.

Critical Habitat

No federally-delineated Critical Habitat is present in the project area. Thus, the no impacts are anticipated to occur as a result of the project. There is no equivalent designation that exists under state law.

Probable Impacts and Mitigation Measures

Development of the planned four-lane roadway expansion may result in a minor loss of vegetation. However, this minor loss will be offset by new landscaping in the median and planting strips as planned for in the project design.

To minimize potential impacts to avian resources, all lights will be shielded during night-time construction activity. Large flood/work lights will also be placed on poles that allow the lighting to be pointed directly at the ground. Streetlights or exterior facility lighting required for the project design will also be shielded to reduce the potential for interactions between nocturnally flying seabirds and exterior lights and/or man-made structures. With the implementation of these proposed mitigation measures, significant project-related impacts on biological resources are not anticipated.

The project area for the biological survey includes the future expansion area of Farrington Highway. The six-lane road will be designed to fit within the existing footprint of the planned four-lane roadway project. During the future phase, environmental conditions and potential impacts to biological resources are not expected to change significantly.

3.8 Air Quality

Existing Conditions

An Air Quality Study was conducted by B.D. Neal and Associates in June 2019 for the planned project *(Appendix C)*. The study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the planned project and suggests mitigative measures to reduce potential air quality impacts where possible and appropriate. A follow-on memo was also provided on May 18, 2020 to discuss potential air related impacts for the future phase (2035) of the project *(Appendix C)*.

Both federal and State standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. The State DOH regulates these same six parameters in addition to hydrogen sulfide. Hawai‘i air quality standards are comparable to the

national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Kapolei area is affected by its leeward and coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time. Average daily temperatures in leeward areas of O‘ahu range from about 70°F to 84°F, with the extreme minimum temperature recorded at 54°F and extreme maximum temperature at 95°F. This area is one of the drier locations in the State with average annual rainfall amounts of about 18 inches.

Except for periodic impacts from volcanic emissions (vog) and occasional localized impacts from traffic congestion, the present air quality of the project area is reasonably good based on nearby monitoring data. Air quality data from the nearest monitoring stations operated by the DOH suggest that all State and National air quality standards are currently being met.

Probable Impacts and Mitigation Measures

Development of the project will result in some short- and/or long-term impacts on air quality either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from construction equipment, from the minor disruption of traffic, and from workers’ vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Therefore, a dust control plan will be implemented for the project to ensure compliance with State regulations. Fugitive dust emissions can be controlled by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering open-bodied trucks. Other dust control measures may include limiting the areas of disturbance and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule can also reduce dust emissions. Monitoring dust at the project boundary during the period of construction will evaluate the effectiveness of the project dust control program. Exhaust emissions can also be mitigated by moving construction equipment and workers to and from the project area during off-peak traffic hours.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, an air quality modeling study was completed. The modeling study estimated the current highest concentrations of carbon monoxide at the intersection of Farrington Highway and Kūalaka‘i Parkway and predicted future levels both with and without the planned project. The model results indicated that present 1-hour and 8-hour highest estimated carbon monoxide concentrations are well within both the State and National ambient air quality standards. In the year 2028 without the project, carbon monoxide concentrations were predicted to decrease despite an increase in traffic, as a result of the retirement of older and more-polluting vehicles over time. New vehicles emit only a small fraction of the carbon monoxide emitted from vehicles manufactured 20 years ago.

With the project in 2028, carbon monoxide concentrations increased only slightly compared to the without project case and remained nearly unchanged compared to the existing case. Concentrations are expected to remain well within standards through the year 2028 with or without the project. Due to the project’s negligible long-term traffic-related air quality impacts, mitigation measures are not

required. In addition, the anticipated trend in increased fuel economy and electric vehicle use are expected to further reduce the potential for adverse long-term air quality effects. No significant adverse impacts to air quality are anticipated to result from the planned project.

Traffic forecasts for the year 2035 future phase have indicated that without further improvements at the intersection of Farrington Highway and Kūalakai Parkway excessive traffic congestion may occur, causing peak-hour traffic to degrade to LOS F and delay times to reach nearly 200 seconds or longer. With the additional improvements and mitigation recommended in the traffic analysis, peak-hour delay times would be significantly reduced to about 68 seconds in the morning and 95 seconds in the afternoon. LOS would be at E in the morning and F in the afternoon. Compared to 2028 with the project and with traffic mitigation, this suggests that traffic flow forecast for 2035 would be somewhat reduced.

While further widening of Farrington Highway to a six-lane roadway will result in more motor vehicles being concentrated within the vicinity, potentially increasing carbon monoxide concentrations, it is anticipated that average motor vehicle emissions may decrease with time due to the retirement of older, more-polluting vehicles, which may partially offset the increase in traffic or congestion. It is also expected that more electric vehicles will enter the fleet in the future, further reducing traffic-related air quality impacts. Given that the quantitative analysis for 2028 shows that maximum carbon monoxide concentrations would reach only a small fraction of the state and federal air quality standards, it is likely that with the future roadway improvements in 2035, air quality standards would continue to be met.

BMPs will be implemented to minimize air quality effects during construction of the future six-lane expansion phase (2035). The potential for long-term air quality effects resulting from traffic operations in the future roadway condition are anticipated to be negligible.

3.9 Noise

Noise is defined as unwanted sound. Sound may be classified as noise when it damages hearing ability, causes other bodily effects detrimental to health and safety, disturbs sleep and rest, interferes with conversation or other forms of communication, or is simply annoying or irritating.

The Day-Night Average Sound Level (DNL) method, developed by the Environmental Protection Agency, is the most widely used to describe environmental noise. The measurement is weighted so that late night noises are penalized, on the assumption that these noises are more objectionable because they can disturb sleep.

In Hawaiʻi, the State DOH regulates noise from fixed mechanical equipment and construction activities. State DOH noise regulations are expressed in maximum allowable noise limits rather than DNL. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for single family residential lands equate to approximately 55 DNL. For multi-family residential, commercial, and resort lands, the State DOH noise limits equate to approximately 60 DNL. For light and heavy industrial lands, the State DOH noise limits equate to approximately 76 DNL. Construction activities, which are typically noisier than the State DOH noise limits, are regulated through the issuance of permits for allowing excessive construction noise during limited time periods.

An acoustic study for the planned project was conducted by Y. Ebisu and Associates in June 2019 *(Appendix D)*. The existing and future traffic noise levels in the environs of the Farrington Highway Improvments project between Kapolei Golf Course Road and Fort Weaver Road were studied to

evaluate potential noise impacts associated with the proposed improvements. Noise measurements were obtained, traffic noise predictions developed, and potential noise impacts evaluated in accordance with the current Hawai‘i State DOT noise impact criteria. A follow-on memo was also provided on May 18, 2020 to discuss potential noise related impacts for the future phase (2035) of the project (*Appendix D*).

Existing Conditions

Existing traffic and background ambient noise levels at 13 locations in the project areas were measured in September 2013 prior to the HART guideway construction at the east end of the project corridor. The traffic noise measurements were used to validate the traffic noise model which was used to calculate the Base Year (2018) and future (2028) traffic noise levels for conditions with and without the roadway improvements project. The background ambient noise measurements defined existing noise levels at noise sensitive receptors which were also used to determine if future traffic noise levels would “substantially exceed” existing background ambient noise levels, and DOT noise standards and criteria.

The only existing noise sensitive developments within the limits of project construction and within 250 feet of the roadway centerline are the Hawai‘i HTIC, Kahi Mohala, and the Sullivan Care Center on the QMC-WO campus. HTIC is located southwest of the intersection with Kūalaka‘i Parkway, but at a relatively large setback distance from the roadway. Kahi Mohala and the Sullivan Care Center at QMC-WO are both located at the east end of the project, and at relatively short distances from the roadway. These existing noise sensitive developments are associated with Federal Highway Administration (FHWA) Noise Abatement Activity Criteria Category C, which permit an Average Hourly Sound Level of 67 A Weighted Decibels (dBA).

Based on noise level monitoring results, the study concluded that existing background noise levels in the project area currently do not exceed FHWA and DOT noise abatement criterial at Kahi Mohala or HTIC. Existing traffic noise levels do exceed that criteria at the Sullivan Care Center on QMC-WO.

Major contributors to the existing background ambient noise levels within the project area are traffic along the existing Farrington Highway, and buses which are idling or positioning. Traffic noise levels tend to be lowest during the early morning hours between 3:00 and 5:00 AM, and highest during the AM and PM commuting hours.

Probable Impacts and Mitigation Measures

Future traffic noise levels in the vicinity of the project were projected for the year 2028 using the FHWA Traffic Noise Model Version 2.5. The projected future traffic noise levels were evaluated for their potential noise impacts.

According to the model, future traffic noise levels within the proposed roadway improvement project will continue to exceed the DOT noise abatement criteria at the Sullivan Care Center on QMC-WO. The DOT noise abatement criteria may also be exceeded at planned future noise sensitive developments along Farrington Highway in 2028. Existing schools, parks, and other public use facilities should not be impacted by future traffic noise levels related to the planned project.

Traffic noise mitigation measures in the form of noise barrier construction may be applied at the Sullivan Care Center on QMC-WO. At planned noise sensitive developments along Farrington Highway, the use of adequate setbacks and/or sound attenuating walls may also be applied. The use of sound

attenuating walls may not be practical at two-story receptors due to the excessive wall heights (10-12 ft) required to attenuate traffic noise at the second floor.

Unavoidable, but temporary, noise impacts may occur during the construction activities within the project area, and particularly during the excavation activities on the project area. Because construction activities are predicted to be audible within the project area and at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment is recommended as a standard mitigation measure. The implementation of DOH noise related permit procedures and curfew periods for construction activities is also expected for this project.

Future expansion of Farrington Highway to a six-lane roadway will likely result in similar minor impacts to noise as those identified above. No significant increase to noise levels are anticipated to occur with the addition of one lane in each direction because of the redistribution of traffic toward the median and away from the ROW. In addition, the expansion of the roadway is not expected to influence the distribution of traffic within the ROW at large distances from the highway centerline. The potential for long-term noise effects resulting from traffic operations in the future roadway condition are anticipated to be negligible. Mitigation measures will be implemented during the construction of the future six-lane expansion phase (2035) to minimize noise effects to the extent practicable.

3.10 Utilities and Infrastructure

3.10.1 Water System

Existing Conditions

The BWS owns and operates multiple transmission lines and a pump station within the project vicinity. Lines are located on both the mauka and makai side of the roadway and within the State and City ROW, as well as within private property in some areas. Where the BWS lines cross through privately-owned land, an easement is typically provided.

Additional water infrastructure within or near the roadway includes Navy water transmission lines, DHHL water transmission lines, and private irrigation piping which cross the roadway at multiple locations. Brief summaries of each of these facilities are included below.

BWS Honouliuli Booster Pump Station: The pump station is located approximately 0.6 miles west of the Fort Weaver/Kunia Road and Farrington Highway interchange. This station was taken out of service between 2012 and 2018. The property is situated at the southwest corner of the Farrington Highway and Old Fort Weaver Road intersection (west of Kahi Mohala). The station was interconnected with 30-inch water transmission lines that run parallel to Farrington Highway at the mauka and makai edge of roadway. When the booster station was taken out of service the interconnection lines were disconnected and abandoned in place.

BWS Farrington Booster Pump Station: The pump station is located approximately 1.2 miles west of the Fort Weaver interchange. The station is situated at the southwest corner of the Farrington Highway and the Old Plantation Road intersection. The pump station boosts pressures in the main water supply lines that serve Kapolei, as well as the western side of Oʻahu, including Waiʻanae. The station is interconnected with the 30-inch and 36-inch water mains that run parallel to Farrington Highway on the mauka and makai sides of the roadway, respectively.

BWS Transmission Lines: There are various water transmission lines that run along Farrington Highway or cross the roadway, between the Kapolei Golf Course Road and the Fort Weaver Road interchange.

A 36-inch water line runs along the makai side of the roadway from the Fort Weaver Road interchange to the Honouliuli Booster Pump Station, which was decommissioned. From the station, the line reduces in size to a 30-inch water line which runs west to the Farrington Booster Pump Station. The line then upsizes back to 36-inches and continues from the Farrington Station to Kapolei Golf Course Road. The water line is typically located within private property, and a 20-foot wide access and maintenance easement is provided to the BWS.

A 30-inch water line runs along the mauka side of the roadway within the entire length of the project. The water line is typically located under the existing roadway pavement and is within the City or State existing ROW. A portion of this main was abandoned in-place to allow for the installation of support columns for the HART rail project. A new 30-inch ductile iron pipe was installed makai of the rail columns between Fort Weaver Road and where the HART access easement abuts Farrington Highway.

A 42-inch water line, which is part of the ‘Ewa Water System, crosses Farrington Highway adjacent to the Farrington Booster Station and heads makai towards ‘Ewa Beach along the Old Plantation Road. The water line does not appear to be connected with the station. The ‘Ewa Water System is supplied by a 5.0 MG reservoir, located mauka of the H-1 Freeway.

A 20-inch water line runs along Farrington Highway from Fort Weaver Road to the eastern old Fort Weaver Road intersection. The water line is interconnected with the 30-inch water line makai of the roadway near the intersection. The 20-inch water line also reduces to a 16-inch water line and travels south along Old Fort Weaver Road to ‘Ewa Beach.

BWS East Kapolei 4.0 MG 215’ Reservoir and Transmission Mains: A BWS reservoir and pump station is located approximately 0.3 miles mauka of Farrington Highway and adjacent to the H-1 Freeway. The transmission main water lines from the reservoir intersect with Farrington Highway approximately 0.2 miles west of the intersection of Farrington Highway and Kūalakaʻi Parkway (also where the access road is located). The reservoir was constructed as part of a Department of Hawaiian Home Lands DHHL project and is used to serve the East Kapolei development’s transmission and distribution system via a water pipeline within Kūalakaʻi Parkway, which extends south towards ‘Ewa.

Kalaeloa Water Company 1.0 MG Reservoir (1 of 2), Well & Pump Station, and Transmission Mains: Former Naval water facilities are used to serve the Kalaeloa (old Barber’s Point Naval Base) water system and are located approximately 0.13 miles mauka of Farrington Highway and adjacent to the H-1 Freeway. The 24-inch transmission main water line from the reservoir intersects with Farrington Highway approximately 0.5 miles east of the intersection of Farrington Highway and Kapolei Golf Course Road (also where the access road is located). The existing water transmission main runs parallel to Farrington Highway along the mauka edge, to Kapolei Golf Course Road. At the intersection, the water line crosses Farrington Highway and extends makai towards Kalaeloa.

Privately-Owned Irrigation Lines: There are several privately-owned water lines for irrigation purposes that run parallel to Farrington Highway or cross the roadway through existing culverts and bridges. The water lines are typically located outside of the existing City or State ROW, except within the crossings. It is unclear if these water lines are permitted to cross the roadway. Based on record drawings, the sizes of irrigation lines within the project limits ranges from 6-inches to 24-inches in diameter. The operational status of these irrigation water lines is unknown, but many are believed to be active.

Probable Impacts and Mitigation Measures

Relocations and adjustments will likely be required for the existing water infrastructure within the project vicinity, in addition to the relocations for the BWS transmission lines required for the alignment of the HART. Pressures and capacities of the water lines are not expected to be affected by the relocations or adjustments of the water lines. Summaries of the potentially impacted facilities are included below:

BWS Honouliuli Booster Pump Station: Additional ROW will be required for the improvements project potentially affecting the water lines around the pump station. Valves and manholes, as well as water main transmission lines, may require horizontal and/or vertical adjustment, but are not anticipated to impact this station as it was taken out of service by the BWS in 2018.

BWS Farrington Booster Pump Station: Additional ROW may be required for the improvements project potentially impacting the water lines entering and exiting the BWS Farrington Pump Station. Valves and manholes, as well as sizable water main transmission lines, may require horizontal and/or vertical adjustment, but will be limited to the area near the booster station. However, depending on the alignment proposed, the pump station (or significant portions of equipment, piping, and appurtenances) may require relocation due to the proximity of the pumps and above-ground pipe to the existing or planned roadway. Available additional ROW for the improved roadway is constrained by the ‘Ewa Nui Switching Station, the SEC to the north, and the pump station to the south of the roadway. Should the majority of the improvements to the roadway occur on the makai side, the BWS Farrington Booster Pump Station will require relocation.

BWS Transmission Lines: The existing BWS water transmission lines will be impacted by the new roadway cross-section as well as the newly constructed drainage structures and bridges along the road and may require horizontal and/or vertical adjustment. The water lines may need to be adjusted based on the proposed grades, and minimum and maximum cover over the water lines should be maintained per BWS standards. Water lines may be moved where the bridges and culverts will be constructed and expanded to avoid new footings and structural improvements. Additionally, separate structures may be used to support the utility relocations. The location of the water lines will likely be within the City or State ROW as dedications are expected on the makai side of the roadway where BWS currently owns a 20-foot wide maintenance and access easement. Manholes and valves may require grade adjustment.

BWS East Kapolei 4.0 MG Reservoir and Transmission Mains: The existing water lines may require horizontal and/or vertical adjustment based on the new roadway alignment and cross-section. Manholes and valves may also require adjustment. A significant portion of water line may be impacted as the line is located makai of the existing roadway where most of the dedications and improvements are likely to occur.

Kalaeloa Water Company 1.0 MG Reservoir, Well & Pump Station, and Transmission Mains: The existing water lines may require horizontal and/or vertical adjustment based on the new roadway alignment and cross-section, and at crossings with the newly constructed drainage structures. Manholes and valves may require grade adjustment. Because the water line is primarily located mauka of the roadway adjacent to the SEC, minimal impacts are expected.

Privately-Owned Irrigation Lines: Irrigation water lines crossing the roadway through the existing culverts may require relocation and adjustment. Further permitting and approvals may be required for the private irrigation water lines crossing the public ROW.

Per discussions with BWS, there is a possibility of reducing or combining water infrastructure and facilities within the project area, which may include and is not limited to removing one of the pumping stations or main transmission lines within the Farrington Highway corridor. Further investigation and research with BWS is required, and preliminary discussions have been initiated to determine the feasibility of such an option.

Some temporary construction impacts to the existing water infrastructure may be unavoidable. Necessary infrastructure relocations will be coordinated with the water system owners and operators to address potential impacts, such as line damage, service interruptions, and construction scheduling. Mitigation measures will be implemented to the extent possible, however, temporary service interruptions may be unavoidable.

Potential impacts to water utilities as part of the future six-lane expansion of Farrington Highway are expected to be minor since much of the utility relocation will occur with development of the proposed four-lane improvement project. The future expansion of the roadway will be designed to fit within the existing footprint of the planned four-lane road which will result in less impacts to undisturbed areas and other utilities located in the area. When the construction of the future phase commences, coordination with water system owners and operators will be conducted to address potential temporary service interruptions.

3.10.2 Wastewater

Existing Conditions

There are existing sewer line improvements at the Fort Weaver Road end of the project. An 8-inch sewer line serves the existing properties in the area, such as Kahi Mohala and QMC-WO. The existing sewer line is located within the existing Farrington Highway pavement and flows towards the east to the Fort Weaver Road interchange.

Properties along the Farrington Highway alignment such as the agricultural farms, Grace Pacific Quarry, and ‘Ewa Nui Switching Station contain private wastewater systems, registered with the State DOH. The UHWO sewer service line connects to the City’s sewer system in Kūalaka‘i Parkway.

Probable Impacts and Mitigation Measures

The planned roadway improvements will not increase the wastewater flow to the existing City sewer system. No significant wastewater impacts are anticipated as a result of the project, and no mitigation measures are proposed.

The future six-lane expansion of Farrington Highway are also not expected to adversely impact wastewater infrastructure, as there will be no increase in wastewater flow to the system from the project.

3.10.3 Storm Drainage

Existing Conditions

Existing runoff generated along the Farrington Highway alignment between Kapolei Golf Course Road and the Fort Weaver Road interchange sheet flows off the roadway onto adjacent open fields and agricultural land. There are no major storm drain improvements along the alignment. Runoff from land mauka of the roadway is conveyed via natural drainage ways and gulches, and crosses under the

roadway through concrete culverts and bridges at Kaloi Gulch and Honuliuli Gulch. The existing drainage culverts and bridges include the following:

- An 8-foot wide, 8-foot tall concrete box culvert located west of Kapolei Golf Course Road.
- A 23-foot span, 26-foot wide bridge, on a 45-degree angle, over Palehua Stream near the Grace Pacific Quarry (National Bridge Inventory Bridge No. 902). The stream bank surrounding the bridge have restricted the flow to a 16-foot wide channel.
- A 6-foot wide by 2-foot, 7-inch tall reinforced concrete box culvert, perpendicular to Farrington Highway, through a drainage channel between Palehua Stream and Hunehune Stream (Bridge No. 935).
- A 17-foot span, 40-foot wide concrete bridge, on a 42.25-degree angle, over Hunehune Gulch (Bridge No. 924).
- A 24-foot span, 40-foot wide concrete bridge, on an 9-degree angle, over Kaloi Gulch (Bridge No. 923).
- A 48" diameter culvert located west of the existing HECo switching station. This culvert will be installed as part of the Hoʻopili development.
- A 30" diameter culvert located east of the existing HECo switching station. This culvert will be installed as part of the Hoʻopili development.
- A 55-foot, 6-inch span, 24-foot wide bridge with 3-foot wide cantilevered sidewalks on each end on a nearly 45-degree angle, over Honouliuli Stream (Bridge No. 922).
- Additional smaller dimensioned drain inlets collect runoff along Farrington Highway near Fort Weaver Road before it enters the State DOT's drainage system within Fort Weaver.

There are existing storm drain improvements at the ends of the project near Kapolei Golf Course and Fort Weaver Road. An 8-foot by 8-foot culvert located at the intersection of Farrington Highway with Kapolei Golf Course Road collects stormwater from the general area, including from catch basins along the roadway, and conveys the stormwater south along the golf course. At the Fort Weaver Road interchange, a series of drain inlets and a 24-inch storm drain pipe collect runoff generated from the roadway. Additional storm drain improvements are located along Kūalakaʻi Parkway, including curb-inlet catch basins and a 72-inch storm drain pipe, which collect runoff generated from the roadway. The 72-inch storm drain pipe crosses Farrington Highway at this intersection, in the north/south direction.

Probable Impacts and Mitigation Measures

The drainage systems on Farrington Highway will be designed adequately to handle roadway runoff and convey off-site mauka stormwater under Farrington Highway. The roadside drainage systems will serve to capture runoff from the roadway and will consist of a series of catch basins connected by pipe culverts.

Post-construction peak runoff rates and volumes generated from the project area is anticipated to increase due to the increase in impervious areas (additional pavements for lanes, shoulders, sidewalks, bike lanes, etc.). However, the increase in runoff will be either mitigated through post-construction stormwater quality BMP's utilizing infiltrations and slower times of concentration, or will be conveyed by constructed infrastructure or natural channelways within the downstream areas of the project, such as Hoʻopili or UHWO.

Existing culverts and bridges will require adjustment and reconstruction to support the improvements to Farrington Highway. The culverts and bridges serve natural drainage channels that cross the roadway and must be designed to convey the tributary area peak stormwater flows.

Existing storm drain improvements at the ends of the project near Kapolei Golf Course and Fort Weaver Road are not expected to be affected by the roadway improvements. Storm drain piping and systems at Kūalakaʻi Parkway, within the State ROW, may require adjustment based on the new intersection. Catch basins may also require horizontal and vertical adjustment based on the planned roadway and intersection grading.

Some minor temporary construction impacts may be unavoidable during the construction of storm drainage improvements, and in the event of heavy rain, runoff may be temporarily diverted to sheet flow overland. No long-term operational impacts are anticipated, and no mitigation measures are recommended.

Similar to the planned project, some temporary construction-related impacts may be unavoidable, during the development of the six-lane future expansion of Farrington Highway. Mitigation measures will be implemented as appropriate to minimize potential impacts. Long-term operational effects associated with the future phase are not anticipated, as storm drain piping and systems will be adjusted as part of the planned four-lane roadway project.

3.11 Electrical and Telecommunications

3.11.1 Electrical

Existing Conditions

There are various existing electrical, street lighting, and traffic signal lighting infrastructure located within the project limits, based on field observations, meetings with utility stakeholders, and review of record drawings.

HECo

HECo electrical lines at Kapolei Golf Course Road, west of the intersection are located in an underground conduit system within the Farrington Highway ROW. The lines transition above ground heading east along the project alignment. At the Fort Weaver Road Interchange, electric lines transition underground through the interchange. These underground electric lines are routed northward to Village Park and Royal Kunia, eastwards towards Waipahu, and southwards toward Honouliuli and West Loch. Between Kapolei Golf Course Road and Fort Weaver Road along Farrington Highway, HECo has three electrical systems:

- Two (2) 138 kilo-Volt (kV) Transmission Lines: Two 138 kV overhead transmission lines are located adjacent to Farrington Highway between Kūalakaʻi Parkway and the ʻEwa Nui Switching Station. The electrical transmission lines are located at the highest position on existing 4.5-foot diameter, HECo-owned, steel utility poles located along the roadway, within the City/State ROW, in most locations. From the Farrington Highway and Kūalakaʻi Intersection, the two 138 kV lines are routed east along the mauka side of the roadway to the ʻEwa Nui Switching Station. At the switching station, the large poles and 138 kV lines head north towards the H-1 Freeway and leave the Farrington Highway alignment. These 138 kV lines and poles are critical facilities to HECo. Constructed in the mid-1990s, they interconnect the HECo Campbell Industrial Park 138 kV

switching station with the HECo Waiau Power Plant, and provide a redundant corridor for HECo's 138 kV system.

- **46 kV Overhead Sub-transmission Line**: The 46 kV overhead electrical transmission line follows the same alignment as the 138 kV transmission lines, and enter and leave the Farrington Highway alignment in the same locations near Kūalakaʻi Parkway and the ʻEwa Nui Switching Station. HECo's existing steel poles are framed for a second 46 kV line and the conductors for this 46 kV circuit have been installed, however, HECo currently energizes these lines at the 12.47 kV. In addition, a 46 kV line extends underground from the switching station to the Fort Weaver Road Interchange, supported on wooden joint utility poles primarily along the makai side of Farrington Highway. HECo has made additional provisions for a 46 kV line to be extended from the Kūalakaʻi Parkway-Farrington Highway intersection westwards along Farrington Highway to the Kapolei Golf Course Road by replacing the older wooden poles along this alignment with taller steel poles in 2008.
- **12.47 kV Overhead Distribution Lines**: 12.47 kV overhead lines are routed along the entire length of roadway from Kapolei Golf Course Road to the Kunia Road/Fort Weaver Road interchange. Between the Golf Course and Kūalakaʻi Parkway, the lines are attached to a combination of wooden and metal utility poles. The poles are mainly located along the mauka side of the roadway. At Kūalakaʻi Parkway, the distribution lines are routed underground via conduit across the intersection. East of the intersection, the line returns above ground and is mounted on existing HECo-owned large diameter metal poles which also carry the 46 kV and 138 kV main transmission lines. The lines run to the ʻEwa Nui Switching Station and from the station, they are routed on wooden joint utility poles to Fort Weaver Road. There are also 12.47 kV overhead lines located along Kūalakaʻi Parkway at the intersection with Farrington Highway.

  Based on a recent State Public Utilities Commission D&O, wood and metal utility poles that were jointly owned and administered by the Joint Pole Committee, which consisted of HECo, HTCOM, the City DDC and the State DOT, are now solely owned by HECo. HTCOM and Charter Communication (Charter) must apply to HECo for permission to attach to these poles and pay a lease for the attachment. It should be noted that poles installed by HTCOM, under its franchise agreements with the City and State, remain under HTCOM ownership.
- **HECo Fiber Optic Line**: A fiber optic line within the roadway corridor is installed and used for controls and communication of their existing transmission and distribution system. The fiber optic line travels along the corridor to the ʻEwa Nui Switching Station and is attached to the metal poles supporting the 138 kV, 46 kV and 12.47 kV overhead lines described above.
- **ʻEwa Nui Switching Station**: The electrical switching station is located approximately 0.9 miles east of the Kūalakaʻi Parkway and Farrington Highway intersection, on the mauka side of the roadway. The switching station is adjacent to another parcel of land that previously contained the ʻEwa Substation, which was dismantled. The switching station was built in the mid-1990s, and serves as a 138-46 kV transmission substation, a 46 kV switching station, and a 46-12.47 kV substation for the regional electrical transmission and distribution systems for Kapolei.

Additional pad and pole mounted transformers and switches are connected to HECo's 12.47 kV line and serve private developments and individual services along the roadway.

City and County of Honolulu Lighting Facilities

The City of Honolulu owns street lighting facilities within the Farrington Highway alignment at both ends of the project limits near the Golf Course and Fort Weaver Road interchange. Additional street lighting is not provided along the existing roadway alignment.

The existing traffic signal infrastructure and equipment within the Farrington Highway corridor between Kapolei Golf Course Road and Fort Weaver Road interchange is owned by the State of Hawaiʻi, however, under an island-wide agreement between the State and City, the City Department of Transportation Services maintains these traffic signal systems. Additionally, a traffic warning light beacon is located within the project alignment.

State of Hawaiʻi Street Lighting and Traffic Signals

The State DOT owns roadway lighting and traffic signal facilities within the State ROW at the intersection of Farrington Highway and Kūalakaʻi Parkway, both State-owned roads in this section. The DOT also owns the traffic signal equipment and roadway lighting equipment within the Fort Weaver Road Interchange.

Privately-owned Street Lights

Several developments contain privately-owned street lights at private driveways along the Farrington Highway alignment, however these lights are located outside of the road ROW.

Probable Impacts and Mitigation Measures

There are various, existing electrical and street lighting/traffic signal lighting infrastructure located within the project limits, which will likely require relocation or adjustment.

HECo Facilities

If relocations are required, above ground installations would be preferred to reduce costs. However, if required by government regulation, undergrounding existing lines (with the exception of the 138 kV main transmission lines) may be feasible. The existing above ground lines could be routed along the roadway alignment similarly to the lines near the Kapolei Golf Course Road intersection.

- Two (2) 138 kV Transmission Lines: Relocation of one or two large diameter poles and the 138 kV lines may be required based on extent of the roadway improvements proposed. However, due to the high cost and the importance of the main 138 kV lines, undergrounding or relocating these lines is not preferred. It should be noted that if relocation of one or more of the metal poles supporting the 138 and 46 kV lines is required, HECo will likely need to obtain the approval of the State Public Utility Commission before any engineering and pole procurement work can commence. This may or may not have an impact on the overall construction schedule of the planned project.
- 46 kV overhead sub-transmission line: In the effort to reduce costs, it is preferred that the existing 46 kV line remain in place and above ground where the improvements to the roadway are proposed to occur, mainly on the makai side of the existing roadway. However, this line may be undergrounded for portions of the project length as deemed necessary. At certain locations, the 46 kV line crosses the existing roadway to the makai side where relocations of the lines and utility poles may be unavoidable.

- **12.47 kV overhead distribution lines**: In the effort to reduce costs, the lines are preferred to remain in place and above ground where the improvements of the roadway are proposed to occur mainly on the makai side of the existing roadway. However, these lines may be undergrounded for portions of the project length as deemed necessary. At certain locations, the 12.47 kV lines will either be located within the travel way of the widened roadway (such as along UHWO or at the Honouliuli Bridge area near Kahi Mohala), or cross the existing roadway to the makai side where relocations of the lines and utility poles may be unavoidable.
- **'Ewa Nui Switching Station**: Minimal impact to the 'Ewa Nui Switching Station is expected. However, above ground electrical lines entering the station may require relocation or adjustment depending on how above ground utilities are affected adjacent to the station.

City and County of Honolulu Lighting Facilities

Some street lighting and traffic signal lighting facilities will require relocation and/or abandonment at the east and west edges of the project at the Fort Weaver Road interchange and Kapolei Golf Course Intersection respectively, as joint utility poles and overhead lines will be affected by the improved roadway. Additionally, existing warning lights and beacons may be relocated or abandoned if no longer needed.

The preferred option for relocation and/or installation of street lighting and traffic signal lines would be via underground conduit along the entire impacted roadway alignment. New street lighting for the project area will also be needed as part of the project design.

State of Hawai'i Street Lighting and Traffic Signals

Street lighting and traffic signal lighting facilities may require relocation/abandonment at Kūalaka'i Parkway and Fort Weaver Road within the State ROW, as joint utility poles, overhead lines, and underground conduit may be affected. The project will provide conduits for traffic signals and Intelligent Transportation Systems (ITS) purposes. The number and size of conduits should be confirmed with the City Department of Transportation Services Traffic Signals and Technology and DOT Traffic Branch.

Privately-owned Street Lights

Privately-owned street lighting systems likely may not require relocation if on the mauka edge of the roadway, while lights on the makai edge may be affected by the planned project.

Some temporary construction impacts may be unavoidable, however, necessary electrical system relocations will be coordinated with HECo to address and avoid potential impacts such as service interruptions. Potential adverse impacts to electrical systems will be mitigated to the extent possible.

Significant adverse impacts to electrical utilities and infrastructure are not anticipated to occur with the future six-lane expansion of Farrington Highway. Much of the utility relocation and associated system adjustments will occur with development of the planned four-lane roadway improvement project. The future expansion of the Farrington Highway will be designed to fit within the existing footprint of the planned four-lane roadway, which will result in less impacts to undisturbed areas. Future phase construction will require coordination with electrical utility owners and operators.

3.11.2 Telecommunications

Existing Conditions

There are various, existing telecommunications infrastructure located within the project limits, based on field observations, meetings with utility stakeholders, and review of record drawings and utility research.

HTCOM Facilities

Existing HTCOM overhead copper lines and fiber optic cable are routed along the Farrington Highway alignment from Kapolei Golf Course Road to the Fort Weaver Road interchange. From the Golf Course to Kūalakaʻi Parkway, the cables are mounted on HECo metal utility poles along with other utility service lines on the mauka side of the roadway. Between Kūalakaʻi Parkway and the ʻEwa Nui Switching Station, HTCOM lines are located on the HECo metal utility poles on the mauka side of the roadway. From the switching station to the Fort Weaver interchange, they are located on wooden joint utility poles makai of the roadway.

The existing HTCOM line consists of a main trunking cable that serves a large number of their customers. A portion of the line will be routed underground as part of relocation work being performed by the HART.

Wavecom, contracted with HTCOM, may also have facilities within the Farrington Highway corridor in the project limits.

Charter Communications (Charter formerly known as OTWC) Facilities

Existing Charter overhead coaxial cable and fiber optic cable are routed along the Farrington Highway alignment from Kapolei Golf Course Road to the Fort Weaver Road interchange. From the golf course to Kūalakaʻi Parkway, the cables are mounted on HECo metal utility poles along with other utility service lines, on the mauka side of the roadway. Between Kūalakaʻi Parkway and the ʻEwa Nui Switching Station, Charter lines are located on the HECo metal utility poles. From the switching station to the Fort Weaver interchange, they are located on wooden joint utility poles makai of the roadway.

The existing Charter lines consist of major service and transmission lines linking the western portion of Oʻahu and all of Kauai to service from Honolulu. The Charter lines also serve existing developments such as the UHWO. A portion of Charter line will be routed underground as part of the relocation work being performed by HART.

AT&T (and AT&T Government Solutions) Facilities

Existing AT&T fiber optic cable is routed via an underground duct bank along the roadway from Kapolei Golf Course Road to the Fort Weaver Road interchange. Based on meetings with AT&T, the following information is known about the conduit.

- Fiber optic cable consists of major transmission line servicing other Hawaiian Islands and areas in the Pacific Rim.
- The fiber line consists of four 1-1/8-inch conduit encased in 6-inches of concrete, with a 6-foot diameter. Six-foot deep manholes are located approximately 1,300 to 1,400 feet apart. The manholes are located within and outside of the existing roadway pavement but are generally within the roadway ROW.
- AT&T Government Solutions fiber runs from Fort Weaver Road towards the north out of the Farrington Highway alignment.

Based on as-built drawing information, the elevation of the duct bank varies with the existing topography. At the Hunehune Gulch culvert crossing, and Kalo‘i Gulch and Honouliuli Stream bridge crossings, the AT&T conduit is routed above ground.

U.S. Army Signal Corps Facilities

Per conversations with the U.S. Army Signal Corps, existing Joint Trunking System (JTS) direct buried cables are located within the Farrington Highway ROW. The underground cable is located near and within the Fort Weaver Road interchange and some cables are also routed south along Old Fort Weaver Road. Additional cable from this intersection heads along Farrington Highway towards the west, to Fort Barrette Road in Kapolei. The cable crosses Kūalaka‘i Parkway and was repaired during construction of the intersecting State roadway. The cable at this intersection was replaced and two new manholes were installed.

Sandwich Isle Communication Facilities

Per conversations with Charter, Sandwich Isle Communication conduit is located within the Farrington Highway ROW. The lines may consist of both underground ducts and overhead conduit.

Probable Impacts and Mitigation Measures

Relocation of some utilities may be required to accommodate the project roadway improvements as described below.

HTCOM Facilities

Existing overhead copper and fiber optic lines may require relocation along the project limits, as joint utility poles and overhead lines could be impacted by the planned project. However, in the effort to reduce costs, the lines may remain above ground where improvements to the roadway may occur mainly on the makai side of the existing roadway. However, at certain locations, the telecom lines cross the existing roadway to the makai side where relocations of the lines and utility poles may be unavoidable.

Charter Facilities

Existing overhead coaxial cable and fiber optic lines may require relocation along the project limits, as joint utility poles and overhead lines may be impacted by the planned project. However, in effort to reduce costs, the lines may remain above ground where improvements to the roadway may occur mainly on the makai side of the existing roadway. At certain locations, the telecom lines cross the existing roadway to the makai side where relocations of the lines and utility poles may be unavoidable.

AT&T (and AT&T Government Solutions) Facilities

The existing lines may require minimal horizontal and vertical adjustments based on the planned roadway alignment and cross-section. Manholes and vaults may require grade adjustment. The existing duct bank and manholes are largely located within the existing roadway pavement and need adjustment.

U.S. Army Signal Corps Facilities

The existing lines may require minimal horizontal and vertical adjustments. While no manholes or vaults were located along the planned roadway, grade adjustments to above-ground improvements such as manholes, etc. may be necessary.

Some temporary construction impacts may be unavoidable; however, necessary telecommunication system relocations will be coordinated with system operators to address and avoid potential impacts such as service interruptions. Construction and relocation plans will also be coordinated with telecommunication system operators. With mitigation measures, impacts to telecommunication systems will be minimized to the extent possible.

Potential impacts to telecommunications may occur with the construction of the future six-lane expansion of Farrington Highway. However, impacts are expected to be temporary since much of the utility relocation will occur with development of the planned four-lane improvement project. In addition, the future roadway expansion will be designed to fit within the existing footprint of the planned roadway which will minimize impacts to undisturbed areas. Coordination with telecommunication owners and operators will be conducted at the appropriate time to address potential temporary service interruptions.

3.12 State Energy Corridor

Existing Conditions

The SEC consists of a 30-foot wide utility area and easement in which underground natural gas and fuel oil transmission lines are routed from the industrial areas within Kapolei to the PUC in Honolulu. The corridor is primarily parallel to the mauka edge of the existing Farrington Highway ROW for the entire length of the planned project. In some areas, the path of easement and physical corridor of utilities may cross or deviate from the edge of the City ROW and State ROW, and in others, the utilities may run within these ROWs for short distances along the roadway.

While the SEC is managed by the State DOT, Harbors Division, the individual users within the SEC may dictate additional requirements and prohibit activities within the easement. Based on initial research with the DOT Harbors Division, there are three main utility companies operating within the SEC.

Hawai‘i Gas Facilities

The gas company owns and maintains a 16-inch main transmission line that originates from James Campbell Industrial Park and travels along the entire length of corridor within the project limits. Based on coordination with the Gas Company and other utility users, the pipeline appears to be located in Slot #2 within the corridor, which is the 2nd of six - 5-foot wide slots (starting from the mauka edge of the easement). The transmission line serves a variety of users within the urban center and surrounding areas of Honolulu.

Based on as-builts drawing information, the steel pipeline is typically 4.5 ft deep (at time of construction), though depth varies based on the existing topography (minimum 3 ft deep). At the Hunehune Gulch culvert crossing, the gas line is routed above ground and crosses adjacent utilities within the corridor while transitioning above ground. At Kalo‘i Gulch and Honouliuli Stream, the gas line is routed below ground with a minimum of 3 ft and 6 ft of cover respectively. Throughout the length of the corridor, valves and pipe markers were located along the roadway.

There is one 4-inch distribution line located within the vicinity of the Grace Pacific Quarry that is tied off the 16-inch transmission main within the corridor. The line crosses to the makai side of Farrington Highway, and runs to the east to serve the UHWO campus.

HECo Facilities

HECo owns and maintains an 8-inch fuel oil main transmission line that originates near the Par Pacific Refinery in Kapolei and travels along the entire length of corridor within the project limits. Based on meetings with HECo, the line is operated and maintained by Par Pacific Refinery, under contract to HECo's Fuel Department. Additionally, the following is known about the pipeline:

- The pipeline is located in Slot #5 within the corridor, which is the 5th of six - 5-foot wide slots (starting from the mauka edge of the easement).
- The pipeline is welded steel with 2-inch insulation and was installed in 2004.
- Cathodic protection is provided.
- Tele-metering and pressure and flow monitoring is provided via fiber optic line adjacent to the fuel piping.
- The pipeline continues to and serves the Waiau Power Plant and is a critical facility for power generation for Honolulu.

Existing as-built drawing information shows that the pipeline depth varies based on the existing topography. At the Hunehune Gulch culvert crossing, and the Kalo'i Bridge and Honouliuli Bridge, the HECo line is routed below ground at depths of 5 to 10 ft. Throughout the length of the corridor, valves and pipe markers were located along the roadway.

Par Hawaii Facilities

Par Hawaii owns and maintains a 10-inch fuel oil main transmission line within the SEC that travels along the entire length of corridor within the project limits. Based on meetings with Par Hawaii, the following is known about the pipeline:

- The pipeline is located in Slot #1 within the corridor, which is the 1st of six - 5-foot wide slots (starting from the mauka edge of the easement).
- The pipeline is welded steel.
- Cathodic protection is provided.
- The pipeline is capable of transmitting multiple types of products to various consumers along the line, including petroleum, jet fuel, and gasoline.
- The pipeline supplies a variety of users including the Airport (jet fuel), Aloha Gas (gasoline), and the U.S. Navy. The terminal point of the pipeline is near Aloha Tower.

Existing as-built drawing information shows that the steel pipeline depth varies based on the existing topography. No profile of the line was available to determine applicable culvert and bridge crossings. Throughout the length of the corridor, valves and pipe markers were located along the roadway.

Probable Impacts and Mitigation Measures

Relocation of some utilities within the SEC may be required for the development of the planned project, as described below.

Hawaii Gas Facilities

Relocation and/or adjustment of the existing 16-inch Hawaii Gas transmission line will be required within the areas of bridge and culvert improvements and the HART guideway alignment, to account for the planned expansion of the roadway or relocation of the existing roadway and structures. Locations and elevations of the pipelines will be impacted by the planned vertical design of the roadbed. The new culverts and bridges may also be wider than the existing structures, requiring further relocation or adjustment of the existing gas line beyond the limits of the existing structures.

The single distribution line near UHWO may require relocation or adjustment where the line crosses the roadway, depending on the new roadway cross-section. The 4-inch line, parallel to makai edge of the existing roadway, may also be located within the new City ROW as part of dedications obtained for the project. Hawaii Gas will be consulted to determine if the line must be relocated, though Hawaii Gas has noted that the line may remain in place based on preliminary review and information.

HECo

Relocation or adjustment of the existing 8-inch HECo fuel transmission line will be required within the areas of bridge and culvert improvements and the HART guideway alignment, to account for the planned expansion of the roadway or relocation of the existing roadway and structures. Locations and elevations of the pipelines are expected to be impacted by the planned vertical design of the roadbed. The new culverts and bridges may also be wider than the existing structures, requiring further relocation or adjustment of the existing line beyond the limits of the existing structures.

Par Hawaii

Relocation and/or adjustment of the existing 10-inch Par Hawaii fuel transmission line will be required within the areas of bridge and culvert improvements, and the HART guideway alignment, to account for the planned expansion of the roadway or relocation of the existing roadway and structures. Locations and elevations of the pipelines are expected to be impacted by the planned vertical design of the roadbed. The new culverts and bridges may also be wider than the existing structures, requiring further relocation or adjustment of the existing line beyond the limits of the existing structures.

Relocations identified may be adjusted based on the final project design and installation of HART facilities within the project area, as relocations of each utility may vary from the project. Preliminary research indicates that HART will not be significantly impacting the utilities within the SEC.

Some temporary construction impacts may be unavoidable, however, necessary SEC fuel system relocations will be coordinated with DOT Harbors Division and utility companies operating within the SEC, to address and avoid potential impacts such as service interruptions. With mitigation measures, impacts to fuel systems will be minimized to the extent possible.

As anticipated with the planned project, short-term construction related impacts may occur during the development of the six-lane future expansion of Farrington Highway. However, since much of the utility relocation will occur with development of the planned four-lane improvements project, it is likely that additional relocations to accommodate the expansion will be minimal. The design footprint for the planned four-lane roadway will include adequate spacing for the future phase widening. At the appropriate time, DOT Harbors Division and utility companies will be contacted to discuss this future phase.

3.13 Utility Relocations Due to Transit

Existing Conditions

HART has installed a new above-ground rail system within a portion of the planned project between an area near the 'Ewa Nui Switching Station to the Fort Weaver Road interchange, parallel to the existing Farrington Highway alignment. The rail line crosses the roadway alignment from south to north, and the rail guideway columns are located typically on the mauka edge of the existing roadway pavement.

As part of the Rail project, existing utilities have been relocated to accommodate the new guideway columns. In particular, the following improvements were completed:

- The 30-inch BWS transmission line at the mauka edge of pavement were relocated south, near the centerline of the existing roadway to avoid the new guideway columns. Connections to the existing pump station were reconstructed and new vaults, manholes, and valves were also installed.
- The 20-inch BWS transmission line within the existing roadway pavement near the Fort Weaver Road Interchange were relocated south, near the centerline of the existing roadway to avoid the new guideway columns. New vaults, manholes, and valves were also installed.
- A section of drain line and several inlets near the Fort Weaver Road Interchange were relocated but is not expected to impact the project.
- Electrical / Telecom / Street Lighting were relocated, particularly at the Fort Weaver Road interchange, as well as the location where the HART rail guideways cross the existing Farrington Highway alignment. Overhead conduits were also relocated underground and return above ground to new utility poles constructed for the crossings. New vaults and manholes were installed as part of the HART project.

Potential Impacts and Mitigation Measures

Utilities relocated by HART may need additional relocation or adjustment as part of the planned Farrington Highway Improvements project, though effort will be made to minimize relocations or adjustment of newly constructed utilities.

Construction and relocation plans will be coordinated with HART and utility companies operating within the SEC. Potential significant adverse impacts to utilities and fuel systems will be mitigated to the extent possible.

If additional utility relocations are required during the future phase expansion of the roadway, coordination with appropriate agencies will be conducted. However, it is likely that much of the utility relocation will occur with the development of the planned project as the roadway design is set to accommodate the future six-lane expansion within the existing footprint.

3.14 Solid and Hazardous Waste Materials

Existing Conditions

State and federal Environmental Database Search Results

Environmental law regulates the manufacture, use, release, and disposal of hazardous materials. Many federal, State and local agencies maintain records of hazardous material use and release events to assist in determining the presence of environmental hazards at specific facilities and locations. The planned Farrington Highway Improvements project area has been evaluated in numerous hazardous material studies and database searches for adjacent and nearby projects. These include:

- North-South Road Corridor Study – Hazardous Materials Technical Report (September 1997)
- University of Hawai‘i West O‘ahu – Environmental Data Resources, Inc. (EDR) Report (January 2003)
- Honolulu Area Rapid Transit Project – EDR Report (November 2007)

The area studied in the November 2007 EDR Report for the Honolulu Rapid Transit Corridor project covers the entire Farrington Highway Improvements project area and vicinity. The following sites were identified either on or in the vicinity of the project area.

#233 East Kapolei Pesticide Mixing and Loading

Site #233 is located approximately one-mile south of the project alignment along Palehua Road. The site was part of the ‘Ewa Plantation and later O‘ahu Sugar Company. Pesticide mixing and loading activities occurred at this site for approximately 40 years, until the O‘ahu Sugar Company closed in 1994. The former East Kapolei agricultural pesticide mixing and loading facility was identified on the Federal US Brownfields list by the Environmental Protection Agency (EPA). The EPA defines a Brownfield site as real property for which redevelopment or reuse is complicated by the presence or potential presence of hazardous substance, pollutant, or contaminant. DHHL acquired the property in 2009 and cleanup activities were planned in part by an EPA Brownfield Cleanup grant.

#241 Grace Pacific, LLC – Makakilo Quarry

Grace Pacific, LLC(GP) owns the upper and lower Makakilo quarries immediately north of the western portion of the project alignment. GP’s Makakilo Quarry produces over a million tons of basalt limestone aggregate per year. The hazardous materials database search identified the quarry on several State and local lists, including the State Hazardous Waste Site (SHWS) sites list, HI SPILLS Release Notifications, Underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST).

The SHWS list provides a list of facilities and sites that the State DOH HEER Office has an interest in or has investigated under HRS 128D. The Makakilo Quarry is included on the SHWS list, but no specific incident is associated with the listing. The HI SPILLS database keeps a record of releases of hazardous substances into the environment that were reported to the State HEER Office since 1988. Under the HI SPILLS database results, five hazardous material releases were reported, and all five were contained and cleaned up. The quarry has three permitted USTs, and one LUST was documented in 1996. The LUST has since been cleaned up and fully remediated.

Three additional sites were identified in the project area and vicinity. However, after review of the address and location of the companies, it was confirmed these three sites were incorrectly mapped within the project area and vicinity and do not pose hazards to the planned project.

- #194 Waimanalo Gulch Sanitary Landfill, 92-460 Farrington Hwy.
- #199 Kahe Point Cable Station, 92-480 Farrington Hwy.
- #202 KSSK FM Transmitter Site – 165 Palehua Rd.

Agricultural Contamination

Lands in the project area were formerly used in agricultural sugar cane production, and portions these lands are still currently in agricultural production. Therefore, there is potential for pesticide residue within the project area.

Potential Impacts and Mitigation Measures

Potential impacts relating to the following sites identified on or in the vicinity of the project area are described below. These potential impacts are based on State and Federal Environmental Database Search Results.

#233 East Kapolei Pesticide Mixing and Loading

Despite its designation as a Brownfield site, site #233 is located over one-mile south of the project area and no impact to project construction or operation is anticipated.

#241 Grace Pacific, LLC – Makakilo Quarry

Although the lower Makakilo quarry is located immediately north of the western portion of the project area, all reported release of hazardous material has been remediated and no residual contamination has been reported.

Agricultural Contamination

The soils in the project area are not expected to be contaminated by pesticide residue. In addition, as a roadway improvement, the project will not result in the introduction of sensitive receptors (such as residential developments) into the vicinity. During construction, workers will be instructed to report discolored soils, odors, or other signs of potential contamination to their supervisors. Appropriate authorities will be notified as the material requires special handling procedures per State DOH requirements. Treatment of the contaminated material will be dependent on the character and volume of the materials. With the implementation of procedures and mitigation measures, no significant solid and hazardous waste and material impacts are anticipated.

During the future phase expansion of Farrington Highway, significant adverse impacts relating to solid and hazardous waste are not anticipated. Construction of the planned four-lane roadway project will likely determine whether any contaminated soils are located in the area. Appropriate precautions and procedures will be carried out to address potential impacts.

3.15 Roadways and Traffic

A traffic study for the planned project was prepared by Jacobs in May 2020 and the complete report with technical appendices is included as *Appendix E*.

The project's traffic study area extends along Farrington Highway between Old Fort Weaver Road to the east and Fort Barrette Road to the west, and to two ramp terminal intersections on H-1 at Kūalakai Parkway. Eight intersections and seven roadway segments within the study area are analyzed to assess regional travel pattern shifts that may result from future developments and highway modifications.

The traffic analysis was conducted for the AM and PM peak hours for the existing year (2018), 2028, and future phase year (2035). The 2028 and future year (2035) analysis includes a baseline "No Build" condition and a "Build" condition assessment of traffic. Both conditions assess background traffic growth and vehicle trips generated by various planned developments. The year 2028 "No Build" scenario assumes no capacity improvements have been made to Farrington Highway. The "Build" scenario includes the project's lane widening improvements to Farrington Highway. The future year (2035) "No Build" scenario assumes Farrington Highway has been widened to a four-lane road. The 'Build' scenario includes Farrington Highway as six-lanes between Old Fort Weaver Road and Kapolei Golf Course Road. Mitigation measures, within the Build scenarios, are also analyzed to identify potential options to alleviate congestion.

Intersection analysis, at the studied intersections, included turning movement count data for heavy vehicle, bicycle, and pedestrian volumes. Synchro software, version 10, and the Highway Capacity Manual (HCM), version 6, analysis techniques were used to calculate intersection Measures of Effectiveness (MOE) which includes (1) Average Vehicle Delay (seconds) and (2) Level-of-Service (LOS). For signalized intersections, the overall LOS and average delay is reported with signal timing data from the field and information provided by the City and County of Honolulu (cycle length, time of day operations, signal phasing and signal splits). At unsignalized intersections, the LOS on the worst operating stop-controlled approach is reported. *Appendix E* describes the assumptions that are used in the traffic study analysis.

Intersection operations are described by LOS classifications which are given a letter designation from LOS A to LOS F. LOS A generally represents ideal operating conditions from the traveler's perspective with little to no delay and LOS F typically represents poor operating conditions, high delays, and extreme congestion. Within the City and County of Honolulu and State facilities, LOS D is generally considered the acceptable level of mobility. LOS E/F is considered less than desirable and should be evaluated for potential improvements that may allow for acceptable operations.

Segment analysis included peak hour segment volumes derived from intersection turning movement volumes and validated with field-collected tube counts on Farrington Highway. Volumes were collected over multiple 24-hour periods in May 2018 at three locations: between Kealanani Avenue and Papaialulu Avenue, approximately 1,200 feet west of Kūalakai Parkway, and approximately 2,000 feet east of Kūalakai Parkway. The methodologies in the most recent version of the HCM were used to evaluate segment operations, which are described by volume to capacity (V/C) ratio and LOS with classifications similar to the intersection analysis.

Existing Conditions

Study area roadways examined for 2018 existing conditions were used as a basis for comparing future year conditions, including the state and county facilities identified below.

State of Hawai‘i Facilities

- **Interstate H-1 (Queen Lilioukalani Freeway)** is an Urban Principal Arterial (Interstate) which runs in an east-west direction, providing access between Honolulu and southwest O‘ahu. In the study area H-1 is a six-lane divided limited access freeway with paved shoulders and no pedestrian or bicycle facilities. The speed limit is 60 miles per hour (mph).
- **Makakilo Drive (State Route 901)** is an Urban Principal Arterial (Other) in the study area (makai of H-1) and runs in a north-south direction. It provides access to H-1 from the Kapolei neighborhood and is a four-lane divided roadway with sidewalks and no paved shoulders or bicycle facilities. The posted speed limit is 35 mph.
- **Fort Barrette Road (State Route 901)** is classified as an Urban Principal Arterial (Other) in the study area and runs in a north-south direction. It provides access between H-1 and Kapolei and Kalaeloa. Fort Barrette Road is a two-lane undivided roadway with sidewalks and no paved shoulders or bicycle facilities. The posted speed limit is 40 mph.
- **Kūalakai Parkway (State Route 8930)** is classified as an Urban Principal Arterial (Other) and runs in a north-south direction. It provides access between H-1 and the Kapolei area. Kūalakai Parkway is a six-lane divided roadway with paved shoulders, sidewalks, and no bicycle facilities. The speed limit is 35 mph.
- **Farrington Highway (State Route 7110)** is an Urban Principal Arterial (Other) east of Fort Weaver Road and runs in an east-west direction. It provides access from Kapolei to Pearl City. Farrington Highway is a four-lane divided roadway with paved shoulders and bicycle facilities west of Kapolei Golf Course Road to the western study limit (Fort Barrette Road). There are sidewalks and bike lanes on both sides of the roadway and the speed limit is 35 mph. West of Old Fort Weaver Road to Kapolei Golf Course Road, it is a two-lane undivided roadway with little to no shoulder and no non-motorized facilities. Between Kapolei Golf Course Road and Old Fort Weaver Road, Farrington Highway is a county facility, except for the intersection of Kūalakai Parkway and Farrington Highway.

City and County of Honolulu Facilities

- **Farrington Highway** is a county facility classified as an Urban Minor Arterial between Kapolei Golf Course Road and Old Fort Weaver Road (except for the intersection of Kūalakai Parkway and Farrington Highway). It runs in an east-west direction with a posted speed limit of 35 mph. Within the study area, Farrington Highway is a two-lane undivided roadway without paved shoulders or pedestrian and bicycle facilities.
- **Kealanani Avenue** is classified as an Urban Major Collector and runs in a north-south direction. It provides access from Farrington Highway to residential land uses in the Kapolei area. Kealanani Avenue is a four-lane divided roadway with sidewalks and paved shoulders, and is designated as a bike route south of Farrington Highway. The posted speed limit is 30 mph. This road is being transferred to City and County of Honolulu jurisdiction from the Hawai‘i Housing Finance and Development Corporation.
- **Kapolei Golf Course Road** is a four-lane divided roadway with a sidewalk on the west side of the road. It extends approximately 400 feet in the makai direction from Farrington Highway and tapers to a two-lane road before entering private property (Kapolei Golf Club).
- **Old Fort Weaver Road** is classified as an Urban Minor Collector. It provides access to residential land uses by an east loop intersection and a west loop intersection with Farrington. Old Fort Weaver Road is a two-lane undivided roadway at both loop intersections without paved shoulders or pedestrian and bicycle facilities. The posted speed limit is 25 mph.

Existing Transit Service

A description of the City and County of Honolulu's TheBus transit routes serving the study area is provided below.

- **Route 40** provides regular service between downtown Honolulu and Makaha, with travel on Farrington Highway.
- **Route 41** provides regular service between the 'Ewa Beach and Kapolei Transit Centers. This route travels on Farrington Highway and Kealanani Avenue.
- **Route 44** provides regular service between Waipahu and 'Ewa Beach. This route travels on Farrington Highway and Old Fort Weaver Road.
- **Route 94** provides peak hour service between downtown Honolulu and Kapolei, with travel on Fort Barrette Road.
- **Route 99** provides peak hour service between the Wahiawa and Kapolei Transit Centers with travel on Farrington Highway.
- **Route 102** provides peak hour service between downtown Honolulu and Kapolei. This route travels on Farrington Highway, Kealanani Avenue, and Fort Barrette Road.
- **Route 411** provides late night service to the Villages of Kapolei. This route travels on Farrington Highway, Kealanani Avenue, and Fort Barrette Road.
- **Route 415** provides peak hour service between Kalaeloa and the Kapolei Transit Center, with travel on Fort Barrette Road.
- **Route C – CountryExpress!** provides express service between downtown Honolulu and Makaha, with travel Fort Barrette R

Existing Traffic Volumes

Existing turning movements were collected over a 2-hour period in the AM and PM peak periods at the study intersections. In addition to the turning movement counts, three tube machine counts were collected along Farrington Highway for 24-hours per day over a 7-day period. The tube counts were collected at the following locations.

- Between Old Fort Weaver Road and Kūalakai Parkway
- Between Kūalakai Parkway and Kapolei Golf Course Road
- Between Kapolei Golf Course Road and Fort Barrette Road

Based on traffic count data, the average daily traffic carried by Farrington Highway is approximately 10,000 vehicles west of Kūalakai Parkway and approximately 9,000 vehicles per day east of Kūalakai Parkway. The daily truck percentage is approximately 3 to 5% and ranges from 2 to 8% during peak hour periods. Truck traffic may be generated by nearby construction sites and the quarry that is located on Farrington Highway, approximately 0.25 miles northeast of Kapolei Golf Course Road. The weekday morning and afternoon peak hours of traffic were determined to occur between 7:00 AM and 8:00 AM and between 4:15 PM and 5:15 PM, respectively. The traffic count data is provided in *Appendix E*.

Under the 2018 existing conditions during both AM and PM peak hours, operations at most study intersections operate at LOS D or better. The intersection of Farrington Highway and Fort Barrette Road operates at LOS E during the PM peak hour due to long delays on the southbound movements as

vehicles travel from H-1 to the Kapolei neighborhoods. *Table 3-3* shows the existing intersection analysis results and *Figure 3-9* displays the existing lane channelization at each study intersection.

Enhancements to other existing and future intersections along Farrington Highway are anticipated with the future developments. These intersections and their designs will be analyzed by the appropriate agencies when the access for the future developments are requested.

In 2018 existing conditions, all roadway segments operate at LOS C or better, indicating that midblock traffic volumes are lower than the roadway capacity (*Table 3-4*). Along Farrington Highway, the existing roadway has two lanes in each direction between Fort Barrette Road and Kapolei Golf Course Road and one lane in each direction from Kapolei Golf Course Road to Old Fort Weaver Road. Along Kūalakai Parkway, the existing roadway has three lanes in each direction between Farrington Highway and the H-1 interchange. South of Farrington Highway for approximately 1,000 feet, Kūalakai Parkway continues as three lanes in each direction before transitioning to two lanes in each direction at the future UHWO access intersection. *Appendix E* shows the existing roadway segment analysis results and intersection output reports, including delay periods and LOS.

Table 3-3 Existing 2018, AM and PM Intersection Operations

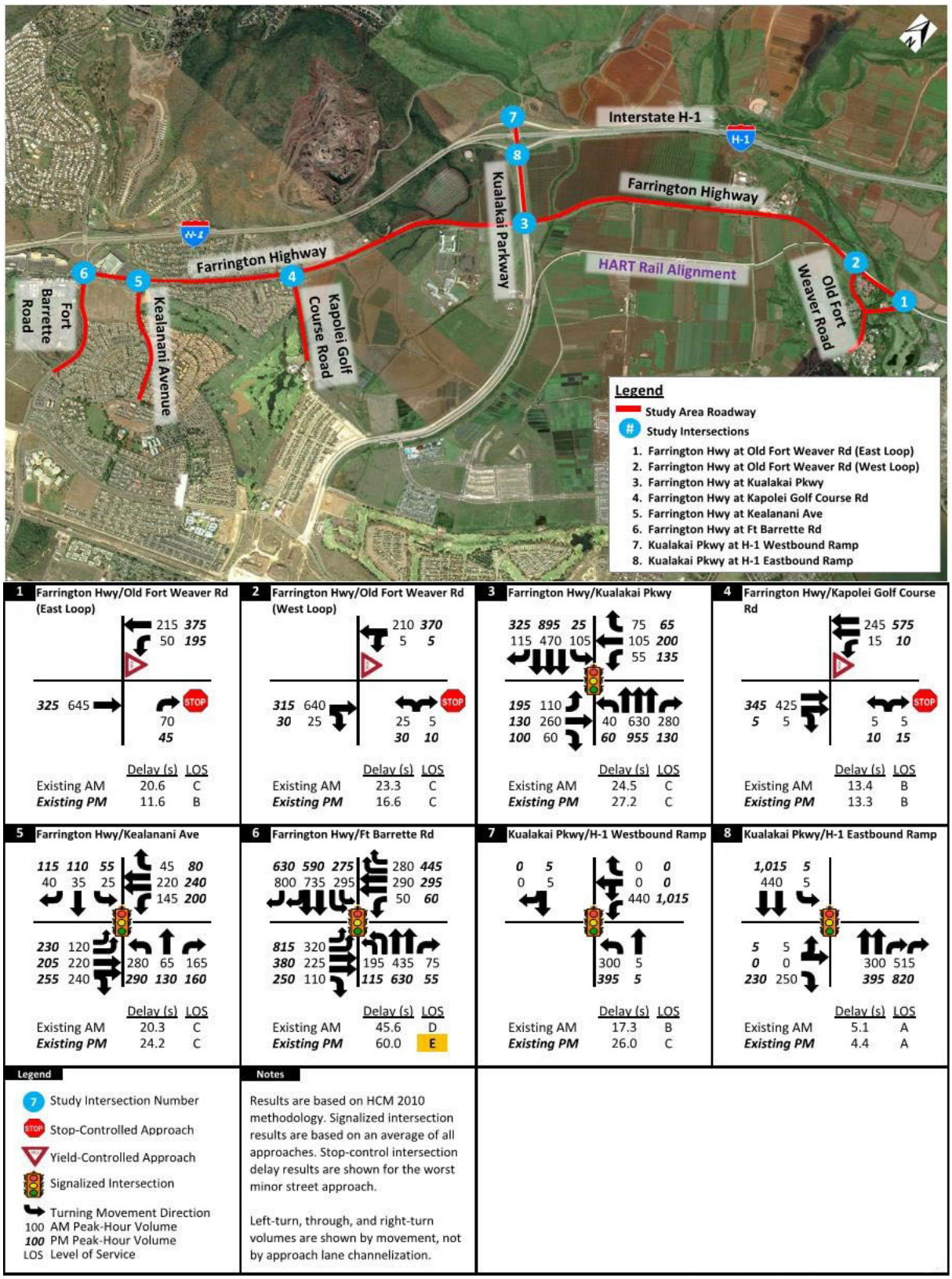
Peak Hour	Int ID	Intersection	Control Type	Delay (seconds)	LOS
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	20.6	C
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	23.3	C
	3	Farrington Highway and Kūalakai Parkway	Signal	24.5	C
	4	Farrington Highway and Kapolei Golf Course Road	Stop	13.4	B
	5	Farrington Highway and Kealanani Avenue	Signal	20.3	C
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	45.6	D
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	17.3	B
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	5.1	A
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	11.6	B
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	16.6	C
	3	Farrington Highway and Kūalakai Parkway	Signal	27.2	C
	4	Farrington Highway and Kapolei Golf Course Road	Stop	13.3	B
	5	Farrington Highway and Kealanani Avenue	Signal	24.2	C
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	60.0	E
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	26.0	C
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	4.4	A

Note: Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

Table 3-4 Existing 2018, No Build and Build 2028 Segment Operations

Roadway Segment	Travel Direction	2018 Existing			2028 No Build			2028 Build		
		Number of Lanes	AM LOS	PM LOS	Number of Lanes	AM LOS	PM LOS	Number of Lanes	AM LOS	PM LOS
Farrington Highway										
Between Fort Barrette Ave and Kealanani Ave	Eastbound	2	A	A	2	B	B	2	B	B
	Westbound	2	A	A	2	B	B	2	B	B
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	A	A	2	B	B	2	B	B
	Westbound	2	A	A	2	A	B	2	A	B
Between Kapolei Golf Course Road and Kūalakai Parkway	Eastbound	1	B	B	1	D	E	2	B	B
	Westbound	1	A	B	1	C	E	2	B	C
Between Kūalakai Parkway and Fort Weaver Road (West Loop)	Eastbound	1	C	A	1	D	D	2	B	B
	Westbound	1	A	B	1	C	D	2	A	B
Between Fort Weaver Road West Loop and East Loop	Eastbound	1	B	A	1	D	C	2	B	A
	Westbound	1	A	A	1	B	C	2	A	A
Kūalakai Parkway										
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	A	B	3	B	C	3	B	C
	Southbound	3	A	B	3	B	C	3	B	C
South of Farrington Hwy (For approximately 1,000 feet)	Northbound	3	A	A	3	C	C	3	C	C
	Southbound	3	A	A	3	B	C	3	B	C

Note: Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.



Existing (2018) AM and PM Peak Hour **Figure 3-9**

Potential Impacts and Mitigation Measures

Future traffic demand forecasts were developed using the O'ahu Regional Transportation Plan (ORTP) travel demand model and forecasts based on planned land use developments within the study area and adjacent to the Farrington Highway corridor (*Figure 3-10)*. The footprint of the DR Horton Ho'opili community shown in this figure is consistent with the planned development as documented in the Ho'opili TIAR (April 28, 2013 and revised May 30, 2014).

Future year traffic volumes in the analysis were established with incremental trips expected with planned developments and background traffic volumes for 2028 and 2035. A detailed description and assumptions used for traffic volume forecasting and associated trip generation are provided in *Appendix E*.

Planned Future Development Map **Figure 3-10**

Year 2028 Conditions

This section describes traffic conditions in the study area for the year 2028. The 2028 No Build scenario assumes a modest 0.5 percent annual background growth in traffic for developments that are already completed, as well as vehicle trips from nearby planned developments that are expected to be complete by 2028.

The 2028 Build scenario includes background traffic plus vehicle trips from anticipated land use and proposed developments, with a four-lane Farrington Highway cross-section (two-lanes in each direction) between Kapolei Golf Course Road and Old Fort Weaver Road.

No Build Operations

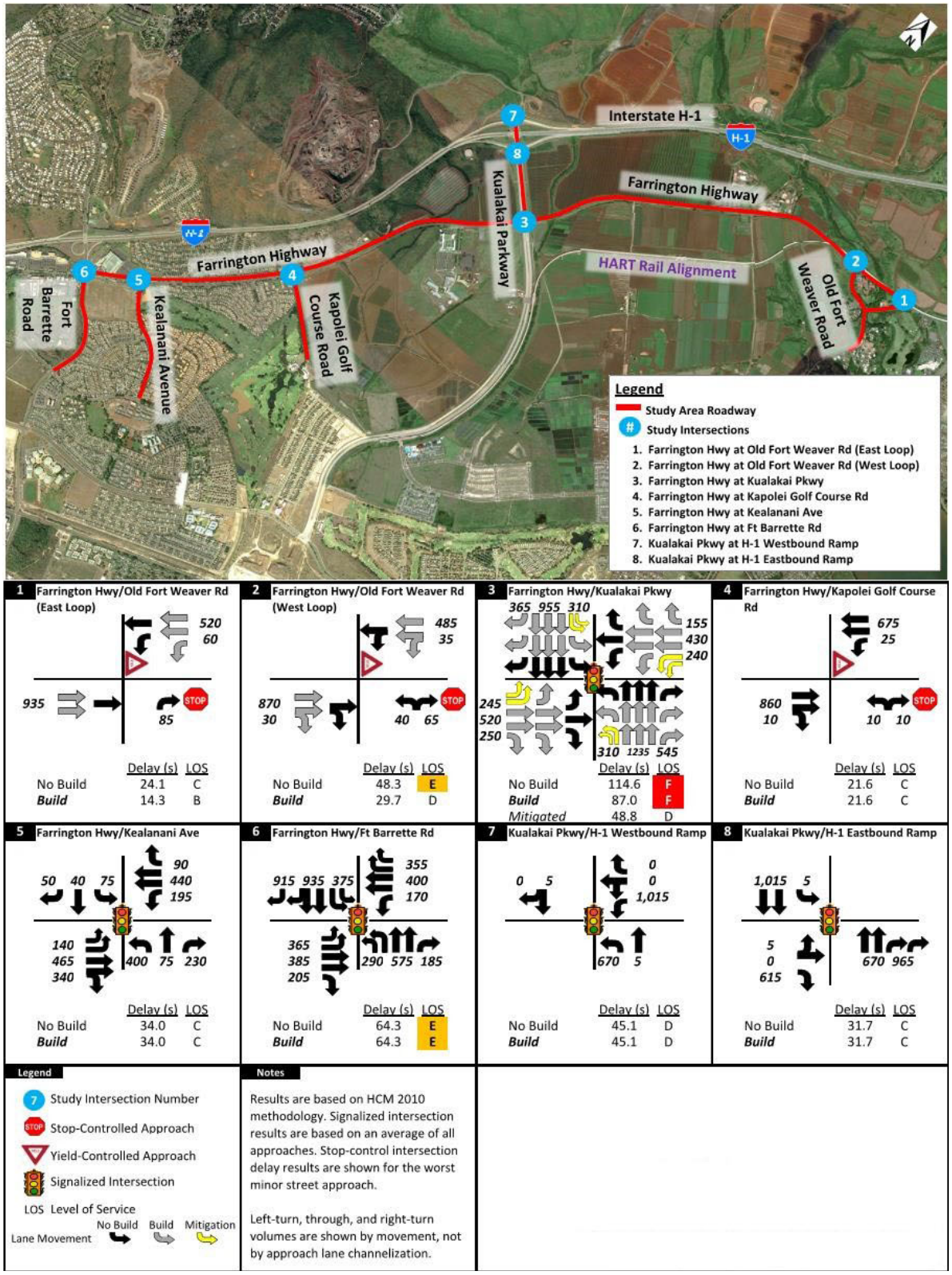
Under the 2028 No Build scenario, the lane configuration on Farrington Highway would remain the same as existing conditions (two-lane road; one-lane in each direction). Between Kapolei Golf Course Road and Old Fort Weaver Road, the roadway is a two-lane, undivided highway with limited shoulders and without non-motorized facilities. With background traffic increases and planned development trips, five of the study intersections would operate at LOS D or better during the AM peak hour. During the PM peak hour, four of the eight study intersections are expected to operate at LOS D or better. The intersections of Farrington Highway at Fort Barrette Road and at Old Fort Weaver Road (west loop) would operate at LOS E or F in both peak hours. During the PM peak hour, the signalized intersection at the H-1 westbound on- and off-ramp at Kūalakai Parkway would operate at LOS F due to high traffic volumes making the left-turn from H-1 towards Kapolei.

Many of the planned developments are located along Farrington Highway or can be accessed by Kūalakai Parkway, therefore most vehicles heading to or coming from H-1 pass through the intersection of Farrington Highway at Kūalakai Parkway. It is expected that this intersection would operate at LOS F with high delay times and congestion during the AM and PM peak. *Table 3-5* and *Figures 3-11 and 3-12* provide a summary of the 2028 No Build intersection operations results for the AM and PM peak hours.

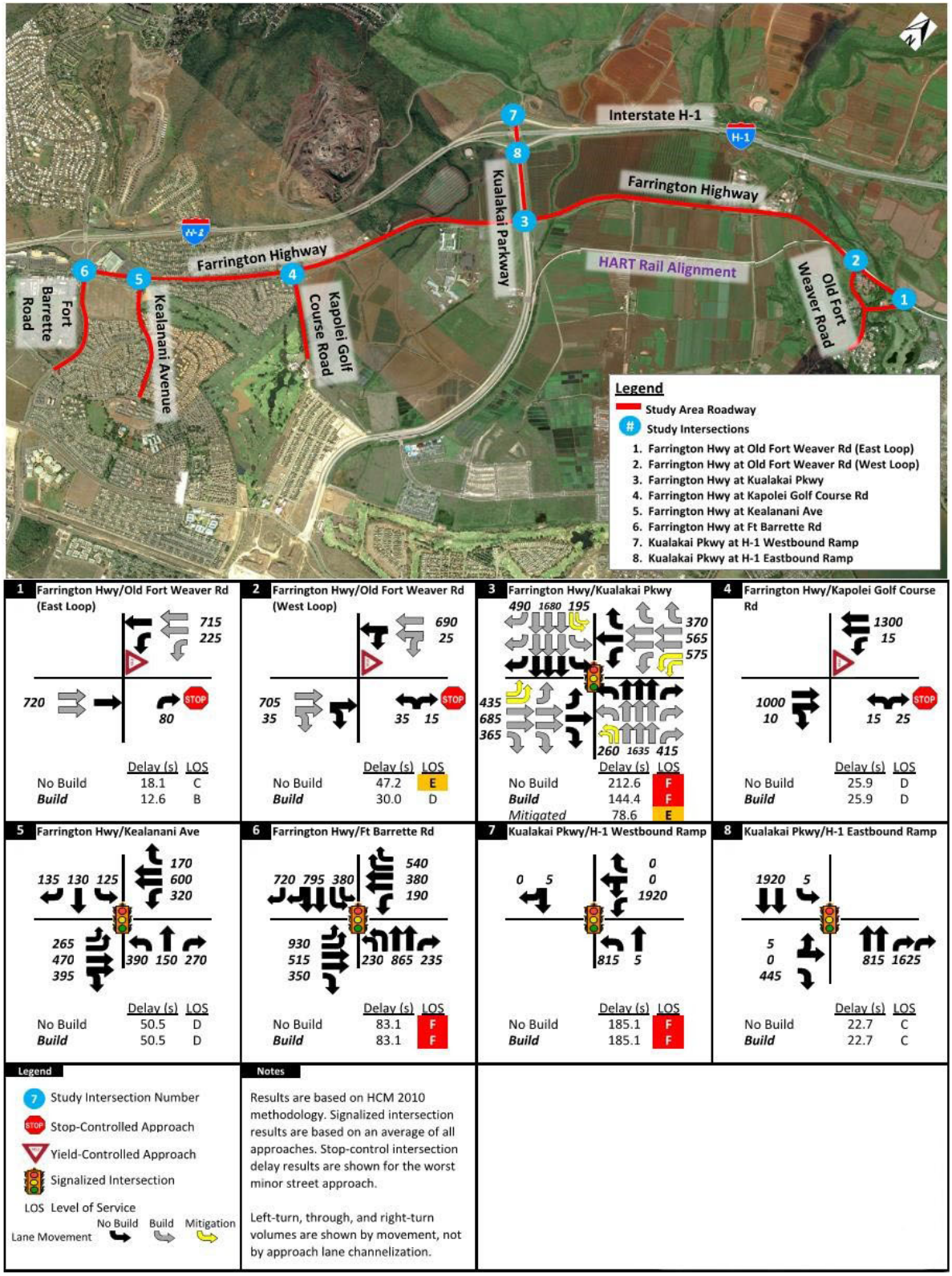
Table 3-5 No Build and Build 2028 Intersection Operations

Peak Hour	Int ID	Intersection	Control Type	2028 No Build (2-lanes to Golf Course Road)		2028 Build (4-lanes to Golf Course Road)		2028 Build Mitigated (4-lanes to Golf Course Rd, double left-turns at Kūalakai Pkwy)	
				Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	24.1	C	14.3	B	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	48.3	E	29.7	D	-	-
	3	Farrington Highway and Kūalakai Parkway	Signal	114.6	F	87.0	F	48.8	D
	4	Farrington Highway and Kapolei Golf Course Road	Stop	21.6	C	21.6	C	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	34.0	C	34.0	C	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	64.3	E	64.3	E	-	-
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	45.1	D	45.1	D	-	-
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	31.7	C	31.7	C	-	-
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	18.1	C	12.6	B	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	47.2	E	30.0	D	-	-
	3	Farrington Highway and Kūalakai Parkway	Signal	212.6	F	144.4	F	78.6	E
	4	Farrington Highway and Kapolei Golf Course Road	Stop	25.9	D	25.9	D	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	50.5	D	50.5	D	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	83.1	F	83.1	F	-	-
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	185.1	F	185.1	F	-	-
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	22.7	C	22.7	C	-	-

Note: Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.



Year (2028) AM Peak Hour
No Build, Build, and Build with Mitigation **Figure 3-11**



Year (2028) PM Peak Hour
No Build, Build, and Build with Mitigation **Figure 3-12**

No lane geometry improvements would be anticipated on Farrington Highway in the 2028 No Build scenario. With background growth and development trips, most study segments during the AM and PM peak hour would operate at LOS D or better. During the PM peak hour, the segment between Kapolei Golf Course Road and Kūalakai Parkway would operate at LOS E in both directions. *Table 3-4* provides a summary of the 2028 No Build segment analysis results.

Build Operations with Developments (Intersections)

To provide additional roadway capacity and accommodate trips from anticipated developments, Farrington Highway east of Kapolei Golf Course Road is projected to be widened to a four-lane, divided roadway with dedicated turn lanes at select cross-streets in the 2028 Build scenario. Intersection controls at the study intersections are expected to remain similar to the existing conditions.

With increased roadway capacity, operations at some study intersections will improve compared to the No Build scenario (*Table 3-5* and *Figures 3-11 and 3-12)*. Operations at Farrington Highway and Old Fort Weaver Road (west loop) will improve from LOS E to D during the AM and PM peak hours. The intersection of Farrington Highway and Kūalakai Parkway will remain at LOS F (same as No Build) but the average delay will improve by over 25 seconds per vehicle in the AM peak hour, and by nearly 70 seconds per vehicle in the PM peak hour. With roadway widening, the pedestrian phases at the intersection of Farrington Highway and Kūalakai Parkway would be longer than in the No Build scenario. These longer crossing times are necessary to accommodate the longer crossing distance as well as the anticipated increase pedestrian activity throughout the day.

An analysis of potential vehicle queuing impacts of future development was also conducted as detailed in *Appendix E*. This analysis network includes the three study intersections along Kūalakai Parkway, including the H-1 interchange ramp terminals and the intersection with Farrington Highway. Although additional capacity is provided on Farrington Highway in the 2028 Build scenario, there will be substantial growth in vehicular and pedestrian demand generated by the planned developments.

- Eastbound through movement queues on Farrington Highway approaching Kūalakai Parkway could extend back beyond the UHWO driveway, and westbound queues may affect access to the Hoʻopili development.
- At the H-1 interchange westbound ramp terminal, congestion and queues are expected on the northbound left-turn and westbound left-turn movements. The northbound left-turn queue from Kūalakai Parkway to westbound H-1, on average, is not expected to affect the eastbound ramp terminal, but occasional maximum queues may extend back past the eastbound ramp terminal.
- The westbound left-turn movement queue from the H-1 off-ramp to southbound Kūalakai Parkway is expected to be long, with high vehicle delays. However, the westbound off-ramp queue would still be contained on the ramp and would not be expected to spill back onto the mainline.

Potential Mitigation

With road widening, the intersection of Farrington Highway and Kūalakai Parkway is expected to operate at LOS F in the 2028 Build scenario. Mitigation measures are identified to increase capacity and improve vehicle efficiency. By implementing double left-turn lanes on all approaches of the intersection, more vehicles will be allowed to pass through the intersection on the same green phase. With more efficient service on the left-turn signal phases, capacity (or green time) can be reallocated to other movements to reduce delay.

In the AM peak hour, the overall average intersection delay will improve from 87 seconds per vehicle (LOS F) to 49 seconds per vehicle (LOS D) with mitigation. Nearly all individual turning movements will improve by at least one LOS grade, and all movements will experience a reduction in vehicle delay from the reallocation of green time. In the PM peak hour, the average intersection delay will improve from 144 seconds per vehicle (LOS F) to 79 seconds per vehicle (LOS E) with mitigation. Although many individual movements will remain at LOS F with the additional turn lanes, all movements will benefit from the increased capacity.

Table 3-5 provides a comparison of intersection operations between the 2028 No Build and Build scenarios, and the improved vehicle delay and LOS at the intersection of Farrington Highway and Kūalakai Parkway with added left-turn capacity mitigation. Lane capacity mitigation is not proposed at the remaining study intersections. The project is not expected to worsen operations at the intersection of Farrington Highway at Fort Barrette Road, or the H-1 westbound ramp terminal on Kūalakai Parkway. Both locations are expected to operate at LOS E or worse in the future No Build scenario, even without the project, as a result of the anticipated regional background traffic growth and vehicle trips generated by area land use developments.

Figures 3-11 and 3-12 display the intersection turning movements at each study intersection for the No Build and Build scenarios with turn lane mitigation at Farrington Highway and Kūalakai Parkway. With mitigation, vehicle queue lengths will improve on nearly all approaches of the Farrington Highway and Kūalakai Parkway intersection. The additional left-turn lane capacity will allow more vehicles to pass through the intersection in the same amount of time as the scenario without lane mitigation. Traffic signal timing has been optimized to provide improvements to the overall intersection LOS. In the PM peak hour, the intersection will improve from LOS F in the Build scenario to LOS E, and the average vehicle delay will be reduced by approximately 65 seconds. The optimized signal includes a reasonable level of prioritization of the southbound left-, through-, and right-turn movements to prevent queues from affecting the H-1 interchange.

More aggressive signal prioritization could be given to the southbound movements, however, it will worsen the remaining approaches and cause the overall intersection to operate at LOS F. Taking time from the eastbound and westbound approaches and giving that time to the southbound movements in anticipated to improve the through- and right-turn movements to LOS D, but will also increase the average vehicle delay on westbound Farrington Highway by over 100 seconds.

Adaptive signal control technology may be considered during the final design phase of traffic signal improvements at Farrington Highway and Kūalakai Parkway, as well as at new traffic signals along the Farrington Highway corridor within the study limits. Adaptive signal control would allow a coordinated system of traffic signals to optimize vehicle flow by actively adjusting phases to accommodate real-time traffic. This type of technology would reduce wait times at intersections and increase efficiency of traffic flow.

Appendix E presents the individual movement delays at the intersection of Farrington Highway and Kūalakai Parkway. Even with improved timing and left-turn vehicle progression, the eastbound through movement queues on Farrington Highway approaching Kūalakai Parkway in the PM peak hour may still extend back beyond the UHWO driveway.

Several grade separation concepts were considered at the intersection of Kūalakai Parkway and Farrington Highway, including a compressed diamond configuration and various partial cloverleaf designs, to provide better LOS for vehicular traffic to meet the State DOT's preferred LOS D operation. However, the grade separated intersection designs at Kūalakai Parkway and Farrington Highway would require significant property acquisition to accommodate the configuration on-ramps and off-ramps.

The ramps would also affect adjacent property owners as ramp lengths would block driveway access to each property. In addition, the proximity of the new grade separated intersection to the H-1 Freeway would require difficult weaving patterns with vehicles merging onto Kūalakai Parkway. The grade separated intersection would be not be consistent with proposed East Kapolei Neighborhood TOD (transit-oriented development) Plan (Public Review Draft 2), which envisions the area as transit-oriented development sites that are compact and pedestrian friendly. Grade separation intersections are typically less pedestrian and bicycle friendly and is not aligned with the future vision of Farrington Highway as a multimodal corridor. For these reasons, the grade separation intersection was eliminated from further consideration. Previously considered grade separation concepts at the intersection of Farrington Highway and Kūalakai Parkway are shown in *Appendix E*. While the proposed at-grade intersection is expected to operate at LOS F and may not meet the State DOT's recommended LOS D for transportation facilities, it will provide additional capacity and mitigation that would not otherwise be provided under the 2028 No Build scenario.

Build Operations with Developments (Segments)

During the AM and PM peak hours, all study segments are expected to continue operating at LOS C or better with development trips. *Table 3-4* provides a summary of the segment operations results for the 2028 Build scenarios compared to the No Build results. Peak hour segment volumes are included in *Appendix E*. No mitigation is proposed for the Farrington Highway study segments because they are expected to operate at LOS C or better with development trips in the 2028 Build scenario.

Future Phase (2035) Conditions

This section describes anticipated traffic conditions in the study area for the future phase year 2035. Year 2035 traffic volumes include background growth (assuming a 0.5 percent annual increase) and trips generated for developments that are expected to be complete by 2035.

The No Build lane configuration includes two lanes in each direction between Kapolei Golf Course Road and Old Fort Weaver Road on Farrington Highway. This No Build scenario assumes that intersection improvements have been made at both Old Fort Weaver Road intersections with Farrington Highway to support access for the Hoʻopili development. As indicated in the Hoʻopili Traffic Impact Analysis Report (TIAR) (2014), both intersections (which are currently stop-controlled) are planned to have traffic signals in 2035.

Recommended regional connectivity projects documented in the ORTP (and documented in the Hoʻopili TIAR for the full project buildout), are assumed to be in place in the No Build scenario. These improvements include an extension of Makakilo Drive to Kūalakai Parkway north of the H-1 interchange, as well as turn lane additions at the westbound H-1 off-ramp terminal intersection at Kūalakai Parkway.

The 2035 future phase Build scenario assumes the same traffic volumes as the No Build scenario, but includes three lanes in each direction of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road.

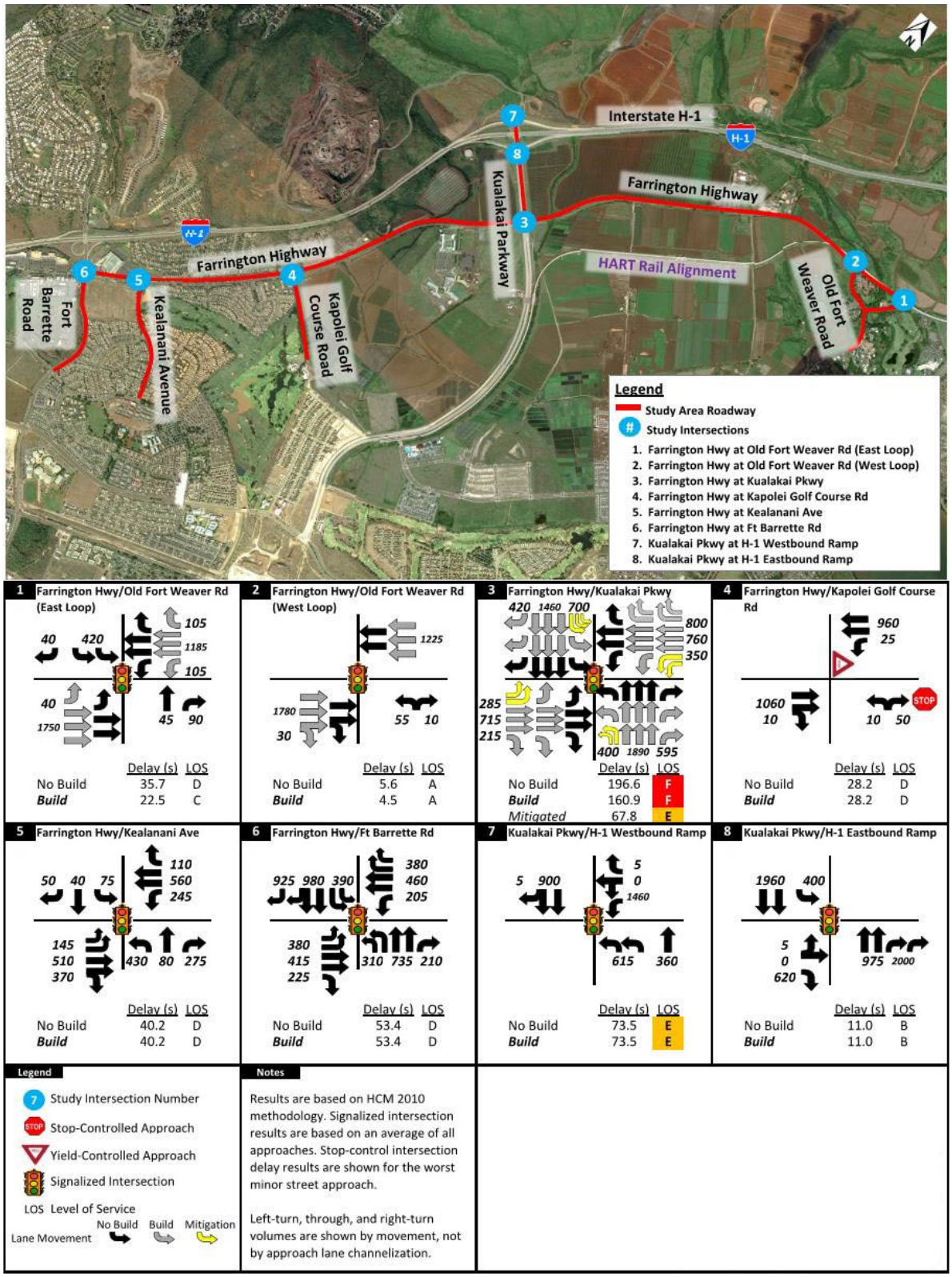
No Build Operations

With Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road as a four-lane, divided roadway, two of the study intersections are expected to operate at LOS E or worse during the AM peak hour. During the PM peak hour, nearly all intersections are expected to operate at LOS E or worse. *Table 3-6* and *Figures 3-13 and 3-14* provide a summary of the 2035 No Build intersection operations results for the AM and PM peak hours.

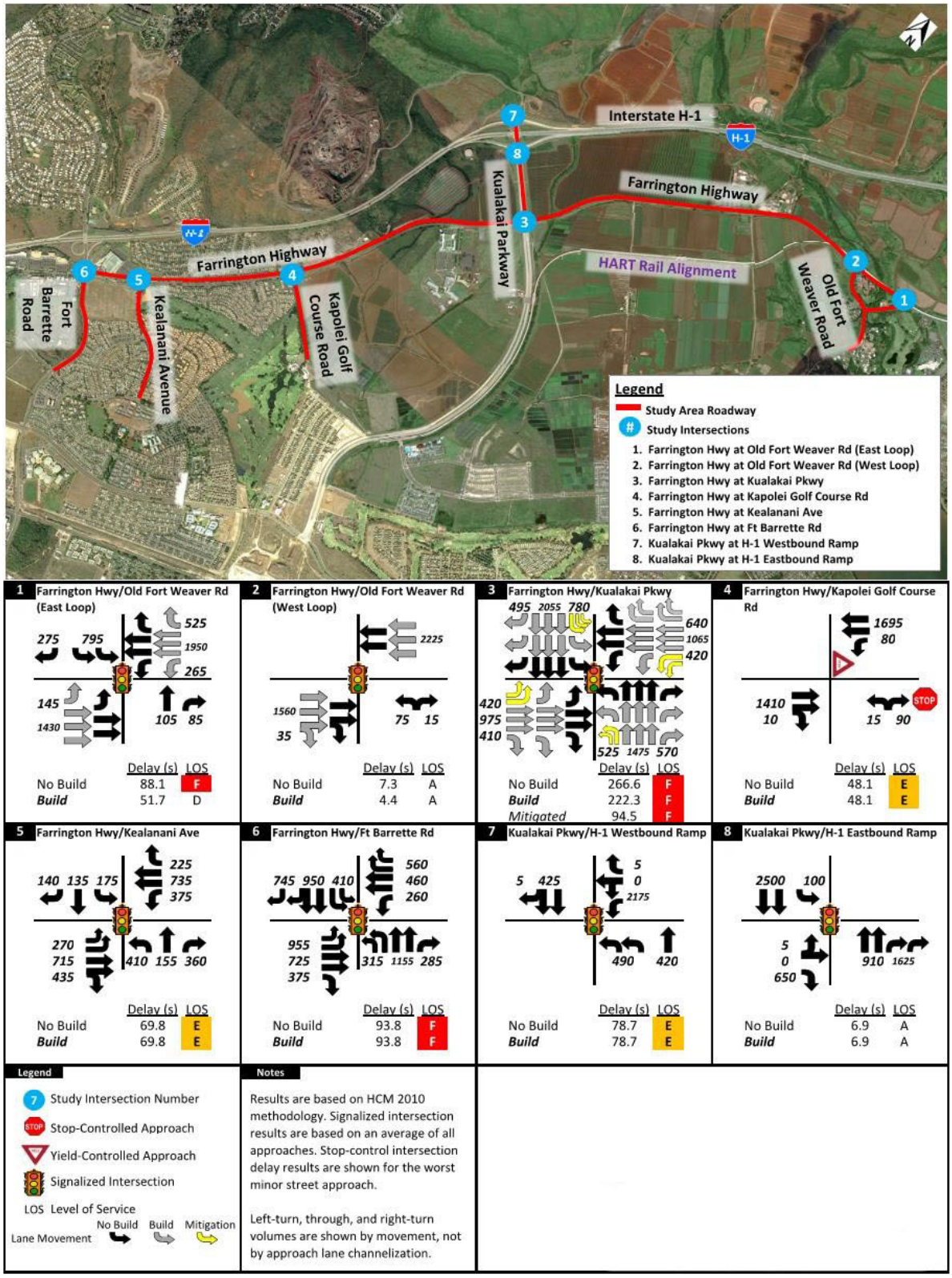
Table 3-6 No Build and Build 2035 Intersection Operations

Peak Hour	Int ID	Intersection	Control Type	2035 No Build (4-lanes to Golf Course Rd)		2035 Build (6-lanes to Golf Course Rd)		2035 Build Mitigated (6-lanes to Golf Course Rd, turn lane improvements at Kūalakai Pkwy)	
				Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	35.7	D	22.5	C	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	5.6	A	4.5	A	-	-
	3	Farrington Highway and Kūalakai Parkway	Signal	196.6	F	160.9	F	67.8	E
	4	Farrington Highway and Kapolei Golf Course Road	Stop	28.2	D	28.2	D	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	40.2	D	40.2	D	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	53.4	D	53.4	D	-	-
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	73.5	E	73.5	E	-	-
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	11.0	B	11.0	B	-	-
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	88.1	F	51.7	D	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	7.3	A	4.4	A	-	-
	3	Farrington Highway and Kūalakai Parkway	Signal	266.6	F	222.3	F	94.5	F
	4	Farrington Highway and Kapolei Golf Course Road	Stop	48.1	E	48.1	E	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	69.8	E	69.8	E	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	93.8	F	93.8	F	-	-
	7	Kūalakai Parkway and H-1 Westbound Ramps	Signal	78.7	E	78.7	E	-	-
	8	Kūalakai Parkway and H-1 Eastbound Ramps	Signal	6.9	A	6.9	A	-	-

Note: Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.



Future Phase (2035) AM Peak Hour
No Build, Build, and Build with Mitigation **Figure 3-13**



Future Phase (2035) PM Peak Hour
No Build, Build, and Build with Mitigation **Figure 3-14**

Potential Mitigation

Mitigation measures are identified at the intersection of Farrington Highway and Kūalakai Parkway to further improve operations in the future phase Build scenario. With the proposed three lanes in each direction of Farrington Highway, the intersection is expected to operate at LOS F with over 160 seconds of average vehicle delay during the peak hours.

Consistent with potential mitigation identified in the Hoʻopili TIAR, increasing the turn lane capacity to double left-turn lanes on the eastbound, westbound, and northbound approaches would allow more vehicles to pass through the intersection on the same green phase. Increasing the southbound left-turn movement to triple lanes would further increase capacity and improve efficiency.

With the turn lane mitigation, the overall average intersection delay in the AM peak hour would improve from approximately 160 seconds per vehicle to 68 seconds per vehicle, resulting in LOS E. In the PM peak hour, average delay will improve from about 220 seconds per vehicle to 95 seconds per vehicle on average. Although mitigation will not provide enough capacity to sufficiently reduce vehicle delays to an acceptable LOS, the intersection will benefit from the additional capacity, and improvements to vehicle delay and queueing would likely be experienced. Adaptive signal control technology at this intersection and new signalized intersections along Farrington Highway within the study limits may be considered to optimize vehicle flow. This technology gathers data from real-time traffic and actively adjusts signal phases to accommodate flow most efficiently.

Mitigation measures such as grade separation of the intersection or widening Kūalakai Parkway to more than three lanes in each direction were not further explored in this study. Although these types of mitigation measures could improve operations to acceptable LOS values, they are not aligned with the future vision of Farrington Highway as a multimodal corridor.

Table 3-6 and Figures 3-13 and 3-14 compares intersection operations between the future phase year 2035 No Build and Build scenarios, and shows the improved vehicle delay and LOS at the intersection of Farrington Highway and Kūalakai Parkway with reasonable mitigation and capacity improvements. Lane capacity mitigation is not proposed at the remaining study intersections. The project is not expected to worsen operations at the intersection of Farrington Highway at Fort Barrette Road, or the H-1 westbound ramp terminal on Kūalakai Parkway. *Figures 3-13 and 3-14* reflect intersection turning movements for the No Build and Build scenarios, and also show the potential turn lane and capacity mitigation measures at the intersection of Farrington Highway and Kūalakai Parkway.

Build Operations with Developments (Segments)

With two lanes in each direction of Farrington Highway, all study segments are expected to operate at LOS D or better with development trips in the No Build scenario. With the future phase Build cross section consisting of three lanes in each direction, segment operations would further improve. *Table 3-7* provides a summary of the segment operations results for the future phase 2035 scenarios.

Table 3-7 No Build and Build 2035 Segment Operations

Roadway Segment	Travel Direction	2035 No Build			2035 Build		
		Number of Lanes	AM LOS	PM LOS	Number of Lanes	AM LOS	PM LOS
Farrington Highway							
Between Fort Barrette Ave and Kealanani Ave	Eastbound	2	B	C	2	B	C
	Westbound	2	B	B	2	B	B
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	B	C	2	B	C
	Westbound	2	B	C	2	B	C
Between Kapolei Golf Course Road and Kūalakai Parkway	Eastbound	2	B	C	3	A	B
	Westbound	2	B	D	3	B	B
Between Kūalakai Parkway and Fort Weaver Road (West Loop)	Eastbound	2	D	D	3	B	C
	Westbound	2	C	D	3	B	C
Between Fort Weaver Road West Loop and East Loop	Eastbound	2	C	C	3	B	B
	Westbound	2	B	D	3	B	C
Kūalakai Parkway							
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	D	C	3	D	C
	Southbound	3	C	D	3	C	D
South of Farrington Hwy (For approximatly 1,000 feet)	Northbound	3	D	C	3	D	C
	Southbound	3	C	D	3	C	D

Note: Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.

Multimodal Assessment

Based on the goals and objectives of long-range transportation plans and multimodal plans, this analysis considers all modes of transportation within the project corridor. A qualitative assessment of existing and 2028 Build scenario multimodal (transit, bicycle, pedestrian, and vehicle) conditions along Farrington Highway is presented in this section.

The level and quality of service of each mode is determined using a specific methodology for each mode. This analysis results in a uniform multimodal score, scaled from one to four, with one being the best. The multimodal score is used in a modal priority analysis to determine whether the modal accommodations meet the 'target' score for the specified street typologies. The 'target' score represents the goal for a particular mode on a specified street typology, which is based on City and County of Honolulu established priorities.

Farrington Highway is given the street typology designation of a 'Boulevard and Parkway' where automobile traffic and transit services are prioritized over non-motorized modes. The preliminary plans for highway improvements include nonmotorized facilities, landscaping, and additional travel lanes. Planned improvements will be constructed within a 140-foot wide right-of-way between Kapolei Golf

Course Road and Old Fort Weaver Road. The improved cross section includes 8-foot sidewalks and 10-foot stormwater treatment planter strips on both sides of the highway. Striped 6-foot bicycle lanes, and two 12-foot travel lanes are provided in each direction of travel on Farrington Highway. Travel directions are separated by a 44-foot planted median. *Figure 2-1* depicts the preliminary typical cross section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road.

For this study, the highway is divided into three segments based on where traffic volumes are anticipated to change along the corridor. The segments are described below and the anticipated roadway cross section design, along with preliminary roadway plan and profile information between Kapolei Golf Course Road and Old Fort Weaver Road, are included in *Appendix E*.

- Segment A extends from Kapolei Golf Course Road to Kūalakai Parkway. This segment is approximately 0.96 miles long.
- Segment B extends from Kūalakai Parkway to Old Fort Weaver Road (west intersection with Farrington Highway). This segment is approximately 1.6 miles long.
- Segment C extends from the Old Fort Weaver Road west intersection with Farrington Highway to the Old Fort Weaver Road east intersection with Farrington Highway. This segment is approximately 0.36 miles long.

Transit Assessment

The Transit Capacity and Quality of Service Manual (TCQSM) developed by the Transportation Research Board evaluates transit service on a corridor based on transit operations, transit amenities, and pedestrian environment data. From this analysis, a Transit Level of Service (Transit LOS) assigns a letter grade and that represent relative transit operations/comfort on a scale of one through four, as shown in *Appendix E.*

The existing (2018) and 2028 Build scenario transit environment was assessed for each of the Segments A, B, and C along the study corridor between Kapolei Golf Course Road and Old Fort Weaver Road using the TCQSM methodology. Existing transit route frequency and headways were gathered from the City and County of Honolulu and existing roadway features such as shelters, buffer widths, and sidewalks were gathered from online aerial mapping. Roadway Segments A and B currently operate at Transit LOS B, while Segment C operates at LOS A.

In the future, the number of local transit routes is assumed to increase to support regional rail operations. Transit amenities at bus stop locations will be improved to include benches, shelters, and wider buffers between the roadway and the bus stop waiting area. Transit LOS with the 2028 Build scenario is expected to be LOS A in all three segments.

Bicycle Assessment

The Level of Traffic Stress (LTS) tool is used to evaluate bicycle comfort on Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. LTS uses assess traffic volumes, vehicle speeds, type of bicycle infrastructure, and roadway design to evaluate bicycling conditions. The bicycle environment is assigned to one of the four levels of traffic stress, which is further described in *Appendix E*. Farrington Highway within the project area currently does not have bicycle lanes or wide shoulders that can accommodate shared bicycle and vehicle traffic. The resulting existing bicycle LTS score of four indicates that the comfort for riders is generally low, and cyclists are likely to experience higher levels of stress.

In 2028 Build scenario, six-foot wide bicycle lanes are planned in both directions for the entire length of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. Bicycle lanes will be

adjacent to vehicle traffic. With striped bicycle lanes in the 2028 Build scenario, Segments A, B, and C, are each expected to operate with a bicycle LTS score of two, representing good cycling conditions.

Pedestrian Assessment

The quality and safety of the physical pedestrian environment is evaluated by the Pedestrian Environmental Quality Index (PEQI). This tool assesses the pedestrian environment in six categories including intersection safety, traffic, street design, land use, the perception of safety, and walkability. Measurable indicators such as the width of sidewalks, number of driveway cuts, and frequency of street lighting and street furniture, contribute to the overall pedestrian quality. Input values generate a total score ranging between 0-100 which correlates to a level of pedestrian comfort on a scale of one through four (*Appendix E*).

The existing PEQI score for Segments A, B, and C is 20, which corresponds to a pedestrian comfort scale of four. This suggests the existing roadway is unsuitable for pedestrians due to the lack of sidewalks or other pedestrian amenities. Although there is little to no pedestrian activity today at the intersection of Farrington Highway and Kūalakai Parkway, a PEQI score of 41 was given as some amenities are in place (traffic signal, street lighting, etc.) to provide basic pedestrian conditions.

By the 2028 Build scenario, Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road is expected to have continuous, eight-foot sidewalks on both sides of the street. These sidewalks will be buffered from vehicle traffic by a 10-foot stormwater/landscaping planter strip and an on-street, striped six-foot bicycle lane. Pedestrian comfort and safety will be supported with lighting on both sides of the street, street trees, and throughways without obstructions or impediments. With these enhancements, the PEQI score for Segments A, B, and C, would increase to 64 and the pedestrian environment will be improved to a comfort scale of one. The intersection of Farrington Highway and Kūalakai Parkway will be enhanced with marked, visible crosswalks and pedestrian signal phases on all approaches. The pedestrian phases for peak periods and off-peak periods will be designed with adequate walk times to account for the anticipated crossing distances across Farrington Highway and across Kūalakai Parkway. With the expected increase in pedestrian activity throughout the day, the intersection will include pedestrian refuge islands on all legs, and accessible curb ramps on all corners of the intersection. These improvements increase the PEQI score to 78, suggesting that the intersection will provide ideal conditions for pedestrians.

Auto Assessment

The multimodal assessment of Farrington Highway considers vehicle operations at intersections and along segments using traffic volumes from the second highest peak hour of traffic counts. Intersection delay and LOS results from the second highest hour analysis are assigned an Auto LOS score ranging from one to four. In addition to intersection calculations, roadway segment LOS is calculated based on the estimated daily traffic volumes (in both directions) and expected use of each analysis segment of Farrington Highway. The estimated volume is compared against the standard HCM 2010 Generalized Daily Service Volumes for Urban Street Facilities, and each segment is assigned an Auto LOS. The Auto LOS scoring systems and ranges for both intersections and segments, are shown in *Appendix E*.

The Auto LOS score the existing Segments A, B, and C by the daily volumes, which are in the range of approximately 7,000 to 10,000 vehicles per day. This volume on a 2-lane road corresponds to an operations scale of two.

In the 2028 Build scenario, study area segment volumes are expected to increase between approximately 14,000 and 26,000 vehicles per day in both directions. On a 4-lane roadway cross-

section, these volumes will correspond to an operations scale of two for Segments A, B, and C. See *Appendix E* for the Auto LOS evaluation of each multimodal segment.

Multimodal Summary

A summary of the transit, bicycle, pedestrian, and auto evaluation scores for study area Segments A, B, and C, along with their target scores for the 'Boulevard and Parkway' street typology, are shown in *Appendix E*. Based on the street type modal priorities, the planned design of Farrington Highway is expected to meet the target score for pedestrian comfort for bicycle conditions. The planned design is expected to meet the target for transit conditions, which include amenities provided and comfort or services focused on transit riders. Transit vehicle operations are expected to be influenced by general purpose vehicle operations along Farrington Highway. Transit coaches are likely to experience high delays and congestion at the study intersections projected to operate at LOS E or F in the future Build scenario.

The projected vehicle operations on Farrington Highway in 2028 are not expected to meet the target condition for a 'Boulevard or Parkway.' The planned design does not worsen the auto target score compared to the existing conditions. Since the auto target score is based solely on daily vehicular volumes, measures to reduce vehicle trip generation along the corridor are recommended. Improving nonmotorized access and mobility, and planning for land uses that are incorporated into the neighborhoods, could encourage drivers to make their trips using an alternative mode.

Recommendations

The proposed improvements for this stretch of Farrington Highway should incorporate a multimodal approach and consider all potential transportation users in the planning and design of the facility. The planned improvements meet the target score for pedestrian comfort and for bicycle conditions. In addition, the planned design is expected to meet the target for transit conditions in terms of amenities provided and comfort or services focused on transit riders. However, transit vehicle operations, in terms of travel time or delay, are expected to be influenced by general purpose vehicle operations along Farrington Highway. The transit coaches will experience the same delays and congestion as autos at the study intersections projected to operate at LOS E or F in the 2028 and future phase (2035) Build scenarios.

With consideration of a context sensitive approach, consistency with the proposed East Kapolei Neighborhood TOD Plan, and the future vision of Farrington Highway as a multimodal corridor, additional lane capacity and grade separation options at the Farrington Highway and Kūalakai Parkway intersection were not further pursued.

Based on the 2028 traffic operations, the Build Mitigated scenario is recommended. Mitigation in the form of double left-turn lanes is recommended at the intersection of Farrington Highway and Kūalakai Parkway. The additional turn lane capacity will improve overall intersection vehicle delay compared to the No Build scenario. Signal prioritization for the movements along Kūalakai Parkway will also allow more efficient north-south vehicle progression, and adaptive signal control technology may be considered. In the AM peak hour, this intersection will improve from LOS F in the No Build scenario (with over 110 seconds of average delay) to LOS D with mitigation (less than 50 seconds of average vehicle delay). In the PM peak hour, additional turn lane capacity will improve the overall LOS from F in the No Build scenario (with over 210 seconds of average delay) to LOS E with mitigation (approximately 80 seconds of average delay).

The recommended planned improvements will meet the purpose of the project to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation options for all users.

3.16 Socio-Economic Characteristics

Existing Conditions

Population and Demographics

There are currently no residential population or dedicated employees on the project area. The project area spans two larger Census Tracts: 86.06 Kapolei Golf Course and 86.14 Kunia West (*Figure 3-15*). *Table 3-8* shows population and demographic information for the State, Island of O‘ahu, the ‘Ewa DP area which includes 23 census tracts, and the two census tracts within which the project is physically located.

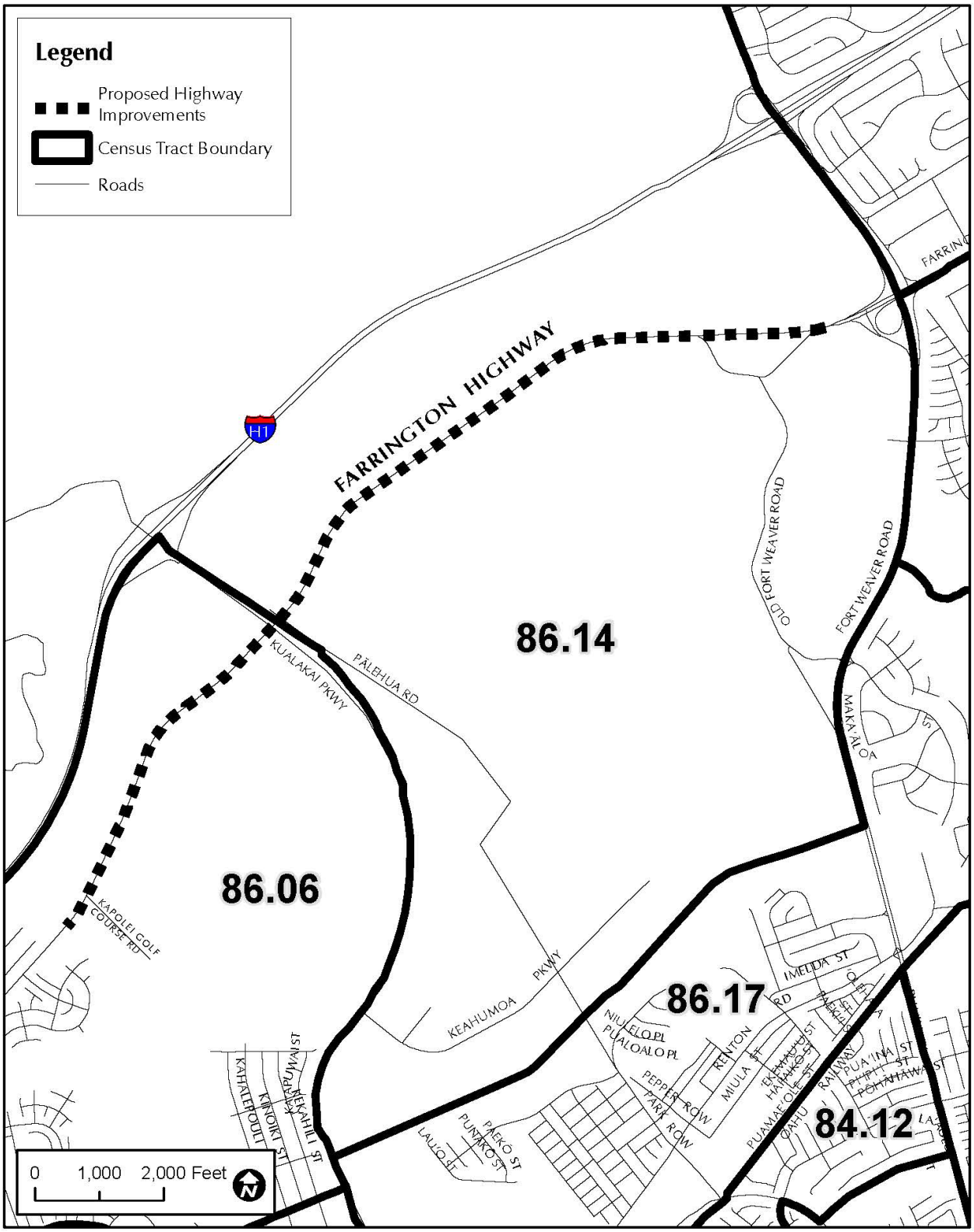
Hawai‘i is unique among other states in the U.S. as no single race comprises the majority of the population. According to 2018 Census Data, “Asian” comprised the largest population in the State at 37.8% of the population, which represented 46.3% of the population within the ‘Ewa DP area. In the ‘Ewa DP area, “Two or More Races” was the second largest ethnic group represented at 25.4%, with “White” was the third largest ethnic group at 16.6%.

The median age in the ‘Ewa DP area and the project area census tracts was 36.1 years old. This is slightly lower than the Statewide median age of 38.9 years old.

Table 3-8 Population and Demographics

2018 Census	State of Hawai‘i	O‘ahu	‘Ewa DP Area (23 Tracts)	Kapolei Golf Course	Kunia West
				86.06	86.14
Population	1,422,029	987,638	344,887	12,017	10,583
Ethnicity					
White	25%	21.0%	16.6%	10.0%	20.2%
African American	1.8%	2.4%	2.7%	0.3%	7.1%
American Indian/Alaskan Native	0.2%	0.2%	0.1%	0%	0%
Asian	37.8%	42.5%	46.3%	35.1%	33.7%
Japanese	12.1%	14.0%	12.8%	6.1%	4.3%
Filipino	15.1%	15.1%	23.6%	22.0%	21.0%
Chinese	4.0%	5.2%	2.3%	2.6%	3.1%
Native Hawaiian/Other Pacific Island.	10.1%	9.5%	8.1%	18.9%	7.2%
Native Hawaiian	6.3%	5.1%	3.8%	10.8%	6.4%
Other	1.1%	0.9%	0.9%	0.2%	0.4%
Two or More Races	24.0%	23.5%	25.4%	35.5%	31.3%
Age					
Under 5 Years	6.4%	6.5%	7.0%	5.8%	8.3%
5-19 Years	17.3%	17.1%	18.8%	25.6%	24.2%
20-64 Years	59.0%	59.5%	59.5%	59.8%	57.5%
65 or More Years	17.3%	16.8%	14.7%	9.3%	9.9%
Median Age (Years)	38.9	37.6	36.1*	35	33.2

Source: 2018 Census (Sf1)
*Average median age based on median age for 23 tracts making up ‘Ewa DP Area



Census Tracts **Figure 3-15**

Income and Employment

Statewide in 2018, approximately 9.9% of individuals earned an income below poverty level. Within the Kapolei Golf Course and Kunia West census tracts (2018), the percentage of individuals earning below the poverty level was only 4.7% and 6.1%, respectively. The median statewide household income was approximately $78,084 (2018). Median income in the census tracts where the project area is located was $96,784 in the Kapolei Golf Course tract, and $93,906 in the Kunia West tract. The percentage of individuals utilizing Social Security income was higher within the ‘Ewa DP and project area census tracts in comparison to O‘ahu and the State overall. In 2018, the unemployment level was about 4.5% island-wide. The unemployment rate within the ‘Ewa DP is 3.8% which was lower than unemployment rates within the Kapolei Golf Course tract at 6.9% and the Kunia West Tract at 4.3%.

Housing

Of the 103,303 housing units in the ‘Ewa DP area, 65.7% of these units are owner-occupied (*Table 3-9*). This is higher than the state-wide and island-wide average of owner-occupied units which is roughly 58.3% and 55.8%, respectively. Approximately 70% of structures within the project area census tracts were constructed prior to 2000, with another approximately 20% constructed after 2000.

Table 3-9 Housing

American Community Survey	State of Hawai‘i	O‘ahu	‘Ewa DP Area (23 Tracts)	Kapolei Golf Course	Kunia West
				86.06	86.14
Number of Housing Units*	539,053	348,497	103,303	3,026	3,177
Tenure					
Owner-Occupied	58.3%	55.8%	65.7%	73.3%	63.9%
Renter-Occupied	41.7%	44.2%	34.3%	26.7%	36.1%
Year Structure Built					
2014 or Later	1.2%	1.4%	0.4%	0.5%	2.3%
2000 to 2013	16.1%	13.4%	19.7%	35.0%	35.3%
1980 to 1999	29.5%	24.0%	35.0%	62.2%	33.2%
1960 to 1979	37.5%	43.1%	34.6%	2.4%	19.4%
Units in Structure					
1 Unit	62.3%	56.4%	67.9%	74.7%	62.7%
2 to 4 Units	6.3%	6.1%	7.0%	5.0%	8.5%
5 or More Units	31.1%	37.4%	24.9%	20.3%	28.9%

Source: 2018 American Community Survey 5-year Estimates (DP04)
*Source: 2018 Census

Potential Impacts and Mitigation Measures

The planned project will not directly result in significant adverse impacts to socio-economic characteristics of within the project vicinity, including population, income, and housing. There are no residential populations or employment centers on the site as the project is proposing improvements to a portion of Farrington Highway. However, master planned developments such as UHWO, DHHL East Kapolei Developments, and Ho‘opili which is set to provide 11,750 homes and 3.4 million sf of business/commercial and light industrial space in the vicinity of the project. As such, the Farrington Highway Improvements project will help to support this additional housing, population growth, and employment in the area.

Other beneficial socio-economic impacts anticipated to result from the project include improved transportation times and short-term construction-related employment. These desirable long-term benefits would also be evenly distributed among area residents.

The future phase expansion of Farrington Highway to a six-lane road will not impact socio-economic characteristics of the area. The future phase of the project will result in increased benefits to the region as additional roadway capacity is provided allowing for more efficient transportation operations.

3.17 Public Services

3.17.1 Police

Existing Conditions

The project area is within the Honolulu Police Department's (HPD) District 8, which encompasses the Leeward Coast and the 'Ewa Plain. Two police stations located in District 8 include the Kapolei Police Station at 1100 Kamokila Boulevard and the Wai'anae Substation located at 85-939 Farrington Highway.

Potential Impacts and Mitigation Measures

The project will not increase the on-site population and will not create a long-term demand for additional police protection services. During the short-term, HPD may receive increased calls regarding construction-related traffic. In addition, HPD may be required to assist with project related construction and traffic flow. Potential traffic impacts will be mitigated through implementation of construction staging and traffic management plans. With the proposed mitigation measures, significant project related impacts on police services are not anticipated.

Future development of the six-lane expansion of Farrington Highway is not expected to impact to police operations and facilities. Population in the area will not increase as a result of the project, as such increased police services will not be required. However, during construction of the future roadway roadway expansion, short-term impacts may occur as HPD would likely provide support in managing construction related traffic operations.

3.17.2 Fire

Existing Conditions

Fire protection in Kapolei and 'Ewa is provided by the HFD 'Ewa Beach Fire Station, Makakilo Fire Station, Kapolei Fire Station, and the East Kapolei Fire Station. The nearest fire station is the East Kapolei Fire Station located at DHHL East Kapolei Parcel I on Kapolei Parkway and Kinoiki Street. To meet the projected population and economic growth in 'Ewa by 2035, four new fire stations at Ko Olina, Kalaeloa, Makaiwa Hills, and Ho'opili are being planned.

Access for fire apparatus, water supply, and building construction within the project will comply with existing codes and regulations. Fire apparatus access will be provided in accordance with the Uniform Fire Code, Section 902.2.1, as amended. Water infrastructure will be designed and installed in accordance with the Uniform Fire Code, Section 903.2, as amended. In addition, civil drawings will be submitted to HFD for its review and approval.

HFD works with the Emergency Medical Services (EMS), who dispatches the closest available unit. This may be either an EMS ambulance or a fire company and typically depends on the type of emergency and location. Since there are only 16 EMS stations on O‘ahu, fire companies are frequently the first responder.

Potential Impacts and Mitigation Measures

The planned project would not increase population and therefore would not increase demand for fire protection services.

The future six-lane expansion of Farrington Highway will also not result in an increase in population or demand for fire protection. The expanded roadway may allow for better HFD and EMS response times in emergencies.

3.17.3 Medical Services

Existing Conditions

The region is serviced by a variety of health care facilities. There are more than 25 choices of health care providers. QMC-WO is the nearest hospital providing services such as emergency care, outpatient care, and lab and imaging services.

Emergency medical and surgical services are also provided by Pali Momi Medical Center in Aiea and Wahiawā General Hospital. Non-emergency medical services are offered at the Kaiser Permanente Punawai Clinic in Kapolei, the Kaiser Permanente Nanaikeola Clinic located in Waianae, and the Kapolei Medical Park.

The City and County of Honolulu Emergency Medical Services (EMS) Division is divided into two operational districts, District 1 (West O‘ahu) and Distrct II (East O‘ahu). Each District is comprised of 10 EMS Advanced Life Support ambulance units and one Rapid Response Unit. Two EMS Advanced Life Support Ambulance units are located nearby at the Kapolei Fire Station and at the Waipahu Fire Station. The Rapid Response Paramedic Unit serving District 1 is located at Fire Station 35 Makakilo.

Potential Impacts and Mitigation Measures

The project will not increase population in the vicinity or demand for emergency medical services. Therefore, existing medical services and facilities are anticipated to be adequate to accommodate the project. No significant adverse impacts are anticipated.

Development of the future phase of the Farrington Highway project to a six-lane roadway is also not expected to result in negative impacts or increased needs for medical services. No mitigation is recommended.

3.17.4 Schools

Existing Conditions

There are no schools on or in the near vicinity of the planned Farrington Highway Improvement project area. The closest schools include Waipahu Elementary School located 1.2 miles east of eastern project terminus, and Kapolei Elementary School, Kapolei Middle School and Kapolei High School, located

approximately one-mile south of the western project terminus. The UHWO campus and HTIC is located adjacent to and south of the project alignment, west of Kūalakaʻi Parkway. Planned school facilities in the vicinity of the project are located within the Hoʻopili master-planned community and will serve the educational needs of this area.

Potential Impacts and Mitigation Measures

No long-term adverse impacts to school facilities are anticipated to occur as a result of the project. Short-term construction related impacts may occur to roadway operations if travel to and from schools are through the improved portion of Farrington Highway. A traffic management plan will be implemented to minimize delays to the extent possible.

During the planned future phase of the project, impacts to schools in the vicinity are not expected. The expansion of the roadway will not result in an increase in population or need for additional educational services.

3.17.5 Recreation

Existing Conditions

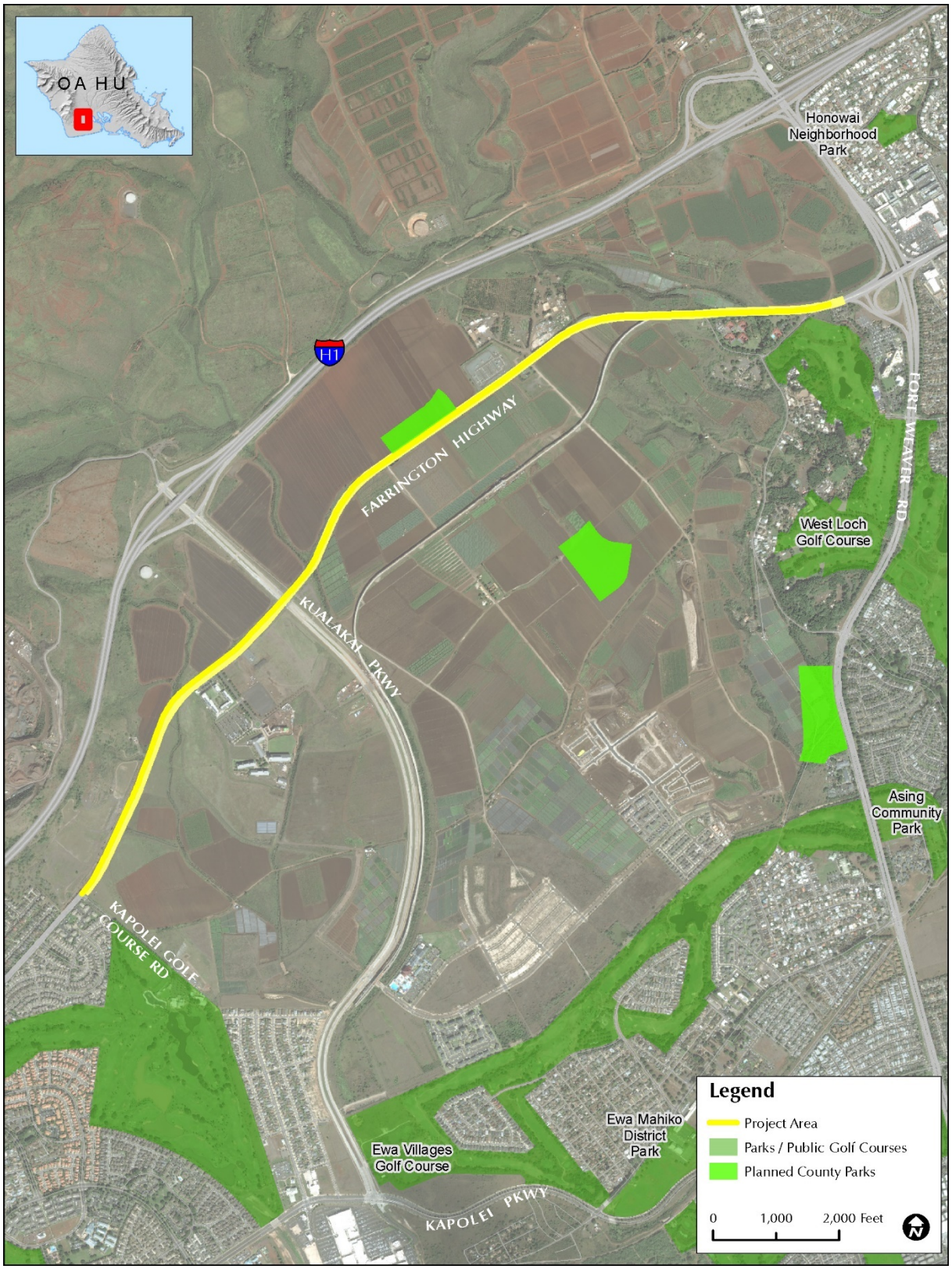
There are several existing and planned recreational facilities in the vicinity of the project area (*Figure 3-16*). Honowai Neighborhood Park is located approximately half a mile northeast from the eastern terminus of the project alignment along Honowai Street in Waipahu. Honowai Park offers basketball, baseball, play fields and playground facilities. Asing Community Park is located 1.5 miles south of the eastern terminus of the project alignment on Renton Road in ʻEwa. This 24-acre park offers wide open playing fields, a baseball field, basketball courts, tennis courts, restrooms, and a playground. Kapolei Community Park is located approximately one-mile southwest of the western terminus of the project alignment. It includes similar amenities – baseball, basketball courts, tennis courts and a playground. Planned recreational facilities in the vicinity of the project are located within the Hoʻopili master-planned community and will serve the recreational needs of this area.

There are also two public golf courses and one private golf course in the project vicinity. The West Loch Golf Course is an 18-hole public golf course, owned and operated by the City, on Okupe Street in ʻEwa Beach. The northern most portion of the West Loch Golf Course comes within 100 feet of the Farrington Highway alignment. This public recreation area is the closest to the project area. The ʻEwa Villages Golf Course is an 18-hole, City-owned golf course located on Park Row Street in ʻEwa Beach, approximately 1.5 miles south of the intersection of Kūalakaʻi Parkway and Farrington Highway. Kapolei Golf Course is a privately-owned and located approximately 700 feet south of the western terminus of the project alignment along Kapolei Golf Course Road.

Potential Impacts and Mitigation Measures

The planned project will not increase the population in the vicinity and will not create additional long-term use of recreational facilities. No adverse impacts are anticipated, and no mitigation is recommended.

Similarly, the future expansion of the roadway to a six-lane road is not expected to result in adverse impacts to existing recreational facilities. While the improved roadway may provide better movement of traffic, use of recreational areas will likely be unchanged.



Public Parks and Recreation Areas **Figure 3-16**

3.18 Historic and Archaeological Resources

An Archaeological Literature Review and Field Inspections (LFRI) was conducted by Cultural Surveys Hawaiʻi (CSH) for the planned project *(Appendix F)*. The investigation was designed, through detailed historical, cultural, and archaeological background research and a field inspection of the project area, to determine the likelihood that historic properties may be affected by the project. Based on findings of the LRFI, cultural resource management is considered, and recommendations are provided. This document is intended to facilitate project planning and support historic preservation and environmental review compliance. However, this investigation does not fulfill the requirements of an archaeological inventory survey investigation, per HAR §13-276.

CSH completed the fieldwork component of this study which included a pedestrian inspection of the project area, Global Positioning System (GPS) data collection, and photography (September 20, 2018). A pedestrian inspection of the project area was undertaken to identify and document the historic crossings (bridges and culverts). Background research included a review of previous archaeological studies, study of historic maps and photographs and examination of Māhele records. This research provided the environmental, cultural, historic, and archaeological background. The sources studied were used to formulate a predictive model regarding the expected types and locations of cultural resources in the project area.

The project area comprises approximately 149.7 acres (60.58 hectares) over 3.1 linear miles. The project area is considered the entire 3.1-mile-long project area. CSH prepared two separate LRFI reports for the project, one for the Farrington Highway Improvements project as a whole and one specific to the seven historic crossings (bridges and culverts) identified during the field inspection. A summary of the findings of these reports are detailed below.

Existing Conditions

Traditional Background

Honouliuli Ahupuaʻa, as a traditional land unit, provided tremendous and varied resources available for exploitation by early Hawaiians. Within Honouliuli Ahupuaʻa, there are 12 miles of coastline with continuous shallow fringing reef, which offers rich marine resources, in addition to the four miles of waterfront along the west side of the West Loch of Puʻuloa (commonly known as Pearl Harbor) that offered extensive fisheries (mullet, awa [milkfish], shellfish) as well as frontage suitable for development of fishponds (e.g., Laulaunui). The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the ahupuaʻa (land division usually extending from the uplands to the sea) as a whole. A broad limestone plain with innumerable limestone sinkholes, offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions to human settlement. The lower portion of Honouliuli Valley in the ʻEwa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley, consisting of an extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. The forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the ahupuaʻa contained biologically-diverse forest with kukui (candlenut), ʻōhiʻa, ʻiliahi (sandalwood), hau (beach hibiscus), tī, banana, etc. These valuable resources contribute to the richness of Honouliuli and the ʻEwa moku (district).

Honouliuli is the largest ahupuaʻa in the moku of ʻEwa. Honouliuli means "dark water," "dark bay," or "blue harbor" and was named for the waters of Puʻuloa (*lit*. long hill) (Jarrett 1930:22), which marks the eastern boundary of the ahupuaʻa.

History of Farrington Highway

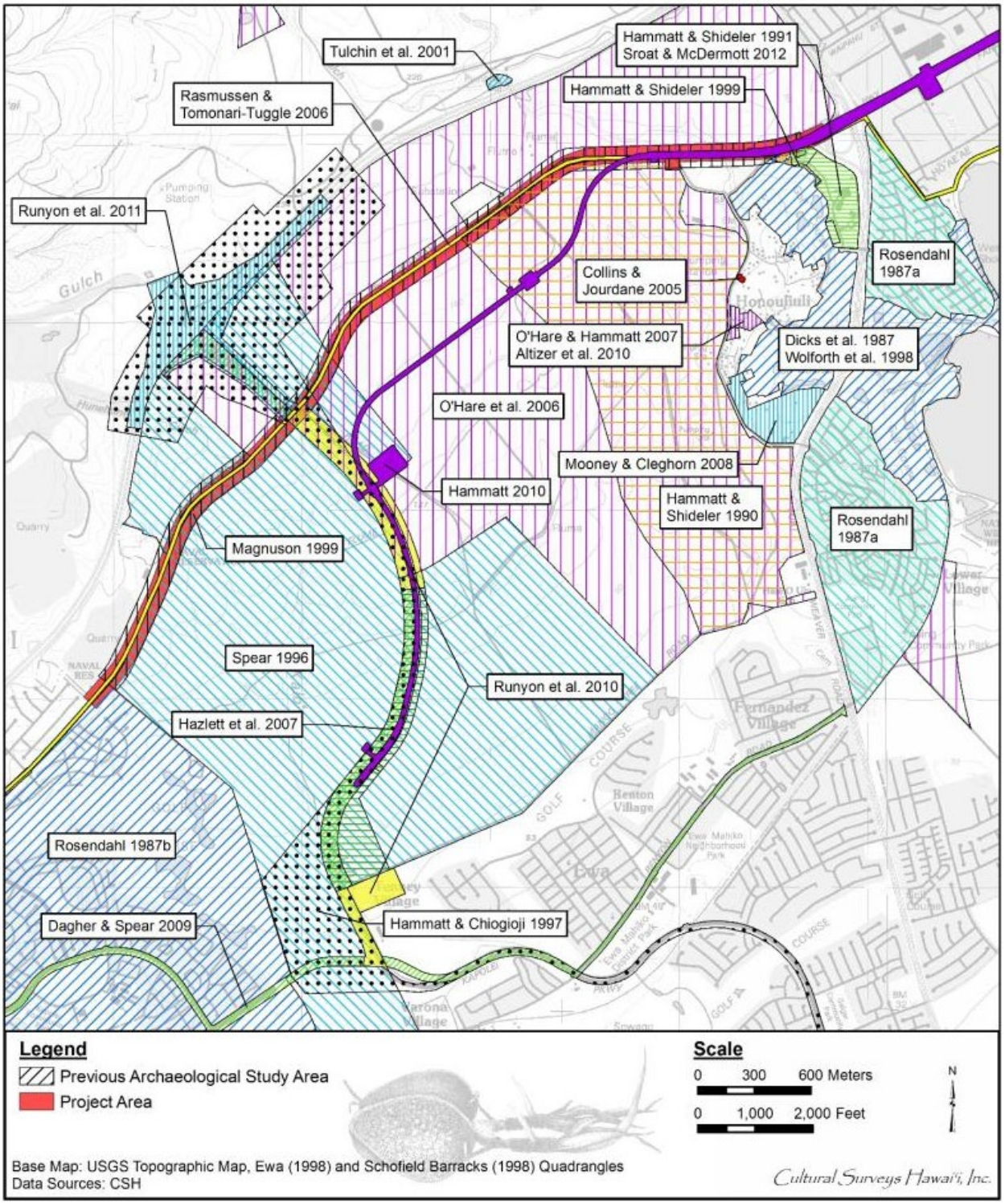
Farrington Highway was originally constructed in the 1930s. Its predecessor was variously termed the "Government Road" or "Waiʻanae Road" and provided less than ideal travel and transport conditions. These precursor roads generally followed the path of a pre-Contact trail that crossed several ahupuaʻa and connected Honolulu to Waiʻanae. An 1873 map by W.D. Alexander (Registered Map 405) depicts the road of which was later labeled as "Govt Road." The 1930s United States Geological Survey (USGS) map and the 1943 U.S. Army War Department map, label the road as Waiʻanae Road. The 1953 USGS map has the road labeled as Farrington Highway.

A section of Farrington Highway's predecessor in the Waiʻanae District was described as a "mud hole in the winter and billowed dust in the summer" (McGrath et al. 1973:51). The Waiʻanae Road was not paved. Because of the transport limitations over the Waiʻanae Road, most transport and travel between Waiʻanae and Honolulu, prior to the construction of Farrington Highway, was made using the OR&L Railroad or steamer ship (McGrath et al. 1973).

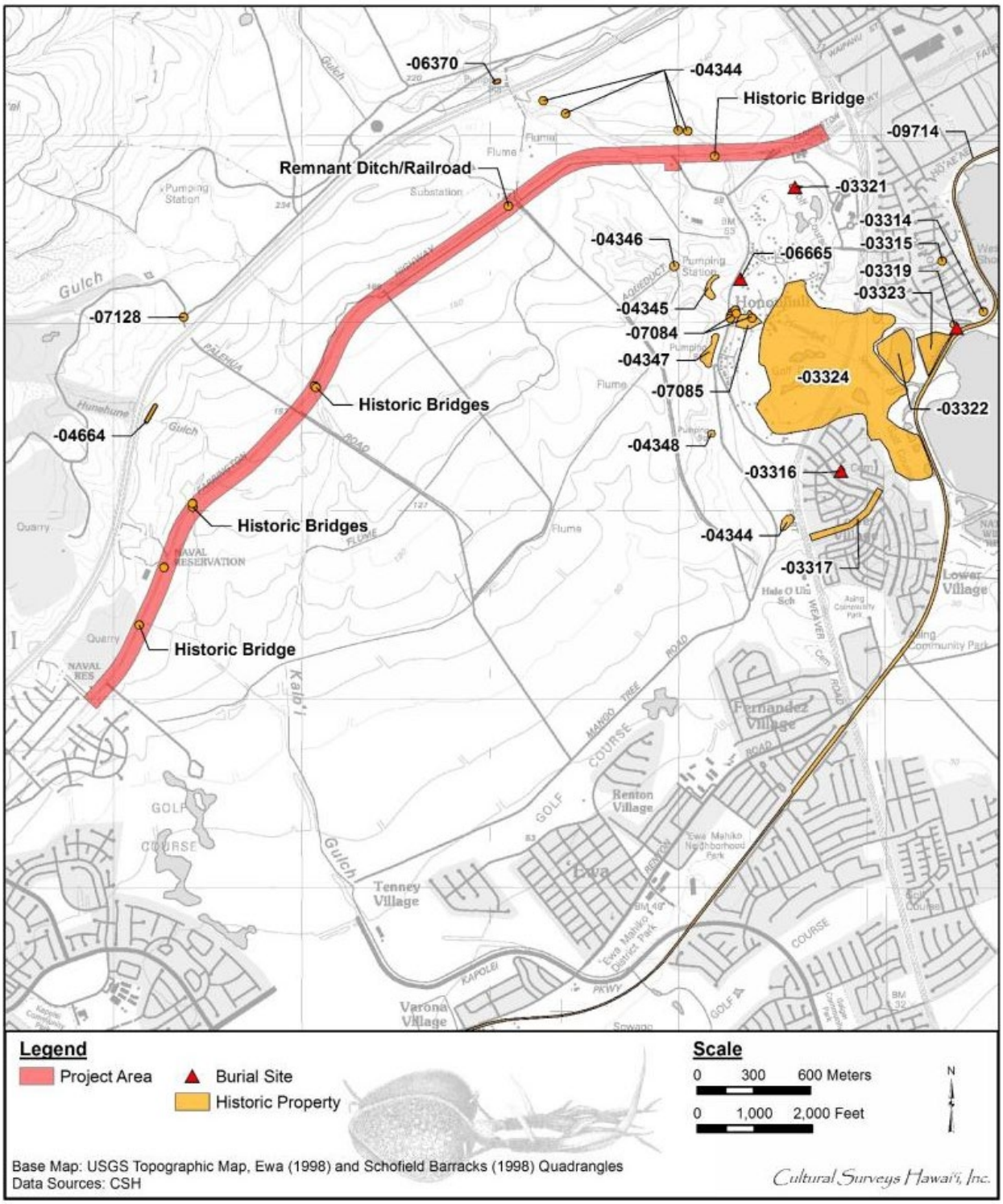
The construction of Farrington Highway was a component of the overall Territorial Highway System. It was only after 1925 that Territorial officials made use of federal funding assistance for road and bridge construction. This led to abundant bridge and road construction after 1925 in Hawaiʻi. Farrington Highway was eventually named after Wallace Rider Farrington (1871–1933), a former Honolulu newspaper man, mayor of Honolulu, and Territorial Governor of Hawaiʻi (1921–1929), who was influential in expanding Hawaiʻi's roadways.

Previous Archaeological Research in the Vicinity of the Project Area

Numerous archaeological studies have been conducted in the vicinity of the project area. These studies are shown in *Figures 3-17 and 3-18* and summarized in *Table 3-10*. A summary of each archaeological study is provided in *Appendix F*.



Previous Archaeological Studies Conducted in the Vicinity of the Project **Figure 3-17**



Previously Identified Archaeological Sites located in the Vicinity of The Project **Figure 3-18**

Table 3-10 Previous Archaeological Studies in the Vicinity of the Project Area

Reference	Nature of Study	Project/Location	Results
Thrum 1906, 1907	Heiau Studies	Island-wide	Reported the existence of Pu‘uokapolei in 1906; in 1917, called the heiau Palole‘i (Kapolei)
McAllister 1933	Archaeological survey	Island-wide	Recorded 14 sites in Honouliuli, including Pu‘u Kapolei Heiau (Site 138)
Dicks et al. 1987	Archaeological reconnaissance survey	West Loch Estates – Golf Course and Parks	Identified seven sites: SIHP #s 50- 80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3233 (a historic fishpond), and -3324 (a prethrough post-Contact buried pondfield system)
Rosendahl 1987a	Archaeological reconnaissance survey	West Loch Estates – Residential Increments I and II	Documented four sites: T-1, a midden deposit; T-2, a historic surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern surface artifact scatter related to the Lower Village plantation settlement
Rosendahl 1987b	Archaeological reconnaissance survey	Kapolei Village Master Plan project	No archaeological sites identified; noted entire project area had been extensively modified by sugarcane cultivation
Hammatt and Shideler 1990	Archaeological inventory survey	West Loch Bluffs project	Recorded four surface features: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (northern pumping station), -4347 (central pumping station), and -4348 (southern pumping station)
Hammatt and Shideler 1991	Archaeological inventory survey	Saint Francis Medical Center West	Project area had been extensively disturbed and contained no surface archaeological sites
Spear 1996	Archaeological reconnaissance survey and assessment	East Kapolei Development project	No archaeological sites identified; reported Kalo‘i and Hunehune Gulches modified for sugarcane irrigation
Hammatt and Chiogioji 1997	Archaeological reconnaissance survey	North-South Rd	Documented that entire area had been extensively graded in association with sugarcane cultivation and construction of plantation infrastructure
Wolforth et al. 1998	Archaeological data recovery	West Loch Estates Residential Increment I, Golf Course and Shoreline Park project	Consisted of excavations of SIHP #s 50-80-12-3319, -3320, -3321, -3322, and -3324; radiocarbon dates for -3321 indicate pond-fields used from tenth to seventeenth centuries
Hammatt and Shideler 1999	Archaeological inventory survey (recorded as an archaeological assessment)	Saint Francis Medical Center West	No cultural resources identified
Magnuson 1999	Archaeological reconnaissance survey	Farrington Hwy between Fort Weaver and Kapolei Golf Course roads	Documented eight historic sites: six bridges, a section of railroad track, and an irrigation ditch; all sites considered not significant and not designated SIHP numbers

Table 3-10 Previous Archaeological Studies in the Vicinity of the Project Area

Reference	Nature of Study	Project/Location	Results
Tulchin et al. 2001	Archaeological inventory survey	‘Ewa Shaft Renovation project	Identified one surface site, SIHP #50-80-08-6370, a historic stone wall alignment
Collins and Jourdane 2005	Burial report	Old Fort Weaver Rd	Partial remains of a possibly Native Hawaiian, adult female found eroding out of ground surface after heavy rains; burial believed to be historic in age
O’Hare et al. 2006	Archaeological inventory survey	Ho‘opili project	Documented four additional features associated with SIHP # 50- 80-12-4344, plantation infrastructure; concluded sugarcane cultivation, irrigation, flood control, railroad construction, road construction, demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of archaeological cultural resources
Rasmussen and Tomonari-Tuggle 2006	Archaeological monitoring	Waiau Fuel Pipeline	Project area along Farrington Hwy not monitored as area determined to not be archaeologically sensitive
Hazlett et al. 2007	Archaeological monitoring	North-South Rd	No cultural materials encountered, with exception of a portion of plantation-era road and associated ditch removed during road construction
O’Hare and Hammatt 2007	Archaeological literature review and field inspection	Old Fort Weaver Rd	Observed one site, a complex of concrete curbs likely associated with Ewa Plantation Co.
Mooney and Cleghorn 2008	Archaeological assessment	Proposed development of two parcels between Fort Weaver Rd and Old Fort Weaver Rd	No cultural materials identified, no further work recommended
Dagher and Spear 2009	Literature review and field inspection	Kapolei Computerized Traffic Control System project	No cultural material identified, no further work recommended
Altizer et al. 2010	Archaeological inventory survey	Hale Kipa project, Old Fort Weaver Rd	Documented two sites: SIHP #s 50-80-12-7084 (historic features including house foundations, a cesspool, and water control features) and -7085 (a subsurface pre-Contact Io‘i terrace)
Hammatt 2010	Archaeological inventory survey	Construction Phase I for Honolulu High- Capacity Transit Corridor Project	Identified one site in Waikele Ahupua‘a: SIHP # 50-80-09-7751, Io‘i sediments
Runyon et al. 2010	Archaeological monitoring	North-South Rd	No cultural materials identified
Runyon et al. 2011	Archaeological monitoring	North-South Rd	Documented two historic-era sites: SIHP #s 50-80-14-4664 (a water diversion structure) and -7128 (burnt trash fill layer used in construction of Pālehua Rd)
Sroat and McDermott 2012	Archaeological literature review and field inspection	Hawaii Medical Center West project	No historic properties identified, area has been extensively modified in historic and modern times

Background Summary and Predictive Model

According to background research, the immediate vicinity of the project area consisted of a dry plain that was little used prior to being placed under a century of sugarcane cultivation. The area has been extensively graded and plowed repeatedly over the past century in association with sugar cultivation and the construction of plantation infrastructure. Since the cessation of cane production, the lands in the vicinity of the project corridor have been under diversified agricultural cultivation. Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae.

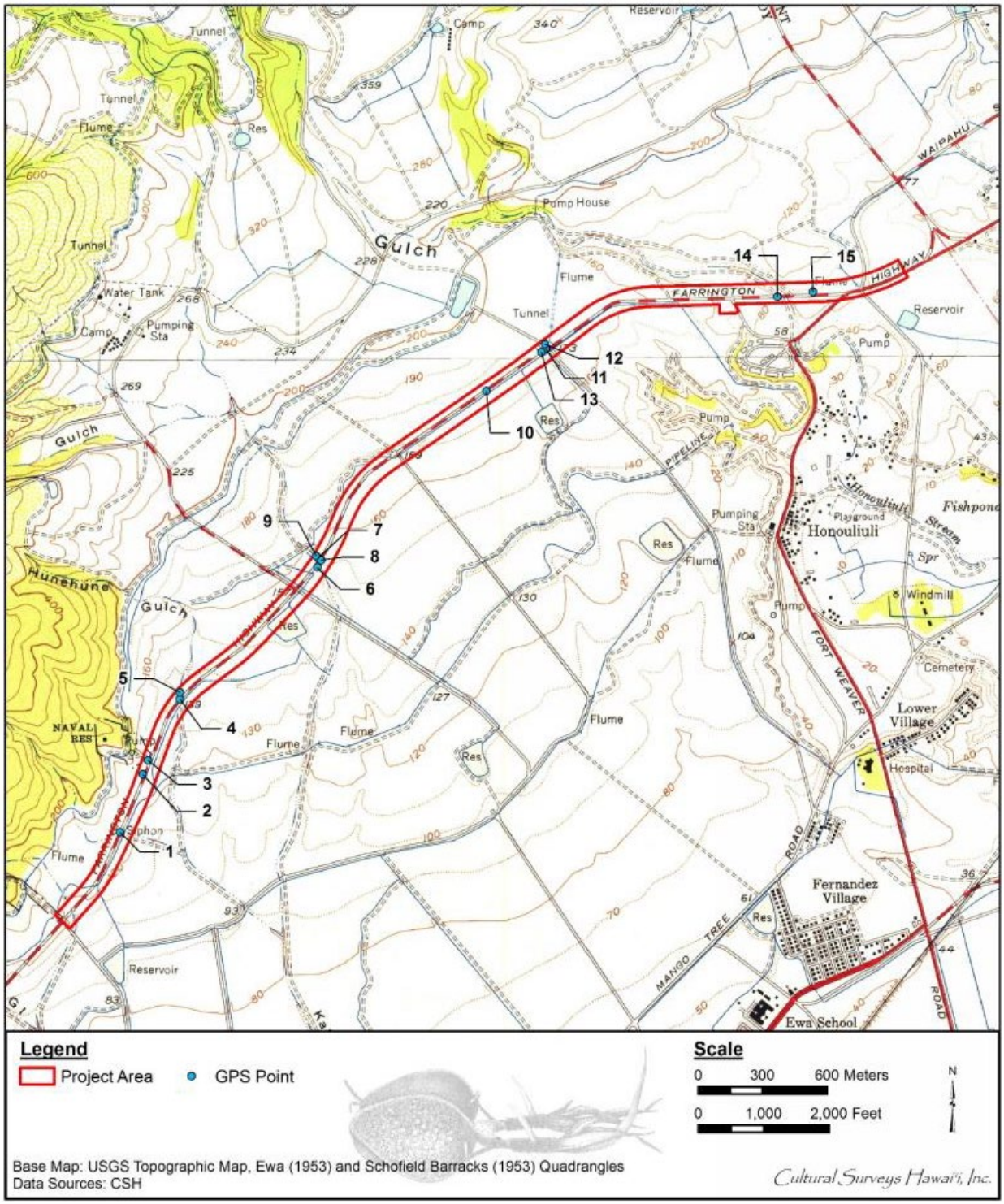
There are no commoner Land Commission Awards in the vicinity of the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area. The intensive land disturbance of a century of commercial sugarcane cultivation probably removed most of what little evidence of pre-Contact land use there was. The archaeological sensitivity of this area is generally regarded as low. As the project area crosses Honouliuli Stream and passes near the northernmost extent of the “Honouliuli Taro Lands,” the sensitivity is believed to increase somewhat, but is still regarded as low. Even though the distance to the former taro lands is not that far, the bottom lands that were preferred for pre-Contact agriculture and habitation near the mouth of Honouliuli Stream seem, in terms of environmental attributes, to have been distantly away.

Any pre-Contact surface features and/or shallow subsurface deposits would likely have been destroyed by the continual commercial utilization of the area for crop land. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. Post-Contact archaeological deposits are not anticipated on the basis of the historic record and previous archaeological studies, but could include irrigation canals, plantation infrastructure remnants, sections of railroad tracks, and of course the bridges that are found along Farrington Highway.

Results of the Fieldwork

Observed surface features of potential historic properties discovered during the pedestrian inspection are presented in *Table 3-11* with locations depicted on *Figure 3-19*. Photographs showing the general project area and identified potential historic properties can be seen in *Appendix F*. The length of the project area consists of the existing two-lane section of Farrington Highway (between Kapolei Golf Course Road and Fort Weaver Road) and associated infrastructure. Elevated berms run alongside both the mauka and makai sides of the roadway for much of the project area. The edges of the roadway are heavily vegetated with an overgrowth of grasses and shrub plants.

Table 3-11 Potential Historic Properties Observed during the Field Inspection			
GPS Point	Feature	Function	Comments
1	Palehua Stream Bridge	Crossing	Active ridge within Farrington Hwy, previously determined eligible for listing on the National Register
2	Concrete shaft	Irrigation	*Mauka* of Farrington Hwy
3	Culvert	Crossing	Active culvert within Farrington Hwy at U.S. Navy Reservoir and Pump Station
4	Hunehune Gulch Bridge (active)	Crossing	Active bridge within Farrington Hwy, previously determined not eligible for listing on the National Register
5	Hunehune Gulch Bridge (inactive)	Crossing	Inactive bridge *mauka* of Farrington Hwy
6	Basalt and mortar wall	Retaining wall	Associated with inactive Kalo‘i Gulch Bridge, *mauka* of Farrington Hwy
7	Kalo‘i Gulch Bridge (active)	Crossing	Active bridge within Farrington Hwy, previously determined not eligible for listing on the National Register
8	Kalo‘i Gulch Bridge (inactive)	Crossing	Inactive bridge *makai* of Farrington Hwy
9	Basalt and mortar wall and concrete drainage	Irrigation/drainage	Associated with the Kalo‘i Gulch Bridges
10	Concrete remnant/filled concrete shaft	Irrigation	*Makai* of Farrington Hwy
11	Concrete remnant	Irrigation	Unknown type, close proximity to other irrigation remnants at Aloun Farms, *makai* of Farrington Hwy
12	Concrete ditch (active)	Irrigation/drainage	Active irrigation ditch at Aloun Farms, *mauka* of Farrington Hwy
13	Concrete ditch (filled)	Irrigation	Filled in irrigation ditch at Aloun Farms, appears similar in structure to active ditch, *makai* of Farrington Hwy
14	Honouliuli Stream Bridge	Crossing	Active bridge within Farrington Hwy, previously determined eligible for listing on the National Register
15	Concrete Shaft	Irrigation	*Mauka* of Farrington Hwy



Locations of Observed Potential Historic Properties **Figure 3-19**

Fifteen surface features of potential historic properties were observed during the pedestrian inspection. These include bridges, culverts, basalt and mortar retaining walls, and concrete shafts, ditches, and other remnants. Seven historic crossings (bridges and culverts) were identified during the field inspection. These consist of Palehua Stream Bridge, an unnamed culvert, two bridges at Hunehune Gulch, two bridges at Kalo‘i Gulch, and the Honouliuli Stream Bridge. A brief description of each crossing is provided below.

Palehua Stream Bridge

The Palehua Stream Bridge spans the Palehua Stream at the west end of the project area and is an active part of Farrington Highway. The existing structure was built in 1922, is 22 ft in length and 27 ft in width. The Palehua Stream Bridge has previously been assessed as significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following description of Palehua Stream Bridge:

The Farrington Highway Bridge No. 3 carries Farrington Highway across Palehua Stream. This single-span reinforced cast-in-place concrete bridge is in its original location, is in poor condition, and its materials remain intact. The bridge has solid panel reinforced concrete parapets with caps and small end posts with caps. Three beams flank the approaches of the parapets but are not attached to the parapet itself. The concrete deck is supported by reinforced concrete abutments and spread footings. The workmanship of the bridge has not been obscured by additions or repairs. [MKE Associates LLC/Fung Associates, Inc. 2013:4-318]

The State Historic Bridge Inventory Evaluation provides the following significance statement for Palehua Stream Bridge:

This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawai‘i. It is a good example of the 1920s concrete slab bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates LLC/Fung Associates, Inc. 2013:4-319].

Culvert at U.S. Navy Reservoir and Pump Station

This culvert spans a small drainage in the west end of the project area adjacent to the entrance of the U.S. Navy Reservoir and Pump Station and is an active part of Farrington Highway. The date of construction is unknown but believed to be during the 1920s and ‘30s. The culvert appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map. The culvert consists of a simple reinforced concrete slab with the addition of modern steel guardrails. This property is not known to have been previously assessed for significance.

Hunehune Gulch Bridge (active)

The Hunehune Gulch Bridge (active) spans Hunehune Gulch in the west end of the project area and is an active part of Farrington Highway. The existing structure was built in 1941 and consists of a single span, reinforced concrete slab-style bridge, with solid concrete parapets. There are modern steel guardrails on either side of the bridge. The Hunehune Gulch Bridge has previously been assessed as non-significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following significance statement for Hunehune Gulch Bridge:

This bridge has lost integrity due to beams that have been bolted in front of the solid concrete parapet such that the concrete is not visible. The bridge does not have distinctive engineering or architectural features that depart from standard bridge design (MKE Associates, LLC/Fung Associates, Inc. 2013:4-19).

Hunehune Gulch Bridge (inactive)

The Hunehune Gulch Bridge (inactive) spans Hunehune Gulch in the west end of the project area. The bridge is not an active part of Farrington Highway and lies just mauka of the active Hunehune Gulch Bridge. This bridge may still be utilized as part of an agricultural access road but was somewhat overgrown at the time of the field inspection. The date of construction is unknown but believed to be during the 1920s and '30s. The bridge appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map, therefore it is likely this bridge represents an earlier alignment of Farrington Highway. Hunehune Gulch Bridge (inactive) consists of a single span, concrete slab-style bridge which measures 6.4 m in length by 7.8 m in width (Magnusson 1999). Magnusson (1999) previously assessed this property as non-significant.

Kalo'i Gulch Bridge (active)

The Kalo'i Gulch Bridge (active) spans Kalo'i Gulch in the central portion of the project area and is an active part of Farrington Highway. The existing structure was built in 1941 and consists of a single span, reinforced concrete slab-style bridge with solid concrete parapets. Magnusson (1999) recorded the bridge as measuring 6.7 m in length by 8.3 m in width. There are modern steel guardrails on either side of the bridge. The Kalo'i Gulch Bridge has previously been assessed as non-significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following significance statement for Kalo'i Gulch Bridge:

This bridge has lost integrity due to thrie beams that have been bolted in front of the solid concrete parapet such that the concrete is not visible. The bridge does not have distinctive engineering or architectural features that depart from standard bridge design (MKE Associates, LLC/Fung Associates, Inc. 2013:4-19).

Kalo'i Gulch Bridge (inactive)

The Kalo'i Gulch Bridge (inactive) spans Kalo'i Gulch in the central portion of the project area. The bridge is not an active part of Farrington Highway and lies just makai of the active Kalo'i Gulch Bridge. This bridge does not appear to be in use and was somewhat overgrown at the time of the field inspection. The Kalo'i Gulch Bridge (inactive) consists of a single span, reinforced concrete, single arch-style bridge. The western abutments are constructed of cemented basalt cobbles. Magnusson (1999:17) recorded bridge measurements as 10.9 m in length by 4.9 m in width and noted the inscription "HH. CO. C. 3rd U.S. ENGRS. JAN 2(4?) 1920". The bridge appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map, therefore it is likely this bridge represents an earlier alignment of Farrington Highway. Magnusson (1999) previously assessed this property as non-significant.

Honouliuli Stream Bridge

The Honouliuli Stream Bridge spans the Honouliuli Stream at the east end of the project area and is an active part of Farrington Highway. The existing structure was built in 1939, is 54 ft in length and 32 ft in width. The Honouliuli Stream Bridge has previously been assessed as significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following description of Honouliuli Stream Bridge:

The Farrington Highway Bridge carries Farrington Highway across the Honouliuli Stream. This single-span reinforced cast-in-place concrete bridge is in its original location, is generally in good condition, and its materials remain intact. The bridge has concrete parapets with cross shaped voids and caps. Wide end posts flank the ends of the parapets. The concrete deck is supported by concrete abutments, two piers, and spread footings. Thrie beams were bolted to the end posts however, the workmanship of the bridge has not been obscured. [MKE Associates LLC/Fung Associates, Inc. 2013:4-321]

The State Historic Bridge Inventory Evaluation provides the following significance statement for Honouliuli Stream Bridge:

This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawai'i. It is a good example of the 1930's concrete tee beam bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates LLC/Fung Associates, Inc. 2013:4-322]

Refer to *Table 3-11* and *Figure 3-18* for the identified historic bridges and their locations within the project area.

In addition to the bridges, eight structural remnants were also observed during the field inspection. These consist of three concrete shafts (two open and one filled), a basalt and mortar wall with concrete drainage, a basalt and mortar retaining wall, two concrete ditches (one active and one filled/inactive), and an indeterminate concrete remnant. These remnants are most likely associated with agricultural irrigation infrastructure from the sugar cane plantation era. The basalt and mortar walls and concrete drainage were clearly associated with the Kalo'i Gulch Bridges. Another group of features including the concrete ditches and indeterminate remnant were observed at the entrance to present day Aloun Farms. The three concrete shaft remnants were spread throughout the project area but are similar in design and construction.

Due to the limitations of the pedestrian inspection and the generally overgrown state of the project area, it is likely that additional remnants (both surface and subsurface) are present within the project area.

Potential Impacts and Mitigation Measures

The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. Background research indicates the project area was not extensively used in pre-Contact times. However, the intensive land disturbance of commercial sugarcane cultivation may have removed most of what little evidence of pre-Contact land use there was. The area currently hosts diversified agricultural cultivation. There are no commoner Land Commission Awards within the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area.

The current field inspection identified seven historic crossings within the project area, as well as structural remnants likely associated with irrigation infrastructure from the plantation era, including basalt and mortar retaining walls, concrete shafts, ditches, and other remnants. No surface pre-Contact archaeological remains were observed. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. It is very likely additional post-Contact archaeological deposits (both surface and subsurface) related to the plantation era exist within the project area.

With regard to the seven historic crossings (bridges and culverts) identified during the field inspection consisting of Palehua Stream Bridge, an unnamed culvert, two bridges at Hunehune Gulch, two bridges at Kalo‘i Gulch, and Honouliuli Stream Bridge, the completion of the planned project may require all crossings to be replaced. Palehua Stream Bridge and the Honouliuli Stream Bridge have previously been assessed as eligible for listing on the National Register of Historic Places (MKE Associates LLC/Fung Associates, Inc. 2013).

Recommendation

The field inspection identified seven historic crossings within the project area, as well as structural remnants likely associated with irrigation infrastructure from the plantation era. These include basalt and mortar retaining walls, concrete shafts, ditches, and other remnants. No surface pre-Contact archaeological remains were identified. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. Additional post-Contact archaeological deposits related to the plantation era may exist within the project area. For the completion of the planned project all historic crossings may need to be replaced, however, the current level of project design is not yet completed to confirm this determination.

Coordination with the State DLNR SHPD on the planned project and future related surveys and studies, historic documentation, and mitigation to complete the HRS 6E review process will be completed as the project moves forward. Appropriate documentation and SHPD approval will be completed prior to construction of the project.

When Farrington Highway is expanded to a six-lane roadway during the future phase of the project, significant adverse impacts to historic and archaeological resources are not anticipated. The expansion will occur within the planned footprint of the four-lane roadway design and is not expected to affect undisturbed areas. Appropriate archaeological and historic surveys and documentation will be conducted as part of the proposed Farrington Highway Improvements project. SHPD review and coordination will be carried out to ensure applicable compliance regulations are met.

3.19 Cultural Resources

Cultural Surveys Hawai‘i prepared a Cultural Impact Assessment (CIA) *(Appendix G)* for the planned project area. For the purposes of this CIA, the project area is considered to be the entire length of the roadway alignment, and the study area included the entire ahupua‘a (land division usually extending from the uplands to the sea) of Honouliuli. The CIA seeks to assess traditional cultural practices as well as resources pertaining to the project area. This section will convey the different types of traditional practices and cultural resources associated within the project vicinity.

The project requires compliance with the State of Hawai‘i environmental review process (HRS §343), which requires consideration of a planned project’s effect on traditional cultural practices. Through document research and cultural consultation efforts this document provides information pertinent to

the assessment of the planned project's impacts to cultural practices (per the Office of Environmental Quality Control's [OEQC] Guidelines for Assessing Cultural Impacts). The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS §6E-42 and HAR §13-275.

Existing Conditions

Background Research

As noted above in Section 3.15.6, the Honouliuli Ahupuaʻa had resources that was attractive and available for early habitation. Honouliuli consists of 12 miles of coastline with a continuous shallow fringing reef, offering rich marine resources. The West Loch of Puʻuloa (commonly known as Pearl Harbor) provided another 4 miles of waterfront that boasted extensive fisheries, fishponds, and salt pans.

The ʻEwa plain consists of a flat, karstic raised limestone reef forming a level, nearly featureless "desert" marked in pre-contact times by a thin or non-existent soil mantle. Many sinkholes dot the plain and offered a nesting home for a large population of avifauna.

The lower portion of Honouliuli Stream fed the Honouliuli Taro Lands and eventually drained into West Loch. The earliest documentation of the Honouliuli Taro Lands can be seen in Charles R. Malden's map in 1825. The area around the Honouliuli Taro Lands and near West Loch would have been ideal for habitation with the abundance of fish and other aquaculture, as well as the close proximity to well-irrigated bottomlands.

John Papa ʻĪʻī describes a network of Leeward Oʻahu trails, which in later historic times encircled and crossed the Waiʻanae Range, allowing passage from West Loch to the Honouliuli lowlands, past Puʻuokapolei and Waimānalo Gulch to the Waiʻanae coast and onward, circumscribing the shoreline of Oʻahu.

Puʻuokapolei is a prominent hill located on the ʻEwa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor to Waiʻanae. A heiau (pre-Christian place of worship) was once located on the summit of the hill. The hill was also used as a point of solar reference or as a place for celestial observations of the winter and summer solstice. A ceremony at a heiau on Puʻuokapolei provides a vantage point to capture the sun setting directly behind Puʻulailai, a peak farther west in the Waiʻanae range. A coinciding ceremony at Kūpalaha Heiau in Waikīkī captures the same essence as the sun sets behind Puʻuokapolei.

Consultation

CSH contacted Hawaiian organizations, agencies, and community members to identify individuals with cultural expertise and/or knowledge of the project area and the vicinity. Outreach included efforts to contact 74 individuals and agencies. The organizations consulted included the SHPD, the Office of Hawaiian Affairs (OHA), the Oʻahu Island Burial Council (OIBC), Hui Mālama I Nā Kūpuna o Hawaiʻi Nei, ʻAhahui Siwila Hawaiʻi O Kapolei Hawaiian Civic Club, Kānehili Cultural Hui, Hawaiian Civic Club of ʻEwa-Puʻuloa, and community members of Honouliuli Ahupuaʻa. Of the 11 people who responded, four kūpuna (elders) and/or kamaʻāina (Native-born) participated in formal interviews for more in-depth contributions to the CIA. The community consultation indicated the following:

According to community participants Mel Kalahiki and Kawika McKeague, Honouliuli Ahupuaʻa was abundant in various types of limu (seaweed) including limu ʻeleʻele, ogo, limu wāwaeʻiole, manauea, and limu kohu.

Mr. McKeague recalled laying net and catching fish such as mullet, weke (goatfish; *Mullidae*), menpachi (squirrelfish; *Holocentridae*), akule (scad fish; *Trachurops crumenophthalmus*), awa (milkfish; *Chanos chanos*), āholehole (Hawaiian flagtail; *Kuhlia sandvicensis*), and manini (convict tang; *Acanthurus triostegus*). He recalled other people gathering hāʻukeʻuke (edible variety of sea urchin; *Colobocentrotus atratus*) and pāpaʻi (general name for crabs) for consumption as well.

A portion of the Kūalakaʻi Trail is located on the grounds of the Kalaeloa Heritage Center. According to Mr. Kāne, the Kūalakaʻi Trail was meant for travel and also to exchange goods. The trail fostered relationships between mauka (towards the mountain) and makai (towards the ocean) residents by establishing a trading system or providing temporary habitation while away from their permanent home.

Mr. Kāne shared that the kia manu (bird catcher) of Kānehili ʻIli favored the method of smoking birds to capture them for their feathers. This method included setting a contained fire where the bird would fly through the smoke, become disoriented, and thus enabling the kia manu to gather the feathers. The manu ʻōʻō (black honey eater; *Moho nobilis*) was the most commonly used bird on Oʻahu for feather work. Keawe Vredenburg shared the moʻolelo (story) of Māʻili-kūkahi and the naming of several places. Māʻili-kūkahi was asked to become mōʻī (paramount ruler, chief) of Oʻahu after the death of the former mōʻī, Haka. For the next 25 years, Oʻahu Island prospered with Māʻili-kūkahi as mōʻī. Two chiefs from Hawaiʻi Island and one from Maui Island plotted against Māʻili-kūkahi. Rumors of the invasion preceded and Māʻili-kūkahi was aware of the possible attack. When a war fleet of canoes landed, Māʻili-kūkahi led his warriors to attack the Hawaiʻi and Maui army. A full battle broke out on the plain known as Punaluʻu, named after the chief Māʻili-kūkahi defeated. Punaluʻu is located near Kīpapa Gulch. Kīpapa translates to "placed prone," which is how the bodies of the defeated warriors were placed. The other Hawaiʻi chief, Hilo, was captured with his staff at a place called Poʻohilo ("the head of Hilo"). Hilo and his staff were beheaded at Poʻohilo, which is located within the project area at the intersection of Fort Weaver Road and Farrington Highway.

Mr. Jan Becket knows of several structures and a kūʻula (any stone god used to attract fish) near the summit of Pālehua, a peak near the border of Nānākuli and Honouliuli Ahupuaʻa. Mr. Becket conducted a site visit with the late Marion Kelly who identified the kūʻula as "the Walking Stone."

Mr. Becket recalled several koʻa (fishing shrine) between the present Ocean Pointe development and the shoreline near Oneʻula Beach Park. During the construction of the development, several koʻa were bulldozed for a proposed marina. Several years later the marina was dropped from the plans. Several sites are still present in the area including SIHP # 50-80-01-4278, a complex of platforms, and a heiau that was identified by Paul Rosendahl. The heiau is located mauka of Pāpipi Road towards Kalaeloa.

Outside of Honouliuli Ahupuaʻa, but still within ʻEwa moku, Mr. Becket and Mr. Kāne have seen petroglyphs below the H-1 freeway between Hōʻaeʻae and Waikele Ahupuaʻa.

The Kalaeloa Heritage Center property contains numerous sinkholes or karsts. The karsts contain water, plants, and burials. Some of the burials were left in place while others were relocated to a modern constructed ahu (altar). Approximately 26 burials are within the ahu. In addition, probable burial mounds (based on length and width) are located on the property. None of the probable burial mounds have been dismantled to verify if iwi kūpuna (ancestral bones) are under the rubble. Mr. Kāne would like to keep most of the site intact to retain the integrity and provenance of the cultural landscape.

Mr. Vredenburg is concerned with finding iwi kūpuna at the location of Poʻohilo, the location where Māʻili-kūkahi beheaded the Hawaiʻi chief, Hilo, and his staff in the moʻolelo of Māʻili-kūkahi. The location of Poʻohilo is within the project area where Fort Weaver Road and Farrington Highway intersect. The area may produce remains at or near the intersection.

Follow on Consultation

Following the completion of a CIA, the project was placed on hold until recommencement in April 2018. Therefore, CSH provided an update on the project status to consulted parties who responded in the initial outreach effort. Additional comments as a result of this outreach may be submitted as part of the environmental review process and included in the EA.

Potential Impacts and Mitigation Measures

Based on information gathered for the cultural and historic background and community consultation detailed in the CIA report, potential impacts relating to the planned project were identified. As such, preliminary recommendations and mitigation to address these concerns have been established. Should historic, cultural, or burial sites or artifacts be identified during ground disturbance, personnel involved with project construction activities will immediately cease all work and the appropriate agencies notified pursuant to applicable law. In the event of discoveries of burials during project construction activities, recognized cultural and lineal descendants will be notified and consulted on matters of burial treatment. Additionally, cultural and lineal descendants will be granted access rights to iwi kūpuna to conduct traditional and customary burial practices on-site.

The future phase expansion of Farrington Highway will not impact the findings of the CIA. The project will be built in the same development area as the proposed four-lane roadway. No additional mitigation is required.

3.20 Visual Resources

Existing Conditions

Farrington Highway between Kapolei Golf Course Road and Fort Weaver Road is an unimproved two-lane roadway. The roadway runs east to west through the ‘Ewa plain in an area that is predominantly used for agriculture.

Views from Farrington Highway to the south are characterized by open expanses of agricultural land with relatively flat topography. UHWO and Kahi Mohala are two developed portions of land adjacent to and visible from the roadway. Views to the north include farmland and the Wai‘anae Mountain Range.

Potential Impacts and Mitigation Measures

With the construction of the Farrington Highway Improvements, the roadway would be improved to include additional lanes, a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes in each direction, bridges and a raised, landscaped median strip. These improvements would provide visual improvements to the roadway corridor for motorists, and multimodal users. The subject portion of Farrington Highway would be brought into visual consistency with the existing Farrington Highway improvements along the alignment west of Kapolei Golf Course Road and bring consistent laneage both east and west of the subject portion of roadway. Views from Farrington Highway would not be significantly altered. No adverse visual impacts are anticipated.

When the future phase of the project is constructed, impacts to visual resources are also not expected to occur as the six-lane roadway will be designed to fit within the existing footprint of the proposed four-lane roadway project. While there will be adjustments to the proposed design it will continue to provide visual improvements to the roadway corridor.

3.21 Potential Cumulative and Secondary Impacts

3.21.1 Cumulative Impacts

Cumulative impacts result from the incremental effects of an activity when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertake such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The project is anticipated to generate beneficial cumulative impacts to the region. The improved roadway infrastructure will help to offset the cumulative traffic impacts of growth in the region resulting from existing and planned developments such as UHWO, Ho‘opili, DHHL East Kapolei Developments, Ko ‘Olina, Kalaeloa, Royal Kunia Phase II, Kapolei West, Kapolei Harborside, and Makaiwa Hills. The project will improve sub-regional mobility and result in less congestion within the regional transportation network. In addition, the improvements will support planned multimodal infrastructure such as bike and pedestrian facilities and access to the mass transit system in East Kapolei, as outlined in regional planning and guidance documents. The proposed four-lane roadway expansion project may also be considered a first phase of a future six-lane expansion of Farrington Highway.

3.21.2 Secondary Impacts

Secondary effects are impacts that are associated with, but do not result directly from, an activity. The environmental analysis of the planned project addresses development of the project in the context of known planned or approved land uses in the vicinity.

Overall, the project’s secondary impact would be a beneficial effect on public transportation facilities and emergency response operations in the ‘Ewa region and island of O‘ahu. This would result in tertiary impacts such as reduced commute times, faster emergency response, safer transportation systems, and other qualitative public benefits. In addition, during the construction phase of the project, secondary impacts relative to employment and construction spending will occur.

Much of the identified secondary impacts associated with the planned project will also occur with the development of the future phase expansion of Farrington Highway.

Chapter 4

Plans and Policies

Chapter 4

Plans and Policies

In this chapter, the project's consistency with applicable land use policies set forth in the Hawai‘i State Plan, Transportation Functional Plan, Land Use Law, Coastal Zone Management (CZM) Program, 2050 Sustainability Plan, and City and County of Honolulu General Plan, ‘Ewa Development Plan and Infrastructure Map, ‘Ewa Highway Master Plan, O‘ahu Regional Transportation Plan (ORTP) 2040, Transportation for O‘ahu Plan 2025, ‘Ewa Roadway Connectivity Study, Bike Plan Hawai‘i, O‘ahu Bike Plan, East Kapolei Neighborhood Transit-Oriented Development (TOD) Plan, UHWO Non-Campus Urban Design Plan, LUO, and Special Management Area (SMA), are discussed.

4.1 Hawai‘i State Plan

The Hawai‘i State Plan (June 1991) establishes a statewide planning system that provides goals, objectives, and policies which detail property directions and concerns of the State of Hawai‘i; these will be discussed as they relate to the planned project.

It is the goal of the State, under the Hawai‘i State Planning Act (Chapter 226, HRS), to achieve the following:

- A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawai‘i present and future generations.
- A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.
- Physical, social, and economic well-being, for individuals and families in Hawai‘i, that nourishes a sense of community responsibility, of caring, and of participation in community life (Chapter 226-4, HRS).

Specific objectives and policies of the State Plan that pertain to the project are as follows:

Section 226-5 Objectives and policies for population

(a) Planning for the State's population to guide population growth to be consistent with the achievement of physical, economic, and social objectives contained in this chapter.

(b) To achieve the population objective, it shall be the policy of this State to:

  (1) Manage population growth statewide in a manner that provides increased opportunities for Hawai'i's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each country.

  (2) Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.

(3) Promote increased opportunities for Hawai'i's people to pursue their socio-economic aspirations throughout the islands.

(4) Encourage research activities and public awareness programs to foster an understanding of Hawai'i's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawai'i's population

(5) Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.

(6) Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their state's population.

(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.

Discussion: The Farrington Highway Improvements project will not have a direct effect on population growth statewide as it relates to physical, economic, and social objectives, however, the project will help to accommodate the increased transportation needs of the area by providing an expanded roadway system.

Section 226-6 Objectives and policies for the economy–in general

(a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:

(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawai'i's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited

(2) A Steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.

(3) Promote Hawai'i as an attractive market for environmentally and socially sound investment activities that benefit Hawai'i's people.

(4) Transform and maintain Hawai'i as a place that welcomes and facilitates innovative activity that may lead to commercial opportunities.

(5) Promote innovative activity that may pose initial risks, but ultimately contribute to the economy of Hawai'i.

(6) Seek broader outlets for new or expanded Hawai'i business investments.

(7) Expand existing markets and penetrate new markets for Hawai'i's products and services.

(8) Assure that the basic economic needs of Hawai'i's people are maintained in the event of disruptions in overseas transportation.

(9) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.

(10) Encourage the formation of cooperatives and other favorable marketing arrangements at the local or regional level to assist Hawai'i's small scale producers, manufacturers, and distributors.

(11) Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.

(12) Encourage innovative activities that may not be labor-intensive, but may otherwise contribute to the economy of Hawai'i.

(13) Foster greater cooperation and coordination between the government and private sectors in developing Hawai'i's employment and economic growth opportunities.

(14) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.

(15) Maintain acceptable working conditions and standards for Hawai'i's workers.

(16) Provide equal employment opportunities for all segments of Hawai'i's population through affirmative action and nondiscrimination measures.

(17) Stimulate the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.

(18) Encourage businesses that have favorable financial multiplier effects within Hawai'i's economy, particularly with respect to emerging industries in science and technology.

(19) Promote and protect intangible resources in Hawai'i, such as scenic beauty and aloha spirit, which are vital to a healthy economy.

(20) Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new or innovative potential growth industries in particular.

(21) Foster a business climate in Hawai'i – including attitudes, tax and regulatory policies, and financial and technical assistance programs –that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.

Discussion: The priority guidelines for the provision of the economy in general are not applicable to the planned project. However, construction of the project improvements will create short-term construction jobs that will ultimately serve to benefit the overall economy.

Section 226-7 Objectives and policies for the economy–agriculture

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

(1) Viability of Hawai'i's sugar and pineapple industries.

(2) Growth and development of diversified agriculture throughout the State

(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawai'i's strategic, economic, and social well-being.

(b) To achieve the agriculture objectives, it shall be the policy of this State to:

(1) Establish a clear direction for Hawai'i's agriculture through stakeholder commitment and advocacy.

(2) Encourage agriculture by making the best use of natural resources.

(3) Provide the governor and the legislature with information and options needed for prudent decision-making for the development of agriculture.

(4) Establish strong relationships between the agricultural and visitor industries for mutual marketing benefits.

(5) Foster increased public awareness and understanding of the contributions and benefits of agriculture as a major sector of Hawai'i's economy.

(6) Seek the enactment and retention of federal and state legislation that benefits Hawai'i's agricultural industries.

(7) Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawai'i's food producers and consumers in the State, nation, and world.

(8) Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural by-products.

(9) Enhance agricultural growth by providing public incentives and encouraging private initiatives.

(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

(11) Increase the attractiveness and opportunities for an agricultural education and livelihood.

(12) In addition to the State's priority on food, expand Hawai'i's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.

(13) Promote economically competitive activities that increase Hawai'i's agricultural self-sufficiency, including the increased purchase and use of Hawai'i-grown food and food products by residents, businesses, and governmental bodies as defined under section 103D-104.

(14) Promote and assist in the establishment of sound financial programs for diversified agriculture.

(15) Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.

(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

(17) Perpetuate, promote, and increase use of traditional Hawaiian farming systems, such as the use of loko iʻa, mäla, and irrigated loʻi, and growth of traditional Hawaiian crops, such as kalo, ʻuala, and ʻulu.

(18) Increase and develop small-scale farms.

Discussion: This objective relating to planning for the State's economy with regard to agriculture is not applicable to the planned project.

Section 226-8 Objectives and policies for the economy–visitor industry

(a) Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawai'i's economy.

(1) Support and assist the promotion of Hawai'i's visitor attractions and facilities.

(2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawai'i's people.

(3) Improve the quality of existing visitor destination areas by utilizing Hawai'i's strengths in science and technology.

(4) Encourage cooperation and coordination between the government and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.

(5) Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawai'i's people.

(6) Provide opportunities for Hawai'i's people to obtain job training and education that will allow for upward mobility within the visitor industry.

(7) Foster a recognition of the contribution of the visitor industry to Hawai'i's economy and the need to perpetuate the aloha spirit.

(8) Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawai'i's cultures and values.

Discussion: This objective relating to planning for the State's economy with regard to the visitor industry is not applicable to the project.

Section 226-9 Objectives and policies for the economy–federal expenditures

(a) Planning for the State's economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawai'i's economy.

(b) To achieve the federal expenditures objective, it shall be the policy of this State to:

(1) Encourage the sustained flow of federal expenditures in Hawai'i that generates long-term government civilian employment.

(2) Promote Hawai'i's supportive role in national defense, in a manner consistent with Hawai'i's social, environmental, and cultural goals by building upon dual-use and defense applications to develop thriving ocean engineering, aerospace research and development, and related dual-use technology sectors in Hawai'i's economy.

(3) Promote the development of federally supported activities in Hawai'i that respect statewide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawai'i's environment.

(4) Increase opportunities for entry and advancement of Hawai'i's people into federal government service.

(5) Promote federal use of local commodities, services, and facilities available in Hawai'i.

(6) Strengthen federal-state-county communication and coordination in all federal activities that affect Hawai'i.

(7) Pursue the return of federal controlled lands in Hawai'i that are not required for either the defense of the nation or for other purposes of national importance, and promote the mutually beneficial exchanges of land between federal agencies, the State, and the counties.

Discussion: The Farrington Highway Improvements project will not be funded by federal resources. However, the project does support the federal expenditures objective and policies by providing an improved roadway system that will be used by the United States military for transportation of personnel, equipment, and access to military installations on the island.

Section 226-10 Objectives and policies for the economy–potential growth and innovative activities

(a) Planning for the state's economy with regard to potential growth and innovative activities shall be directed towards achievement of the objective of development and expansion of potential growth and innovative activities that serve to increase and diversity Hawai'i's economic base.

(b) To achieve the potential growth and innovative activity objective, it shall be the policy of this State to:

(1) Facilitate investment and employment growth in economic activities that have the potential to expand and diversity Hawai'i's economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, health care, and science and technology-based sectors.

(2) Facilitate investment in innovative activity that may pose risks or be less labor intensive than other traditional business activity, but if successful, will generate revenue in Hawai'i through the export of services or products or substitution of imported services or products.

(3) Encourage entrepreneurship in innovative activity by academic researchers and instructors who may not have the background, skill, or initial inclination to commercially exploit their discoveries or achievements.

(4) Recognize that innovative activity is not exclusively dependent upon individuals with advanced formal education, but that many self-taught, motivated individuals are able, willing, sufficiently knowledgeable and equipped with the attitude necessary to undertake innovative activity.

(5) Increase the opportunities for investors in innovative activity and talent engaged in innovative activity to personally meet and interact at cultural, art, entertainment, culinary, athletic, or visitor-oriented events without a business focus.

(6) Expand Hawai'i's capacity to attract and service international programs and activities that generate employment for Hawai'i's people.

(7) Enhance and promote Hawai'i's roles as a center for international relations, trade , finance, services, technology, education, culture, and the arts.

(8) Accelerate research and development of new energy-related industries based on wind, solar, ocean, underground resources, and solid waste.

(9) Promote Hawai'i's geographic, environmental, social, and technological advantages to attract new or innovative economic activities to the State.

(10) Provide public incentives and encourage private initiative to attract new or innovative industries that best support Hawai'i's social, economic, physical, and environmental objectives.

(11) Increase research and the development of ocean-related economic activities such as mining, food production, and scientific research;

(12) Develop, promote, and support research and educational training programs that will enhance Hawai'i's ability to attract and develop economic activities of benefit to Hawai'i; Foster a broader public recognition and understanding of the potential benefits of new or innovative growth-oriented industry in Hawai'i;

(13) Foster a broader public recognition and understanding of the potential benefits of new or innovative growth-oriented industry in Hawai'i.

(14) Encourage the development and implementation of joint federal and state initiatives to attract federal programs and projects that will support Hawai'i's social, economic, physical, and environmental objectives.

(15) Increase research and development of businesses and services in the telecommunications and information industries.

(16) Foster the research and development of non-fossil fuel and energy efficient modes of transportation.

(17) Recognize and promote health care and health care information technology as growth industries.

Discussion: The project will improve a portion of Farrington Highway which will serve to support energy efficient modes of transportation, such as use of bike paths and mass transit system. In addition, the planned widening of the roadway will reduce congestion that could affect Hawai'i's position in economic growth and innovative activities.

Section 226-10.5 Objectives and policies for the economy–information industry.

(a) Planning for the State's economy with regard to telecommunications and information technology shall be directed toward recognizing that broadband and wireless communication capability and infrastructure are foundations for an innovative economy and positioning Hawai'i as a leader in broadband and wireless communications and applications in the Pacific Region.

(b) To achieve the information industry objective, it shall be the policy of this State to:

(1) Promote efforts to attain the highest speeds of electronic and wireless communication within Hawai'i and between Hawai'i and the world, and make high speed communication available to all residents and businesses in Hawai'i.

(2) Encourage the continued development and expansion of the telecommunications infrastructure serving Hawai'i to accommodate future growth and innovation in Hawai'i's economy.

(3) Facilitate the development of new or innovative business and service ventures in the information industry which will provide employment opportunities for the people of Hawai'i.

(4) Encourage mainland- and foreign- based companies of all sizes, whether information technology-focused of not, to allow their principals, employees, or contractors to live

in and work from Hawai'i, using technology to communicate with their headquarters, offices, or customers located out-of-state.

(5) Encourage greater cooperation between the public and private sectors in developing and maintaining a well-designed information industry.

(6) Ensure that the development of new businesses and services in the industry are in keeping with the social, economic, and physical needs and aspirations of Hawai'i's people.

(7) Provide opportunities for Hawai'i's people to obtain job training and education that will allow for upward mobility within the information industry.

(8) Foster a recognition of the contribution of the information industry to Hawai'i's economy.

(9) Assist in the promotion of Hawai'i as a broker, creator, and processor of information in the Pacific.

Discussion: The project is planned to improve a portion of Farrington Highway. This objective relating to planning for the State's economy with regard to the information industry is not applicable to the project.

Section 226-11 Objectives and policies for the physical environment–land-based, shoreline, and marine resources.

(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:

(1) Prudent use of Hawai'i's land-based, shoreline, and marine resources.

(2) Effective protection of Hawai'i's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

(1) Practice an overall conservation ethic in using Hawai'i's natural resources.

(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.

(8) Pursue compatible relationships among activities, facilities, and natural resources.

(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

Discussion: The Farrington Highway Improvements project is not anticipated to result in adverse impacts to the physical environment in terms of nearby land-based, shoreline, and marine resources. A Natural Resource Survey was conducted for the project area and no endangered plant species, animal species, or habitats were found to be present. The project area is not located directly at the shoreline area and will not result in substantial impacts to environmental and marine resources.

Section 226-12 Objectives and policies for the physical environment—scenic, natural beauty, and historic resources.

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai‘i’s scenic assets, natural beauty, and multi-cultural/historical resources:

(b) To achieve the scenic, natural beauty, and historic resources objectives, it shall be the policy of this State to:

(1) Promote the preservation and restoration of significant natural and historic resources.

(3) Promote the preservation of views and vistas to enhance the landscapes, and other natural features.

(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

Discussion: The project wll not adversely impact existing scenic, natural beauty and historic resources. There are no scenic view sheds identified in the project vicinity or detailed in the ‘Ewa Development Plan. The design of the roadway improvements wll blend with the existing roadway system.

A CIA and Archaeological LRFI was conducted for the project. The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. The field inspection identified seven historic crossings, as well as structural remnants likely associated with irrigation infrastructure from the plantation era. Coordination with the SHPD on the planned project and future related surveys and studies, historic documentation, and mitigation to complete the HRS 6E review process will be completed as the project moves forward. Appropriate documentation and SHPD approval will be completed prior to construction of the project.

If any cultural, historic, or archaeological resources are unearthed or ancestral remains are inadvertently discovered during construction, all work will cease, and appropriate agencies will be notified. The treatment of these resources will be conducted in strict compliance with the applicable historic preservation and burial laws.

Section 226-13 Objectives and policies for the physical environment–land, air, and water quality.

(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawai‘i's land, air, and water resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(2) Promote the proper management of Hawai‘i's land and water resources.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawai‘i's people.

(6) Encourage design and construction practices that enhance the physical qualities of Hawai‘i’s communities.

(7) Encourage urban developments in close proximity to existing services and facilities.

(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.

Discussion: The project will not result in adverse impacts to land, air and water quality. The project area is not located directly along the shoreline and will not impact coastal resources or water quality. Construction related short-term air quality impacts (i.e. fugitive dust generation dust or on-site/off-site emissions) are expected to be minimal and construction BMPs will be implemented to mitigate potential air quality impacts. Appropriate mitigation measures will be carried out to address potential impacts to the physical environment – land, air, and water – that may occur as a result of the project.

Section 226-14 Objective and policies for facility systems–in general

(a) Planning for the State's facility systems in general shall be directed towards the achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.

(b) To achieve the general facility systems objective, it shall be the policy of this State to:

(1) Accommodate the needs of Hawai'i's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

(4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.

Discussion: The Farrington Highway Improvements project supports the objectives and policies for facility systems in Hawai'i. The project will be coordinated with both City and State facility systems to support the existing and future need for additional transportation system capacity in the vicinity. The planned design also provides flexibility to support the future expansion of Farrington Highway into a 6-lane road to accommodate expected growth for the region.

Section 226-15 Objectives and policies for facility systems–solid and liquid wastes

(a) Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:

(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes

(2) Provision of adequate sewerage facilities for physical and economic activities

(b) To achieve solid and liquid waste objectives, it shall be the policy of this State to:

(1) Encourage adequate development of sewerage facilities that complement planned growth.

(2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic.

(3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.

Discussion: The project is proposing to improve a portion of Farrington Highway. Facility systems relating to solid and liquid wastes will not be adversely affected by the project, therefore, this objective is not applicable to the project.

Section 226-16 Objectives and policies for facility systems–water

(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

(1) Coordinate development of land use activities with existing and potential water supply.

(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.

(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.

(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.

(5) Support water supply services to areas experiencing critical water problems.

(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

Discussion: The project improvements may result in relocation of existing water infrastructure. Relocation associated with construction will be coordinated with the Board of Water Supply. Significant adverse impacts relating to water facility systems are not anticipated.

Section 226-17 Objectives and policies for facility systems–transportation

(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:

(1) An integrated multimodal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.

(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.

(b) To achieve the transportation objectives, it shall be the policy of this State to:

(1) Design, program, and develop a multimodal system in conformance with desired growth and physical development as stated in this chapter.

(2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives.

(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties.

(4) Provide for improved accessibility to shipping, docking, and storage facilities.

(5) Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs.

(6) Encourage transportation systems that serve to accommodate present and future development needs of communities.

(7) Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods.

(8) Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs.

(9) Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification.

(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai'i's natural environment.

(11) Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation.

(12) Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives.

(13) Encourage the diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency.

Discussion: The project is consistent with the Hawai'i State Plan. Widening the Farrington Highway transportation corridor is a coordinated effort that will serve the future need for additional transportation system capacity of the 'Ewa community. The project will support the State's objective to provide integrated multimodal roadways, including bicycle and pedestrian facilities, and access to mass transit. The integrated multimodal system will accommodate planned growth objectives and provide efficient, safe, and economical movement of people and goods.

Section 226-18 Objectives and policies for facility systems–energy

(a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:

(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;

(2) Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawai'i's dependence on imported fuels for electrical generation and ground transportation

(3) Greater diversification of energy generation in the face of threats to Hawai'i's energy supplies and systems;

(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and

(5) Utility models that make the social and financial interests of Hawai'i's utility customers a priority.

(a) To achieve the energy objectives, it shall be the policy of this State to ensure the short- and long-term provision of adequate, reasonably priced, and dependable energy services to accommodate demand.

(b) To further achieve the energy objectives, it shall be the policy of this State to:

(1) Support research and development as well as promote the use of renewable energy sources.

(2) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth.

(3) Base decisions of least-cost supply-side and demand-side energy resources options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits.

(4) Promote all cost effective conservation of power and fuel supplies through measures, including:

(A) Development of cost-effective demand-side management programs

(B) Education

(C) Adoption of energy-efficient practices and technologies

(D) Increasing energy efficiency and decreasing energy use in public infrastructure

(5) Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems uses the least-cost energy supply option and maximizes efficient technologies.

(6) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth.

(7) Promote alternate fuels and transportation energy efficiency.

(8) Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications.

(9) Support actions that reduce, avoid, or sequester Hawai'i's greenhouse gas emissions through agriculture and forestry initiatives.

(10) Provide priority handling and processing for all state and county permits required for renewable energy projects.

(11) Ensure that liquefied natural gas is used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and does not impede the development and use of other cost-effective renewable energy sources.

(12) Promote the development of indigenous geothermal energy resources that are located on public trust land as an affordable and reliable source of firm power for Hawai'i.

Discussion: The project supports the State's objectives and policies for energy. The long-term operation of the roadway will not require substantial energy consumption. The project will reduce regional energy and fuel consumption as a result of improved traffic flow.

Section 226-18.5 Objectives and policies for facility systems–telecommunications

(a) Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.

(b) To achieve the telecommunications objective, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable telecommunications services to accommodate demand.

(c) To further achieve the telecommunications objective, it shall be the policy of this State to:

(1) Facilitate research and development of telecommunications systems and resources.

(2) Encourage public and private sector efforts to develop means for adequate, ongoing telecommunications planning.

(3) Promote efficient management and use of existing telecommunications systems and services.

(4) Facilitate the development of education and training of telecommunications personnel.

Discussion: This objective relating to the State's telecommunications facility systems is not applicable to the project.

Section 226-19 Objectives and policies for socio-cultural advancement–housing

(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:

(1) Greater opportunities for Hawai'i's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawai'i's population.

(2) The orderly development of residential areas sensitive to community needs and other land uses.

(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawai'i's people.

(b) To achieve the housing objectives, it shall be the policy of this State to:

(1) Effectively accommodate the housing needs of Hawai'i's people.

(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.

(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.

(4) Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.

(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.

(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.

(7) Foster a variety of lifestyles traditional to Hawai'i through the design and maintenance of neighborhoods that reflect the culture and values of the community.

(8) Promote research and development of methods to reduce the cost of housing construction in Hawai'i.

Discussion: This objective relating to the State's socio-cultural advancement relating housing is not applicable to the project. However, the planned roadway improvements will help to support the increased transportation needs of the 'Ewa region resulting from the development of new residential communities in the area.

Section 226-20 Objectives and policies for socio-cultural advancement–health

(a) Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the following objectives:

(1) Fulfillment of basic individual health needs of the general public

(2) Maintenance of sanitary and environmentally healthful conditions in Hawai'i's communities

(3) Elimination of health disparities by identifying and addressing social determinants of health.

(b) To achieve the health objectives, it shall be the policy of this State to:

(1) Provide adequate and accessible services and facilities for prevention and treatment of physical and mental health problems including substance abuse.

(2) Encourage improved cooperation among public and private sectors in the provision of health care to accommodate the total health needs of individuals throughout the State.

(3) Encourage public and private efforts to develop and promote statewide and local strategies to reduce health care and related insurance costs.

(4) Foster an awareness of the need for personal health maintenance and preventative health care through education and other measures.

(5) Provide programs, services, and activities that ensure environmentally healthful and sanitary conditions.

(6) Improve the State's capabilities in preventing contamination by pesticides and other potentially hazardous substances through increased coordination, education, monitoring, and enforcement.

(7) Prioritize programs, services, interventions, and activities that address identified social determinants of health to improve native Hawaiian health and well-being consistent with the United States Congress' declaration of policy as codified in title 42 United States Code Section 11702, and to reduce health disparities of disproportionately affected demographics, including native Hawaiians, other Pacific

Islanders, and Filipinos. The prioritization of affected demographic groups other than native Hawaiians may be reviewed every ten years and revised based on the best available epidemiological and public health data.

Discussion: The project is proposing to improve a portion of Farrington Highway. This objective relating to planning for the State's socio-cultural advancement-health is not applicable to the project.

Section 226-21 Objectives and policies for socio-cultural advancement-education

(a) Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.

(b) To achieve the education objective, it shall be the policy of this State to:

(1) Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.

(2) Ensure the provisions of adequate and accessible educational services and facilities that are designed to meet individual and community needs.

(3) Provide appropriate educational opportunities for groups with special needs.

(4) Promote educational programs which enhance understanding of Hawaii's cultural heritage.

(5) Provide higher educational opportunities that enable Hawaii's people to adapt to changing employment demands.

(6) Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.

(7) Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.

(8) Emphasize quality educational programs in Hawaii's institutions to promote academic excellence.

(9) Support research programs and activities that enhance the education programs of the State.

Discussion: This objective relating to planning for the State's socio-cultural advancement--education is not applicable to the project.

Section 226-22 Objectives and policies for socio-cultural advancement--social services

(a) Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.

(b) To achieve the social service objective, it shall be the policy of the State to:

(1) Assist individuals, especially those in need of attaining a minimally adequate standard of living and those confronted by social and economic hardship conditions, through social services and activities within the State's fiscal capacities.

(2) Promote coordination and integrative approaches among public and private agencies and programs to jointly address social problems that will enable individuals, families, and groups to deal effectively with social problems and to enhance their participation in society.

(3) Facilitate the adjustment of new residents, especially recently arrived immigrants, into Hawai'i's communities.

(4) Promote alternatives to institutional care in the provision of long-term care for elder and disabled populations.

(5) Support public and private efforts to prevent domestic abused and child molestation, and assist victims of abuse and neglect.

(6) Promote programs which assist people in need of family planning services to enable them to meet their needs.

Discussion: The project is proposing to improve a portion of Farrington Highway. This objective relating to planning for the State's socio-cultural advancement—social services is not applicable to the project.

Section 226-23 Objectives and policies for socio-cultural advancement–leisure

(a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(b) To achieve the leisure objective, it shall be the policy of this State to:

(1) Foster and preserve Hawai'i's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities-oriented programs and activities.

(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.

(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.

(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.

(5) Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.

(6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.

(7) Provide adequate and accessible physical fitness programs to promote the physical and mental well-being of Hawai'i's people.

(8) Increase opportunities for appreciation and participation in the creative arts, including the literary, theatrical, visual, musical, folk, and traditional art forms.

(9) Encourage the development of creative expression in the artistic disciplines to enable all segments of Hawai'i's population to participate in the creative arts.

(10) Assure adequate access to significant natural and cultural resources in public ownership.

Discussion: The project is proposing to improve a portion of Farrington Highway. This objective relating to planning for the State's socio-cultural advancement--leisure is not applicable to the project.

Section 226-24 Objectives and policies for socio-cultural advancement–individual rights and personal well-being

(a) Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.

(b) To achieve the individual rights and personal well-being objective, it shall be the policy of this State to:

(1) Provide effective services and activities that protect individuals from criminal acts and unfair practices and that alleviate the consequences of criminal acts in order to foster a safe and secure environment.

(2) Uphold and protect the national and state constitutional rights of every individual.

(3) Assure access to, and availability of, legal assistance, consumer protection, and other public services which strive to attain social justice.

(4) Ensure equal opportunities for individual participation in society.

Discussion: The project is proposing to improve a portion of Farrington Highway. This objective relating to planning for the State's socio-cultural advancement—individual rights and personal well-being is not applicable to the project.

Section 226-25 Objectives and policies for socio-cultural advancement—culture

(a) Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai'i's people.

(b) To achieve the culture objective, it shall be the policy of this State to:

(1) Foster increased knowledge and understanding of Hawai'i's ethnic and cultural heritages and the history of Hawai'i.

(2) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people and which are sensitive and responsive to family and community needs.

(3) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawaii.

(4) Encourage the essence of the aloha spirit in people's daily activities to promote harmonious relationships among Hawaii's people and visitors.

Discussion: This objective relating to planning for the State's socio-cultural advancement--culture is not applicable to the project.

Section 226-26 Objectives and policies for socio-cultural advancement–public safety

(a) Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:

(1) Assurance of public safety and adequate protection of life and property for all people.

(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.

(3) Promotion of a sense of community responsibility for the welfare and safety of Hawai‘i’s people

(b) To achieve the public safety objectives, it shall be the policy of this State to:

(1) Ensure that public safety programs are effective and responsive to community needs.

(2) Encourage increased community awareness and participation in public safety programs.

(c) To further achieve public safety objectives related to criminal justice, it shall be the policy of this State to:

(1) Support criminal justice programs aimed at preventing and curtailing criminal activities.

(2) Develop a coordinated, systematic approach to criminal justice administration among all criminal justice agencies.

(3) Provide a range of correctional resources which may include facilities and alternatives to traditional incarceration in order to address the varied security needs of the community and successfully reintegrate offenders into the community.

(d) To further achieve public safety objectives related to emergency management, it shall be the policy of this State to:

(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.

(2) Enhance the coordination between emergency management programs throughout the State.

Discussion: The project is proposing to improve a portion of Farrington Highway. This objective relating to planning for the State’s socio-cultural advancement—public safety is not applicable to the project.

Section 226-27 Objectives and policies for socio-cultural advancement–government

(a) Planning the State’s socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:

(1) Efficient, effective, and responsive government services at all levels in the State.

(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.

(b) To achieve the government objectives, it shall be the policy of this State to:

(1) Provide for necessary public goods and services not assumed by the private sector.

(2) Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.

(3) Minimize the size of government to that necessary to be effective.

(4) Stimulate the responsibility in citizens to productively participate in government for a better Hawai'i.

(5) Assure that government attitudes, actions, and services are sensitive to community needs and concerns.

(6) Provide for a balanced fiscal budget.

(7) Improve the fiscal budgeting and management system of the State.

(8) Promote the consolidation of state and county governmental functions to increase the effective and efficient delivery of government programs and services and to eliminate duplicative services wherever feasible.

Discussion: The project supports this objective relating to planning for the State's socio-cultural advancement—government. The City is providing a governmental service of supporting infrastructure needs of the community by proposing to improve a portion of Farrington Highway.

Part III Priority Guidelines

Overall priority guidelines were established by the State of Hawai'i to address areas of statewide concern. It is the goal of the State to strive to improve the quality of life for Hawai'i's present and future population through the pursuit of desirable courses of action in seven 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, principles of sustainability, and climate change adaptation.

Section 226-103 Economic priority guidelines

(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawai'i's people and achieve a stable and diversified economy:

(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.

(A) Encourage investments which:

(i) Reflect long term commitments to the State;

(ii) Rely on economic linkages within the local economy;

(iii) Diversify the economy;

(iv) Reinvest in the local economy;

(v) Are sensitive to community needs and priorities;

(vi) Demonstrate a commitment to provide management opportunities to Hawai'i residents.

(B) Encourage investments in innovative activities that have a nexus to the State, such as:

(i) Present or former residents acting as entrepreneurs or principals;

(ii) Academic support from an institution of higher education in Hawai'i

(iii) Investment interest from Hawai‘i residents;

(iv) Resources unique to Hawai‘i that are required for innovative activity;

(v) Complementary or supportive industries or government programs or projects.

(2) Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements.

(3) Improve the quality, accessibility, and range of services provided by government to business, including data and reference services and assistance in complying with governmental regulations.

(4) Seek to ensure that state business tax and labor laws and administrative policies are equitable, rational, and predictable.

(5) Streamline the processes for building and development permit and review and telecommunication infrastructure installation approval and eliminate or consolidate other burdensome or duplicative governmental requirements imposed on business, where scientific evidence indicates that public health, safety, and welfare would not be adversely affected.

(6) Encourage the formation of cooperatives and other favorable marketing or distribution arrangements at the regional or local level to assist Hawai’i’s small-scale producers, manufacturers, and distributers.

(7) Continue to seek legislation to protect Hawai’i from transportation interruptions between Hawai’i and the continental United States.

(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics

(A) An industry that can take advantage of Hawai‘i’s unique location and available physical and human resources.

(B) A clean industry that would have minimal adverse effects on Hawai‘i’s environment.

(C) An industry that is willing to hire and train Hawai‘i’s people to meet the industry’s labor needs at all levels of employment.

(D) An industry that would provide reasonable income and steady employment.

(9) Support and encourage, through educational and technical assistance programs and other means, expanded opportunities for employee ownership and participation in Hawai’i business.

(10) Enhance the quality of Hawai’i’s labor force and develop and maintain career opportunities for Hawai’i’s people through the following actions.

(A) Expand vocational training in diversified agriculture, aquaculture, information industry, and other areas where growth is desired and feasible.

(B) Encourage more effective career counseling and guidance in high schools and post-secondary institutions to inform students of present and future career opportunities.

(C) Allocate educational resources to career areas where high employment is expected and where growth of new industries is desired.

(D) Promote career opportunities in all industries for Hawai‘i’s people by encouraging firms doing business in the State to hire residents.

(E) Promote greater public and private sector cooperation in determining industrial training needs and in developing relevant curricula and on –the-job training opportunities.

(F) Provide retraining programs and other support services to assist entry of displaced workers into alternative employment.

(b) Priority guidelines to promote the economic health and quality of the visitor industry:

(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawai’i’s residents and visitors.

(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.

(3) Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair, and maintenance of visitor facilities.

(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawai’i’s significant natural, scenic, historic, and cultural resources.

(5) Develop and maintain career opportunities in the visitor industry for Hawai’i’s people, with emphasis on managerial positions.

(6) Support and coordinate tourism promotion abroad to enhance Hawai’i’s share of existing and potential visitor markets.

(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.

(8) Support law enforcement activities that provide a safer environment for both visitors and residents alike.

(9) Coordinate visitor industry activities and promotions to business visitors through the state network of advanced data communication techniques.

(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:

(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(2) Continue efforts to maintain federal support to provide stable sugar prices high enough to allow profitable operations in Hawai’i.

(3) Support research and development, as appropriate, to improve the quality and production of sugar and pineapple crops.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.

(2) Assist in providing adequate, reasonably priced water for agricultural activities.

(3) Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.

(4) Assist in the formation and operation of production and marketing associations and cooperatives to reduce production and marketing costs.

(5) Encourage and assist with the development of a waterborne and airborne freight and cargo system capable of meeting the needs of Hawai'i's agricultural community.

(6) Seek favorable freight rates for Hawai'i's agricultural products from interisland and overseas transportation operators.

(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities.

(8) Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.

(9) Require agricultural uses in agricultural subdivisions and closely monitor the uses in these subdivisions.

(10) Support the continuation of land currently in use for diversified agriculture.

(11) Encourage residents and visitors to support Hawai'i's farmers by purchasing locally grown food and food products.

(e) Priority guidelines for water use and development:

(1) Encourage the development, demonstration, and commercialization of renewable energy sources.

(2) Encourage the improvement of irrigation technology and promote the use of nonpotable water for agricultural and landscaping purposes.

(3) Increase the support for research and development of economically feasible alternative water sources.

(4) Explore alternative funding sources and approaches to support future water development programs and water system improvements.

(f) Priority guidelines for energy use and development:

(1) Encourage the development, demonstration, and commercialization of renewable energy sources.

(2) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.

(3) Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.

(4) Encourage the development and use of energy conserving and cost-efficient transportation systems.

(g) Priority guidelines to promote the development of the information industry:

(1) Establish an information network, with an emphasis on broadband and wireless infrastructure and capability that will serve as the foundation of and catalyst for overall economic growth and diversification in Hawai‘i.

(2) Encourage the development of services such as financial data processing, a products and services exchange, foreign language translations, telemarketing, teleconferencing, a twenty-four-hour international stock exchange, international banking, and a Pacific Rim management center.

(3) Encourage the development of small businesses in the information field such as software development; the development of new information systems, peripherals, and applications; data conversion and data entry services; and home or cottage services such as computer programming, secretarial, and accounting services.

(4) Encourage the development or expansion of educational and training opportunities for residents in the information and telecommunications fields.

(5) Encourage research activities, including legal research in the information and telecommunications fields.

(6) Support promotional activities to market Hawai‘i's information industry services.

(7) Encourage the location or co-location of telecommunication or wireless information relay facilities in the community, including public areas, where scientific evidence indicates that the public health, safety, and welfare would not be adversely affected.

Discussion: While most of the economic priority guidelines are not applicable to the planned project, the project improvements to Farrington Highway will help to minimize existing traffic related inconveniences to Hawai‘i’s residents and visitors, thereby contributing to visitor satisfaction.

Section 226-104 Population growth and land resources priority guidelines

(a) Priority guidelines to effect desired statewide growth and distribution:

(1) Encourage planning and resource management to ensure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawai‘i's people.

(2) Manage a growth rate for Hawai‘i's economy that will parallel future employment needs for Hawai‘i's people.

(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.

(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.

(5) Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.

(6) Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.

(7) Support the development of high technology parks on the neighbor islands.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.

(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

(3) Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.

(4) Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.

(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.

(6) Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.

(7) Pursue rehabilitation of appropriate urban areas.

(8) Support the redevelopment of Kakaʻako into a viable residential, industrial, and commercial community.

(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.

(10) Identify critical environmental areas in Hawaiʻi to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.

(11) Identify all areas where priority should be given to preserving rural character and lifestyle.

(12) Utilize Hawaiʻi's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.

(13) Protect and enhance Hawaiʻi's shoreline, open spaces, and scenic resources.

Discussion: The project will provide additional transportation capacity with the planned widening of a portion of Farrington Highway. This will help to support existing and projected population growth of the ʻEwa region. The project is identified in various transportation and development plans as a future improvement within the overall transportation network, ensuring adequate support facilities to accommodate the distribution of growth throughout the State.

Development of the project will not result in adverse impacts to Hawai‘i’s shoreline, open spaces and scenic resources.

Section 226-105 Crime and criminal justice

Priority guidelines in the area of crime and criminal justice:

(1) Support law enforcement activities and other criminal justice efforts that are directed to provide a safer environment.

(2) Target state and local resources on efforts to reduce the incidence of violent crime and on programs relating to the apprehension and prosecution of repeat offenders.

(3) Support community and neighborhood program initiatives that enable residents to assist law enforcement agencies in preventing criminal activities.

(4) Reduce overcrowding or substandard conditions in correctional facilities through a comprehensive approach among all criminal justice agencies which may include sentencing law revisions and use of alternative sanctions other than incarceration for persons who pose no danger to their community.

(5) Provide a range of appropriate sanctions for juvenile offenders, including community-based programs and other alternative sanctions.

(6) Increase public and private efforts to assist witnesses and victims of crimes and to minimize the costs of victimization.

Discussion: The crime and criminal justice priority guidelines are not applicable to the planned project.

Section 226-106 Affordable housing

Priority guidelines for the provision of affordable housing:

(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.

(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.

(3) Improve information and analysis relative to land availability and suitability for housing.

(4) Create incentives for development which would increase home ownership and rental opportunities for Hawai‘i’s low- and moderate-income households, gap-group households, and residents with special needs.

(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawai‘i’s people for the purchase of initial owner-occupied housing.

(6) Encourage public and private sector cooperation in the development of rental housing alternatives.

(7) Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.

(8) Give higher priority to the provision of quality housing that is affordable for Hawai‘i’s residents and less priority to development of housing intended primarily for individuals outside of Hawai‘i.

Discussion: The affordable priority guidelines are not applicable to the planned project.

Section 226-107 Quality education

Priority guidelines to promote quality education:

(1) Pursue effective programs which reflect the varied district, school, and student needs to strengthen basic skills achievement.

(2) Continue emphasis on general education “core” requirements to provide common background to students and essential support to other university programs.

(3) Initiate efforts to improve the quality of education by improving the capabilities of the education work force

(4) Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision making responsibilities.

(5) Increase and improve the use of information technology in education by the availability of telecommunications equipment for:

(A) The electronic exchange of information

(B) Statewide electronic mail

(C) Access to the Internet

Encourage programs that increase the public’s awareness and understanding of the impact of information technologies on our lives.

(6) Pursue the establishment of Hawai‘i’s public and private universities and colleges as research and training centers of the Pacific.

(7) Develop resources and programs for early childhood education.

(8) Explore alternatives for funding and delivery of educational services to improve the overall quality of education.

(9) Strengthen and expand educational programs and services for students with special needs.

Discussion: The priority guidelines for the provision of quality education are not applicable to the planned project.

Section 226-108 Sustainability

Priority guidelines and principles to promote sustainability shall include:

(1) Encouraging balanced economic, social, community, and environmental priorities.

(2) Encouraging planning that respects and promotes living within the natural resources and limits of the State.

(3) Promoting a diversified and dynamic economy.

(4) Encouraging respect for the host culture.

(5) Promoting decisions based on meeting the needs of the present without compromising the needs of future generations.

(6) Encourage planning that respects and promotes living within the natural resources and limits of the State

(7) Emphasizing that everyone, including individuals, families, communities, businesses, and government, has the responsibility for achieving a sustainable Hawai‘i.

Discussion: The project will improve a portion of Farrington Highway which will support sustainable modes and energy efficient transportation, such as use of bike paths and mass transit system. In addition, the planned widening of the roadway will reduce traffic congestion. The planning for the project promotes decisions based on meeting the needs of the present and projected future growth, without compromising the generations to come.

Section 226-109 Climate change adaptation priority guidelines

Priority guidelines to prepare the State to address the impacts of climate change, including impacts to the areas of agriculture; conservation lands; coastal and nearshore marine areas; natural and cultural resources; education; energy; higher education; health; historic preservation; water resources; the built environment; such as housing, recreation, transportation; and the economy shall:

(1) Ensure that Hawai‘i’s people are educated, informed, and aware of the impacts climate change may have on their communities.

(2) Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies.

(3) Invest in continued monitoring and research of Hawai‘i’s climate and the impacts of climate change on the State.

(4) Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change.

(5) Encourage the preservation and restoration of natural landscape features, such as coral reefs, beaches and dunes, forests, streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change.

(6) Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to actual or expected climate change impacts to the natural and built environments.

(7) Promote sector resilience in areas such as water, roads, airports, and public health by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options.

(8) Foster cross-jurisdictional collaboration between county, state, and federal agencies and partnerships between government and private entities and other nongovernmental entities, including nonprofit entities.

(9) Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans.

(10) Encourage planning and management of the natural and built environments that effectively integrate climate change policy.

Discussion: The project supports the priority guidelines for climate change. The roadway improvements will not contribute to adverse impacts relating to existing climate change and sea level rise. The project area is not located in the tsunami evacuation zone and is not expected to be affected by increases in sea levels.

4.2 Hawai‘i State Functional Plans

The Hawai'i State Plan provides for the development of State Functional Plans (SFP) in the areas of agriculture, conservation lands, education, employment, energy, health, higher education, historic preservation, housing, human services, recreation, tourism, transportation and water resources development. SFP are the primary implementing mechanisms for the Hawai'i State Plan. While the State Plan establishes long-term objectives for Hawai'i, the SFP focuses on policies and priority actions which can be implemented in the short term. Policies and objectives of the State Transportation Functional Plan (1991) are applicable to the project and are discussed below:

Issue I: Congestion

Objective I. A: Expansion of the transportation system.

Policy I.A.1. Increase transportation capacity and modernize transportation infrastructure in accordance with existing master plans and laws requiring accessibility fo people with disabilities.

Objective I.E: Planning and designing of State highways to enhance inter-regional mobility.

Policy I.E.1. Design highways with controlled accesses, grade-separated crossings, and a minimum four-lane dividied highway standards where applicable. Encourage counties to develop local road networks for local travel and access.

Issue III: Funding

Objective III.A: Expansion of revenue bases for transportation improvements.

Policy III.A.2. Pursue private sector participation in the financing of transportation systems, developments and projects.

Discussion: The project is consistent with the objectives and policies of the State Transportation Functional Plan. The Farrington Highway Improvements project will expand the existing transportation system and increase capacity of the roadway network while modernizing infrastructure. The project will also maximize the effectiveness of existing transportation systems by providing a four-lane divided roadway to enhance inter-regional mobility. Funding for the improvements will include both public and private sector participation.

4.3 Hawai‘i State Land Use District Boundaries

Under the Chapter 205, HRS, all lands of the State are to be classified in one of four categories: urban, rural, agricultural, and conservation lands. The State LUC, an agency of the State Department of Busines, Economic Development, and Tourism (DBEDT), is responsible for each district's standards and for determining the boundaries of each district (Chapter 205-2(a), HRS). The LUC is also responsible for administering all requests for district reclassifications and/or amendments to district boundaries, pursuant to Chapter 205-4, HRS, and the HAR, Title 15, Chapter 15 as amended. Under this Chapter, all lands in Hawai‘i are classified into four land use districts: (1) Conservation, (2) Agricultural; (3) Urban, and (4) Rural.

The Urban District generally includes lands characterized by "city-like" concentrations of people, structures and services. This District also includes vacant areas for future development. Jurisdiction of this district lies primarily with the respective counties. Generally, lot sizes and uses permitted in the district area are established by the respective County through ordinances or rules.

Discussion: As classified by the State of Hawai‘i LUC, the project area is within the State Urban and Agricultural land use districts. The roadway improvements project is consistent with these districts and serve to support the future transportation needs of the area.

4.4 Hawai‘i Coastal Zone Management Program

The Coastal Zone Management Act of 1972 (16 USC Section 1451), as amended through Public Law 104-150, created the coastal management program and the National Estuarine Research Reserve system. The coastal states are authorized to develop and implement a state coastal zone management program. Hawai‘i Coastal Zone CZM Program received federal approval in the late 1970s. The objectives of the State's Hawai‘i CZM Program, Section 205A-2, HRS, are to protect valuable and vulnerable coastal resources such as coastal ecosystems, special scenic and cultural values and recreational opportunities. The objectives of the program are also to reduce coastal hazards and to improve the review process for activities planned within the coastal zone. Each county is responsible for designating a SMA that extends inland from the shoreline. Development within this SMA is subject to County approval to ensure the proposal is consistent with the policies and objectives of the Hawai‘i CZM Program.

The project is not located within the coastal zone or SMA as delineated by the City. However, HRS Chapter 205A requires all state and county agencies to enforce CZM objectives and policies as set forth in HRS §205A-2. The following discussions addresses the applicability of the project to the ten subject CZM objectives and policies.

Recreational Resources

Objective: Provide Coastal Recreational Opportunities Accessible to the Public

(A) Improve coordination and funding of coastal recreation planning and management.

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

- Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;
- Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;
- Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;
- Encouraging expanded public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value;
- Adopting water quality standards and regulating point and non-point sources of pollution to protect and where feasible, restore the recreational value of coastal waters;
- Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, artificial reefs for surfing and fishing; and
- Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use Commissions, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of section 46-6.

Discussion: The project would have no impact on coordination and funding of coastal recreation planning and management. The project is not located directly adjacent to the coastline, therefore, no shoreline recreational opportunities will be affected with the project improvements. Existing coastal resources with significant recreational value and existing public accessways will not be impacted. No shoreline improvements are planned, such as artificial reefs or beaches.

Historic Resources

Objective: Protect, Preserve and, Where Desirable, Restore Those Natural and Man-Made Historic and Pre-Historic Resources in the Coastal Zone Management Area that are Significant in Hawaiian and American History and Culture

(A) Identify and analyze significant archaeological resources.

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation and display of historic resources.

Discussion: A LRFI and CIA were conducted for the planned project. The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. Coordination with the SHPD on the planned project and future related surveys and studies, historic documentation, and mitigation to complete the HRS 6E review process will be completed as the project moves forward. Appropriate documentation and SHPD approval will be completed prior to construction of the project.

If any cultural, historic, or archaeological resources are unearthed or ancestral remains are inadvertently discovered during construction, all work will cease, and appropriate agencies will be notified. The treatment of these resources will be performed in strict compliance with the applicable historic preservation and burial laws.

Scenic and Open Space Resources

Objective: Protect, Preserve and, Where Desirable, Restore or Improve the Quality of Coastal Scenic and Open Space Resources

(A) Identify valued scenic resources in the coastal zone management area;

(B) Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(C) Preserve, maintain and where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments which are not coastal dependent to locate in inland areas.

Discussion: The project will not adversely impact existing scenic and open space resources. There are no scenic view sheds identified in the project vicinity or detailed in the 'Ewa DP. The design of the roadway improvements will blend with the existing roadway system. The project is not located directly adjacent to the shoreline and does not adversely affect shoreline open space.

Coastal Ecosystems

Objective: Protect Valuable Coastal Ecosystems from Disruption and Minimize Adverse Impacts on all Coastal Ecosystems

(A) Improve the technical basis for natural resource management;

(B) Preserve valuable coastal ecosystems of significant biological or economic importance;

(C) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(D) Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.

Discussion: The Farrington Highway Improvements project is located well away from the shoreline area and will not affect natural resource management or valuable coastal ecosystems

Economic Uses

Objective: Provide Public or Private Facilities and Improvements Important to the State's Economy in Suitable Location

(A) Concentrate in appropriate areas the location of coastal dependent development necessary to the state's economy;

(B) Ensure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent development to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

- Utilization of presently designated locations is not feasible;
- Adverse environmental effects are minimized; and
- Important to the State's economy.

Discussion: The project is not considered a coastal dependent development and will not impact facility improvements to the State's economy.

Coastal Hazards

Objective: Reduce Hazard to Life and Property from Tsunami, Storm Waves, Stream Flooding, Erosion and Subsidence.

(A) Develop and communicate adequate information on storm wave, tsunami, flood, erosion, and subsidence hazard;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(D) Prevent coastal flooding from inland projects.

Discussion: The project is not located within the tsunami evacuation zone or extreme tsunami evacuation zone (*Figure 3-8*). Tsunami conditions impose no constraints on the project. Most of the project area is located in Flood Zone D, which is defined as an undetermined flood hazard area and Flood Zone X which includes areas of minimal hazard (*Figure 3-7*). Small portions of the project improvements are also located in Flood Zones A, AE and AEF. Construction in these zones will adhere to City LUO Section 21-9.10 Flood Hazard Districts and will obtain applicable permits for construction. The site is not located directly adjacent to the shoreline and/or stream courses; therefore, risks of impacts occurring from storm waves and/or stream flooding are low.

Managing Development

Objective: Improve the Development Review Process, Communication, and Public Participation in the Management of Coastal Resources and Hazards

(A) Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements; and

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their lifecycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Discussion: The project supports the development review process, communication, and public participation. This EA is prepared pursuant to HRS Chapter 343, to conduct an environmental review of the planned Farrington Highway Improvements project and provides an evaluation of the potential short and long-term impacts on environmental, social, and cultural resources. The OEQC publishes notice of the EA availability for public review and participation, providing a 30-day comment period. During the pre-scoping phase of the project, agencies, organizations, and individuals were also consulted and a public meeting was provided.

4.5 Hawai‘i 2050 Sustainability Plan

The Hawai‘i 2050 Sustainability Plan has as its main goals and objectives respect for culture, character, beauty, and history of the state's island communities; balance among economic, community, and environmental priorities; and an effort to meet the needs of the present without compromising the ability of future generations to meet their own needs.

The 2050 Plan delineates five goals toward a sustainable Hawai‘i accompanied by strategic actions for implementation and indicators to measure success or failure. The goals and strategic actions that are pertinent to the Hale Mauliola project are as follows.

Goal One: *Living sustainably is part of our daily practice in Hawai‘i. Strategic Actions: Develop a sustainability ethic.*

Goal Two: *Our diversified and globally competitive economy enables us to meaningfully live, work and plan in Hawai‘i. Strategic Actions: Develop a more diverse and resilient economy.*

Goal Three: *Our natural resources are responsibly and respectfully used, replenished, and preserved for future generations. Strategic Actions: Provide greater protection for air, and land-, fresh water- and ocean-based habitats; conserve agricultural, open space and conservation lands and resources.*

Goal Four: *Our community is strong, healthy, vibrant and nurturing, providing safety nets for those in need. Strategic Actions: Provide access to diverse recreational facilities and opportunities.*

Goal Five: *Our Kanaka Maoli and island cultures and values are thriving and perpetuated. Strategic Actions: Honor Kanaka Maoli culture and heritage; Celebrate our cultural diversity and island way of life; Enable Kanaka Maoli and others to pursue traditional Kanaka Maoli lifestyles and practices.*

Discussion: The project is proposing to improve a two-lane section of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road to serve the projected growth of West O‘ahu. The improvements will also be designed to serve various modes of transportation (i.e. vehicle, mass transit, bike, and pedestrian) along the roadway system to provide a safe and efficient way to travel. Public infrastructure improvements such as this is key to building a strong economy, thereby enabling citizens, business and communities to function properly.

4.6 City and County of Honolulu General Plan

Adopted by resolution in 1977, the 1992 revised edition of the General Plan for the City, as amended in 2002, sets forth the long-range objectives for the general welfare and prosperity of the people of O‘ahu and broad policies to attain those objectives. The Draft 2035 O‘ahu General Plan Update was published in November 2012, and the Revised General Plan dated December 2017 was submitted to the City Council and approved on as of February 13, 2020.

The General Plan Update provides objectives and policies intended to guide and coordinate City land use planning and regulation, and budgeting for operations and capital improvements. The Planned Revised Plan includes continued focus on critical issues such as regional population, economic health, and affordable housing, while also addressing concerns such as climate change, sea level rise, and sustainability.

The project is consistent with the applicable objectives and policies of the current City General Plan as described below.

I. Population

Objective A: To plan for anticipated population growth in a manner that acknowledges the limits of O'ahu's natural resources, that protects the environment, and that minimizes social, cultural, and *economic disruptions.*

Policy 1: Allocate efficiently the money and resources of the City and County in order to meet the needs of O'ahu's anticipated future population.

Objective B: To establish a pattern of population distribution that will allow the people of O'ahu to live, work and play in harmony.

Policy 2: Encourage development within the secondary urban center at Kapolei and the 'Ewa and Central O'ahu urban-fringe areas to relieve developmental pressures in the remaining urban-fringe and rural areas and to meet housing needs not readily provided in the primary urban center.

Policy 4: Direct growth according to Policies 1, 2, and 3 above by providing development capacity and needed infrastructure to support a distribution of O'ahu's resident population.

Discussion: The project will provide additional transportation capacity with the planned widening of a portion of Farrington Highway. This will help to support existing and projected population growth of the 'Ewa region and development within the Secondary Urban Center. The project is identified in various transportation and development plans as a future improvement within the overall transportation network.

II. The Economy

Objective G: To establish a pattern of population distribution that will allow the people of O'ahu to live, work and play in harmony.

Policy 1: Concentrate economic activity and government services in the primary urban center and in the secondary urban center at Kapolei.

Discussion: The project will help to establish a pattern of population distribution on O'ahu by providing improved infrastructure and expansion of a portion of Farrington Highway. This additional capacity of the transportation roadway network will support concentrated economic activity and government services in the Secondary Urban Center.

III. Natural Environment and Resource Stewardship

Objective A: To protect and preserve the natural environment.

Policy 7: Protect the natural environment from damaging levels of air, water, and noise pollution.

Policy 8: Protect plants, birds, and other animals that are unique to the State of Hawai'i and O'ahu, and protect their habitats.

Policy 3: Locate and design public facilities, infrastructure and utilities to minimize the obstruction of scenic views.

Discussion: The Farrington Highway Improvements project will be designed to protect and preserve the natural environment. Construction related short-term air quality and noise impacts are expected to be minimal and construction BMPs will be implemented to mitigate potential impacts.

A Natural Resource Survey was conducted for the project, no adverse impacts to plants, birds, or other animals and their habitats are anticipated to occur as a result of the project's development.

There are no scenic view sheds identified in the project vicinity or listed in the 'Ewa DP. The design of the roadway improvements wll blend with the existing roadway system.

IV. Housing and Communities

Objective C: To provide residents with a choice of living environments which are reasonably close to employment, recreation, and commercial centers and which are adequately served by transportation networks and public utilities.

Policy 4: Encourage residential development in suburban areas where existing roads, utilities, and other community facilities are not being used to capacity, and in urban areas where higher densities can be readily accommodated.

Discussion: The project supports the General Plan's policy and objectives relating to housing and communities by encouraging residential development through improved roadway infrastructure. The planned Farrington Highway Improvements project will help to meet increased transportation needs of the region providing residents with more efficient access to employment, recreation, and commercial centers.

V. Transportation and Utilities

Objective A: To create a multimodal transportation system which moves people and goods safely, efficiently, and at a reasonable cost and minimizes fossil fuel consumption and greenhouse gas emissions; serves all users, including limited income, elderly and disabled populations; and is integrated with existing and planned development.

Policy 1: Develop a comprehensive, well-connected and integrated ground transportation system that enables safe, comfortable and convenient travel for all users, including motorists, pedestrians, bicyclists, and public transportation users of all ages and abilities.

Policy 2: Provide multimodal transportation services to people living within the 'Ewa, Central O'ahu, and Pearl City-Hawai'i Kai corridors primarily through a mass transit system including exclusive right-of-way rail transit and feeder-bus components as well as through the existing highway system.

Policy 6: Support the development of transportation plans, programs, and facilities that are based on Complete Streets features. Maintain and improve road, bicycle, and pedestrian facilities in existing communities to eliminate unsafe conditions.

Policy 9: Consider environmental, social, cultural, and climate change and natural hazard impacts, as well as construction and operating costs, as important factors in planning transportation system improvements.

Policy 11: Enhance pedestrian-friendly and bicycle-friendly travel via public and private programs and improvements

Objective D: To maintain transportation and utility systems which support O'ahu as a desirable place to live and visit.

Policy 2: Evaluate the social, cultural, economic, and environmental impact of additions to the transportation and utility systems before they are constructed.

Discussion: Widening the Farrington Highway transportation corridor is a coordinated effort that will serve the future need for additional transportation system capacity of the 'Ewa community. The Farrington Highway Improvements project is part of an integrated multimodal roadway system that supports pedestrian-friendly and bicycle-friendly travel. The planned expansion of the roadway supports various transportation plans and identifies it as a priority project for future growth and support of the region.

Planning and design for the project included an evaluation of social, cultural, economic, and environmental impacts, as described in *Chapter 3.0* of the EA. Development of the Farrington Highway Improvements project is not anticipated to result in significant adverse impacts and will maintain transportation systems that support O'ahu as a desirable place to live. Mitigation measure will be implemented, as appropriate, to minimize potential impacts from occurring.

VI. Energy

Objective C: To increase energy self-sufficiency and maintain an efficient, reliable, resilient, and cost-efficient energy system.

Policy 3: Promote and assist efforts to establish safe and adequate fossil fuel supply reserves within Hawai'i's boundaries until Hawai'i reaches its renewable energy goals

Objective B: Promote the development of a multimodal transportation system that minimizes fossil fuel consumption and greenhouse gas emissions.

Policy 4: Promote the development of a multimodal transportation system that minimizes fossil fuel consumption and greenhouse gas emissions.

Discussion: The Farrington Highway Improvements project supports the General Plan's policy and objectives relating to energy. The project will be part of an integrated multimodal roadway, including bicycle and pedestrian facilities, and access to mass transit. The integrated multimodal system will accommodate planned growth objectives for the 'Ewa region and will help to minimize fossil fuel consumption and greenhouse emission with a more efficient transportation system.

VII. Physical Development and Urban Design

Objective A: To coordinate changes in the physical environment of O'ahu to ensure that all new developments are timely, well-designed, and appropriate for the areas in which they will be located.

Policy 1: Provide infrastructure improvements to serve new growth areas, redevelopment areas, and areas with badly deteriorating infrastructure.

Policy 2: Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation, and other public facilities and services.

Policy 6: Facilitate transit-oriented development in rail transit station areas to create live/work/play multimodal communities that reduce travel and traffic congestion.

Objective D: To develop a secondary urban center in 'Ewa with its nucleus in the Kapolei area.

Policy 1: Allocate funds from the City and County's capital improvement program for public projects that are needed to facilitate development of the secondary urban center at Kapolei.

Policy 2: Encourage the development of a major residential, commercial, and employment center within the secondary urban center at Kapolei.

Objective E: To maintain those development characteristics in the urban-fringe and rural areas which make them desirable places to live.

Policy 2: Coordinate plans for developments within the 'Ewa and Central O'ahu urban-fringe areas with the State and Federal governments, major landowners and developers, agricultural industries, and the community.

Discussion: The planned project promotes the physical development and urban design objectives of the General Plan. The expansion of the Farrington Highway transportation corridor is a coordinated effort that will serve the future need for additional transportation system capacity of the 'Ewa community. The project will provide integrated multimodal roadways, including bicycle and pedestrian facilities, and access to mass transit. The improved transportation system will accommodate planned growth objectives and encourage development of major residential, commercial, and employment centers within the Secondary Urban Center at Kapolei, as detailed in various State and County plans. Development of the project involves coordination with government agencies, major landowners, and the community.

IX. Health and Education

Objective A: To protect the health and well-being of residents and visitors.

Policy 2: Provide prompt and adequate ambulance and first-aid services in all areas of O'ahu.

Discussion: The project will support the health and well-being of residents and visitors by providing ambulance and first-aid services with the ability to travel more efficiently on the roadways. Increased capacity of the roadway will lessen travel times to better assist in emergency situations.

X. Culture and Recreation

Objective B: To protect, preserve and enhance O'ahu's cultural, historic, architectural, and archaeological resources.

Policy 2: Identify and, to the extent possible, preserve and restore buildings, sites, and areas of social, cultural, historic, architectural, and archaeological significance.

Policy 7: Encourage the protection of areas that are historically important to Native Hawaiian cultural practices and to the cultural practices of other ethnicities, in order to further preserve and continue these practices for future generations.

Discussion: The project supports the General Plan's policy and objectives relating to culture and recreation, by protecting O'ahu's historic and cultural resources. A CIA and Archaeological LRFI was conducted for the project. Coordination with the SHPD on the planned project and future related surveys and studies, historic documentation, and mitigation to complete the HRS 6E review process will be completed as the project moves forward. Appropriate documentation and SHPD approval will be completed prior to construction of the project.

If any cultural, historic, or archaeological resources are unearthed or ancestral remains are inadvertently discovered during construction, all work will cease, and appropriate agencies will be notified. The treatment of these resources will be conducted in strict compliance with the applicable historic preservation and burial laws.

XI. Government Operations and Fiscal Management

Objective B: To ensure fiscal integrity, responsibility, and efficiency by the City and County government in carrying out its responsibilities.

Policy 3: Ensure accountability and transparency in government operations.

Discussion: The Farrington Highway Improvements project is being planned by the City. The project ensures accountability and transparency of government operations through the preparation of this EA pursuant to HRS Chapter 343. The environmental review process evaluates the potential short and long-term impacts of the project on environmental, social, and cultural resources, and provides opportunities for public participation.

4.7 City and County of Honolulu 'Ewa Development Plan

The 'Ewa DP is one of the eight community-based plans intended to provide conceptual, long-range visions and policies to guide land use and infrastructure improvements decisions. The plan was first adopted by the City Council in 1997 and amended by Ordinance 00-16 in 2000 and again by Ordinance 13-26 in 2013. The 'Ewa DP supports development of the City of Kapolei as a Secondary Urban Center on O'ahu in order to relieve housing pressures in the Primary Urban Center. The 'Ewa DP also describes plans for development of 'Ewa's roadways, transit system and bikeways and reviews planning guidelines for future transportation development in 'Ewa.

The vision for the 'Ewa DP has two horizons. The first horizon extends from the present to 2035. By 2035, the 'Ewa DP area will have experienced tremendous growth made significant progress toward providing a Secondary Urban Center for O'ahu Population will have grown from 68,700 people in 2000 to over 164,000. Between 2000 and 2035, over 35,000 new housing units will have been built in a series of master planned communities.

Job growth will be equally impressive, rising from 16,400 non-construction jobs in 2000 to over 87,000 in 2035. O'ahu residents and visitors will be attracted to 'Ewa by a new university campus, the Ko 'Olina Resort, the Hoakalei Resort, a major super regional park, and a thriving City of Kapolei which has retail and commercial establishments and private and government offices.

Beyond 2035, the plan identifies what ‘Ewa should look like when "fully" developed. Such a perspective helped identify where open space should be preserved within the urbanized area, and where to set the limits to development in ‘Ewa for the foreseeable future. As such, this second horizon might be called the "built-out" horizon and is probably 40 to 50 years in the future.

Elements of the “build-out” review the protection of agricultural lands and open space, development of the Secondary Urban Center, the building of master planned residential communities that support walking, biking, and transit use, protecting natural, historic, and cultural resources, and providing adequate infrastructure to meet the needs of new and existing development. The project’s consistency with the Vision Statement (Section 2.1) and Transportation Systems (Section 4.1) of the ‘Ewa DP is examined below.

Vision Statement (Section 2.1)

Protect Agricultural Lands and Open Space

Urban growth will be contained within a boundary (community growth boundary) that protects prime agricultural lands. Preservation of prime agricultural lands mauka of H-1 and on the Waiʻanae side of Kunia road for use in diversified agriculture will help retain open space and views, in addition to supporting economic diversification. Within the Community Growth Boundary, ‘Ewa will be built around a regional system of open space and greenways where residents will be able to easily access beaches. Linear shoreline access will be provided along the coast from Ko ‘Olina to ‘Ewa Beach.

A network of greenways will link the communities together, with landscaping along major roads such as Kapolei Parkway, Kūalakaʻi Parkway (formerly North-South Road), and Fort Weaver Road, and pedestrian and bike paths along grassed drainageways and utility corridors. A major pedestrian and bike path will be provided by the Pearl Harbor Historic Trail, which extends about 18.5 miles from the U.S.S. Arizona Visitor Center through the ‘Ewa Development Plan area and on to Nānākuli along the OR&L Railroad right-of-way.

Develop the Secondary Urban Center

The Secondary Urban Center will provide a wide range of jobs located at visitor units and activity centers in Ko ‘Olina and Hoakalei, in industrial areas near the Kalaeloa Barbers Point Deep Draft Harbor, in offices and retail centers located at the City of Kapolei and community and neighborhood centers in residential communities, at the UHWO, and in diversified agriculture activities located along Kunia Road and around the Pearl Harbor Naval Munitions Command.

At the heart of the Secondary Urban Center will be the City of Kapolei with an urban mix of retail, office and residential uses. The City Center will become a regional commercial center, attracting customers from all parts of Oʻahu.

Build Master Planned Residential Communities That Support Walking, Biking, and Transit Use

Substantial residential growth (over 35,500 new units between 2000 and 2035) will occur primarily in ‘Ewa. The new developments must demonstrate how they would create communities that interact with neighboring communities designed with accessible main street areas and incorporate a mixture of residential and commercial development.

Separate identities should be created for communities by using open space, architectural design, streetscape treatments and landscaping which links to the regional open space and greenway

network. Communities should be designed to reduce automobile use by providing transportation systems of connectivity, within and between subdivisions, with easy access to transit, and encouraging people to walk and bike.

Protect Natural, Historic, and Cultural Resources

Natural resources will be conserved through retaining natural drainageways, protecting valuable plant and wildlife habitats, cleaning up contaminated areas and efficiently using water supplies. Cultural and historical resources will be preserved by retaining visual landmarks and significant views, preserving historic, cultural, and archaeological features from ‘Ewa's past, and by conducting surveys to assess the historical significance of sites and structures affected by development projects and to identify the appropriate measures to preserve these resources.

Provide Adequate Infrastructure to Meet the Needs of New and Existing Development

Public agencies will work with the community to address current deficiencies in roads, schools, and parks and to create adequate infrastructure to meet the needs of the residential and working population of the area. Completion of the first increment of the elevated fixed guide way transit system (from East Kapolei to Ala Moana Shopping Center) is critical to relieving development pressure elsewhere on O‘ahu by developing the Second City and the Urban Fringe in ‘Ewa. It is needed to provide an effective and reliable alternative to commuting by auto for a significant number of commuters by 2020.

Discussion: The project is consistent with the ‘Ewa DP and is listed as a planned project ORTP #205 phased for 2019-2029. Development of the roadway improvements will not adversely impact agricultural lands and open space as the project will be expanding an existing roadway system. The project will help to support development of the Secondary Urban Center, including master planned residential communities, by providing additional transportation capacity along Farrington Highway for commuters in the region. The roadway system will include sidewalks and bike lanes that will help to provide connectivity that supports walking, biking, and transit use.

Significant adverse impacts to natural, historic, and cultural resources are not anticipated to occur as a result of the project. A Natural Resource Survey and Archaeological LRFI were conducted for the project and are discussed in *Chapter 3.0* of this EA. Mitigation measures will be implemented as appropriate to minimize potential impacts.

The Farrington Highway Improvements project will implement ‘Ewa DP and improve existing ‘Ewa Roadway networks for the transportation needs of the region. The project will help to provide adequate infrastructure for the region to meet the needs of new and existing and development.

Transportation Systems (Section 4.1)

The planned roadway elements and other transportation system features in ‘Ewa were identified through the regional planning and transportation analysis done for the initial ‘Ewa Development Plan Revision Program from 1994 to 1997, subsequent revisions of the ORTP, the ‘Ewa Highway Master Plan and the 2009 ‘Ewa Roadway Connectivity Study. The ‘Ewa Highway Master Plan and the ORTP 2035 show major elements of the future ‘Ewa roadway network. One of these major improvements include the widening of Farrington Highway (See the Public Facilities Map in Appendix A and the Planned ‘Ewa Roadway Network Improvements listing in Table 4.1 of the ‘Ewa DP).

Discussion: The project is consistent with the ‘Ewa DP and is listed as a planned project. The ‘Ewa

Highway Master Plan and the ORTP 2040 show major elements of the future ‘Ewa roadway network. One of these major improvements include the widening of Farrington Highway. Therefore, the project is consistent with the ‘Ewa DP and supports its planned projects. Development of the project will expand the existing roadway system and help to provide connectivity which supports walking, biking and transit use.

4.8 City and County of Honolulu ‘Ewa Infrastucture Map

The Public Infrastructure Map (PIM) for each of eight O‘ahu regions show symbols identifying planned major public infrastructure facilities projects, such as roads, wastewater, and drinking water facilities for that region. The Council must approve placing the symbols on the PIM prior to approving the appropriation of funds for project land acquisition or construction in the City's Capital Improvement Program budget. In doing so, Council must find the projects to be consistent with the General Plan, and relevant DPs and/or Sustainable Communities Plans. The projects shown on the PIM represent desired long-term future improvements and more immediate priority projects of importance. These projects will carry out the intent of City plans to shape the communities we live in that meet the people.

The PIM for ‘Ewa shows symbols for the Farrington Highway Improvements (North-South Road to Fort Weaver Road) and Farrington Highway Widening Project.

Discussion: The Farrington Highway Improvements project will implement the plans of the ‘Ewa PIM as a priority project that will help to create a transportation system that supports the existing and future development of the ‘Ewa region.

4.9 ‘Ewa Highway Master Plan (2011)

The ‘Ewa Highway Master Plan was recently updated as part of the ‘Ewa Highway Impact Fee program. The plan, along with the ORTP 2035, identify major transportation projects in the ‘Ewa region needed to accommodate planned growth in the region by 2035, including the Widening of Farrington Highway. ‘Ewa Highway Master Plan impact fees are set forth in Section 33A1.6 ROH.

Discussion: The Farrington Highway Improvements project is included as a planned project in the ‘Ewa Highway Master Plan.

4.10 O‘ahu Regional Transportation Plan 2040

The ORTP is developed by the O‘ahu Metropolitan Planning Organization (OMPO) under federal mandate to provide a long-range surface transportation strategy. The purpose of the ORTP is to guide the development of transportation on O‘ahu through 2040.

The widening of Farrington Highway between Kapolei Golf Course Road and Fort Weaver Road is listed in the ORTP 2040 Project List as Project No. 205. The project considered a mid-range project planned to occur between 2019 and 2029. The estimated to cost of the improvements is listed at approximately $100 million dollars.

Discussion: The Farrington Highway Improvements project supports the ORTP 2040 as it is planned for in the list of mid-range projects (#205) phased for 2019-2029.

4.11 Transportation for O‘ahu Plan 2025

OMPO, under mandate by the United States Department of Transportation, is tasked with of establishing the eligibility of metropolitan areas for federal funds earmarked for ground transportation systems. The Transportation for O‘ahu Plan 2025 (TOP) is a multimodal long-range plan that documents ground transportation projects selected for federal funding. The TOP 2025 updated the 2020 ORTP, which has since been replaced by the ORTP 2035.

The Farrington Highway Widening from Kapolei Golf Course Road to Fort Weaver Road is listed as the highest priority project for implementation in the TOP 2025. The operational and safety improvement project is estimated to cost approximately $31.6 million (Year 2000 dollars).

Discussion: The Farrington Highway Improvements project is included in the TOP 2025 list of priority projects.

4.12 ‘Ewa Roadway Connectivity Study

This study by the City promotes better roadway connectivity in the rapidly developing ‘Ewa region. The study explains how the lack of interconnectivity between developments adjacent to Farrington Highway naturally feeds all sub-regional traffic and local circulation onto this rural, mostly two-lane arterial roadway. The lack of parallel facilities in the City of Kapolei could cause significant congestion during peak-hour travel periods. The study further recommends that Farrington Highway be widened between the North South Road and Fort Weaver Road. Table 3 of the ‘Ewa Roadway Connectivity Study lists Implementation and Planning Level Cost Estimates of Roadway Projects in Constant 2008 Dollars, and recommends widening two segments of Farrington Highway to four lanes:

1) One-mile segment from the North-South Road to Kapolei Golf Course Road (2012, estimated cost $19 million in 2008 dollars)

2) Two-mile segment from the North-South Road to Fort Weaver Road (2015, estimated cost $38 million in 2008 dollars)

Discussion: The project is listed as a planned improvement in the ‘Ewa Roadway Connectivity Study.

4.13 Bike Plan Hawai‘i

Bike Plan Hawai‘i is a tool to integrate bicycling into the state’s transportation system. The plan outlines how the state intends to accommodate and promote bicycling and includes a combination of existing and future bicycle facilities, policies, and programs to ensure a successful bicycle network. The overall goal of Bike Plan Hawai‘i is to establish bicycling as a safe and convenient mode of transportation for residents and visitors throughout the state.

The Bike Plan Hawai‘i planned bicycle facilities lists Farrington Highway from Kapolei Golf Course Road to Fort Weaver Road as a signed and shared road type of bicycle path. The project has a priority level of IV and is estimated to cost approximately $906,000.

Discussion: The Farrington Highway Improvements project is included in the Bike Plan Hawai‘i list of planned O‘ahu bicycle facility projects.

4.14 O‘ahu Bike Plan (2019)

The O‘ahu Bike Plan provides a strategy for better integrating bicycling into the City’s transportation system. It provides important policy and program recommendations and identifies an integrated network of on-road bike lanes and routes and off-road paths that will link people with their favorite and most visited destinations.

O‘ahu currently has 211 miles of on- and off-road bikeway facilities and the plan calls for an additional 575 miles of bicycle facilities. The O‘ahu Bike Plan provides a list of planned priority projects based on their potential to enhance bicyclist safety, increase ridership, improve connectivity, and advance transportation equity. Priority 2 projects for O‘ahu relating to the Farrington Highway Improvements project include:

- Project 2-38 Farrington Highway (Ho‘opili) from Kūalaka‘i Parkway to Fort Weaver Road, comprising of about 2.21 miles.
- Project 2-39 Farrington Highway (UHWO) from Kapolei Golf Course Road to Kūalaka‘i Parkway comprising approximately 2.04 miles.

Discussion: The project supports the O‘ahu Bike Plan and will help to implement priority projects listed for the ‘Ewa DP area.

4.15 East Kapolei Neighborhood TOD Plan (Public Review Draft #2)

The East Kapolei Neighborhood TOD Plan (Public Review Draft 2) presents a very unique opportunity to create a sustainable, responsible and integrated community for O‘ahu. Located along the planned transit line that will connect downtown Honolulu with the East Kapolei region, Ho‘opili, HWO and East Kapolei stations are envisioned as transit-oriented development sites envisioned as compact, pedestrian friendly environments that provide numerous housing, employment and recreational opportunities. Each station plan has been developed through an inclusive community-based planning effort to ensure that the needs of the area stakeholders have been integrated into the Station Area Plan.

Discussion: The Farrington Highway Improvements project supports the East Kapolei Neighborhood TOD Plan. The plan identifies the widening of Farrington Highway as a “next step” that should be taken by the City and County of Honolulu and local property owners in the near term to put the TOD Plan into action and ensure the established framework. The project is integral piece to the overall transportation network and East Kapolei TOD plan, supporting the Honouliuli, Kaone‘ae, and Kūalaka‘i Transit Station Areas by providing additional transportation capacity and connectivity to and from the stations for vehicles, bicycles and pedestrians.

4.16 UHWO Non-Campus Lands Urban Design Plan

The UHWO Non-Campus Lands Urban Design Plan (UDP) defines the design character of the Non-Campus Lands surrounding the UHWO Campus, and sets forth concepts, standards and guidelines for its development as part of East Kapolei and the City and County of Honolulu’s plans for the first segment of the Honolulu High-Capacity Transit Corridor or “rail transit” project. This vision for the UHWO Non-Campus Lands is supported by three interrelated planning principles that have been established to assure implementation of the vision:

- An interconnected community with the campus at its core.

- A University District with smaller, distinct integrated communities.
- A sustainable development, promoting alternative energy, while catering to our Hawaiian lifestyle.

Portions of the UHWO Non-Campus Lands abut both Farrington Highway and Kūalakaʻi Parkway. Farrington Highway is noted as contributing to the vehicular and pedestrian circulation and access of the campus and surrounding area. The Farrington Highway Mixed-Use/Campus Expansion Neighborhood is included in the UHWO TOD Makai Neighborhood as a parcel zoned BMX-3 (business mixed-use), along Farrington Highway. This area is envisioned to include an area for UHWO Campus expansion, and/or for multi-family or residential/commercial mixed-use.

Discussion: Farrington Highway as an existing two-lane, undivided roadway, is noted in the UHWO UDP as being planned for widening to a four-lane roadway and bike lanes. The widening of Farrington Highway supports the UHWO Non-Campus Lands UDP as the project will help to support plans for future expansion of the non-campus lands, including the Farrington Highway Mixed-Use/Campus Expansion Neighborhood.

4.17 City and County of Honolulu Land Use Ordinance

The purpose of the LUO is to regulate land use in a manner that will encourage orderly development in accordance with adopted land use policies, including the County General Plan and development plans. The LUO is also intended to provide reasonable development and design standards. These standards are applicable to the location, height, bulk and size of structures, yard areas, off-street parking facilities, and open spaces, and the use of structures and land for agriculture, industry, business, residences or other purposes (Revised Ordinance for the City and County of Honolulu [ROH], Chapter 21).

Discussion: The existing Farrington Highway roadway parcel does not have a City zoning district. However, the alignment borders a variety of different zoning districts, that include: AG-1 (Restricted Agricultural District), AG-2 (General Agricultural District), BMX-3, (Community Business Mixed Use District), and A-2 (Medium Density Apartment District) (*Figure 1-4*).

The project improvements to Farrington Highway is consistent with providing service to the land use/zoning designations for development projects along this corridor, and will help to meet the future transportation demands.

4.18 City and County of Honolulu Special Management Area

The Special Management Area (SMA) was established to preserve, protect, and where possible, to restore the natural resources of the coastal zone of Hawaiʻi. Special controls on development within this area are necessary to avoid permanent loss of valuable resources and foreclosure of management options. The review guidelines of Section 25-3.2 of the ROH are used by the DPP and the Honolulu City Council for the review of developments planned in the SMA. These guidelines are derived from Section 205A-26 HRS.

Discussion: The Farrington Highway Improvements project is not located within the City designated SMA and hence is not subject to the City's SMA Rules and Regulations. However, this *Section 4.4* of this EA examines the project's consistency with State Coastal Zone Management guidelines.

Chapter 5

Findings Supporting the Anticipated Determination

Chapter 5

Findings Supporting the Anticipated Determination

5.1 Anticipated Determination

After reviewing the significance criteria outlined in Chapter 343, HRS, and Section 11-200.1-12, HAR, Contents of EA, the project has been determined to not result in significant adverse effects on the natural or human environment. A FONSI is anticipated.

5.2 Reasons Supporting the Anticipated Determination

5.2.1 Significance Criteria

HRS Chapter 343 requires additional evaluation of the project with regarding to the 13 significance criteria outlined in Section 11-200.1-12, State Administrative Rules:

The potential impacts of the roadway improvement and future and operation of the planned project have been fully examined and discussed in this EA. No significant adverse environmental impacts are expected to occur as a result of the proposed project. This determination is based on an evaluation of the project in accordance with Chapter 343, HRS significance criteria, as presented below for criterion (1) to (13).

(1) Involve an irrevocable loss or destruction of any natural or cultural resources.

As detailed in *Chapter 3.0* of the EA, an Archaeological LRFI and CIA were conducted for the planned project. The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. The field inspection identified seven historic crossings, as well as structural remnants likely associated with irrigation infrastructure from the plantation era. Coordination with the SHPD on the planned project and future related surveys and studies, historic documentation, and mitigation to complete the HRS 6E review process will be completed as the project moves forward. Appropriate documentation and SHPD approval will be completed prior to construction of the project.

If any cultural, historic, or archaeological resources are unearthed or ancestral remains are inadvertently discovered during the course of construction, SHPD, the OIBC representative, and participating interests from lineal descendants and individuals will be notified. The treatment of these resources will be conducted in strict compliance with the applicable historic preservation and burial laws.

(2) Curtail the range of beneficial uses of the environment.

Existing uses conform to existing zoning and land use designations. The project will increase beneficial uses of the project site by better serving motorists. Project site enhancements will be compatible with the surrounding area.

(3) Conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The planned project does not conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

(4) Substantially affects the economic or social welfare of the community or State.

Short-term economic benefits anticipated during construction will include direct, indirect, and induced employment opportunities and multiplier effects but not at a level that will generate significant economic expansion. Long-term economic benefits anticipated during future operations include improved traffic flow, coordinated emergency response to traffic incidents, and increased travel safety.

(5) Substantially affects public health.

The project is consistent with existing land uses and is not expected to affect public health, except in beneficial ways mentioned in item (4) above. However, there will be temporary short-term impacts to air quality emanating from possible dust emissions and temporary degradation of the acoustic environment in the immediate vicinity resulting from construction equipment. Construction-related impacts of noise, dust, and emissions will be mitigated by compliance with the State Department of Health Administrative Rules. Anticipated duration of construction is 24 plus months.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities.

Secondary impacts such as population changes are not anticipated. The overall impact of the project will be a beneficial effect on public transportation facilities to accommodate projected growth.

(7) Involves a substantial degradation of environmental quality.

The planned project will not involve a substantial degradation of environmental quality. To the contrary, improvements to the project area improve an existing roadway that will better serve the transportation needs of the surrounding area.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

The project will not have a considerable effect upon the environment. The roadway improvements will help to alleviate existing and future traffic congestion and will support planned development of the surrounding area. The project will not cause a commitment of other actions. Other roadway projects in the area will be closely coordinated to minimize the potential for cumulative impacts.

(9) **Substantially affects a rare, threatened or endangered species, or its habitat.**

A natural resource survey of the area was conducted for the project. No significant adverse impacts to rare, threatened or endangered species or habitat area are expected to occur as a result of the project.

(10) **Detrimentally affects air or water quality or ambient noise levels.**

General temporary impacts associated with construction have been identified in this EA. Mitigation measures will be applied during the on-going construction activity. No detrimental long-term impacts to air, water, or acoustic quality are anticipated to occur with the development of the Farrington Highway Improvements project.

(11) **Affects or is likely to suffer damage by being located in an environmentally sensitive area such as flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.**

The project is not located in an environmentally sensitive area. No impact is anticipated.

(12) **Substantially affects scenic vistas and view-planes identified in county or state plans or studies.**

The project will have a minimal effect on mauka-makai views within the corridor. No structures are proposed and therefore no view impacts are anticipated.

(13) **Require substantial energy consumption.**

The long-term operation of the roadway will not require substantial energy consumption. The project will reduce regional energy consumption as a result of improved traffic flow.

5.3 Summary

Based on the above findings, the project will not generate significant adverse socio-economic or environmental impacts. The EA recommends mitigation measures to alleviate potential impacts when such impacts are identified.

The project is consistent with the Hawai‘i State Land Use District Boundaries, the Hawai‘i State Plan and Functional Plans, the Hawai‘i CZM Plan, the City’s General Plan and DP, the City’s LUO, and SMA.

The purpose of this EA is to support improvements to Farrington Highway which will help to upgrade and expand an existing roadway in Kapolei. The project will improve traffic conditions in the surrounding area and is designed to help the City and State meet its current and future infrastructure needs. Overall, the project will provide a public benefit to motor vehicle travelers and will support planned developments in the ‘Ewa region.

Chapter 6

List of Preparers

Chapter 6

List of Preparers

Below is a list of individuals that contributed to the preparation and completion of this Environmental Assessment. The list includes the name of the individual and their role, or the name of the company and the subfield of professional expertise utilized to conduct and complete the EA.

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Technical Consultants/Support	*Area of Specialty*
Jacobs (CH2MHILL)	Traffic Impact Assessment & Transportation Planning
AECOS Inc.	Flora/Fauna Assessment
B.D. Neal	Air Quality Analysis
Y. Ebisu & Associates	Noise Assessment
Cultural Surveys Hawaii, Inc.	Archaeology, Historic and Cultural Resources

Chapter 7

List of References

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List of References

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Geographical Information Systems Data

All maps produced using GIS are based on source data available from the Federal Government, State of Hawaii and County of Hawaii resources. The data layers used to create the maps are applied "as is" and are not modified or edited for visual improvement.

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Chapter 8

List of Agencies, Organizations, and Individuals Receiving Copies of the EA

Chapter 8

List of Agencies, Organizations and Individuals Consulted

As part of the EA pre-consultation process, a meeting was held on July 2, 2013 to involve the community in the planning and development of the Farrington Highway project. The meeting was conducted with neighbors and interested members of the community to discuss potential planning issues associated with the project and to address public concerns. The ideas and insight gathered from the community during the pre-consultation process have been assessed and are addressed in the analysis contained in this document.

Agencies, organizations, and other parties contacted as part of the EA process are listed below. A copy of comment letters received on the EA are provided in *Appendix A*.

Distribution	HRS 343 Pre-Consultation	Pre-Consultation Comments Received	Received Draft EA	Draft EA Comments Received	Received Final EA
A. Federal Agencies or Affiliates					
U.S. DOT, Federal Highway Administration	X		X		
U.S. Army Corps of Engineers, Honolulu District	X		X		
U.S. DOA, Natural Resources and Conservation Service	X		X		
U.S. DOI, Fish and Wildlife, Pacific Islands Fish and Wildlife Office	X		X		
U.S Environmental Protection Agency, Pacific Islands Contact Office	X		X		
U.S. Army Garrison Hawaii, Directorate of Public Works	X		X		
U.S. Army Signal Corps	X		X		
Naval Facilities Engineering Command (NAVFAC)	X		X		
Federal Emergency Management Agency (FEMA)	X		X		

Distribution	HRS 343 Pre-Consultation	Pre-Consultation Comments Received	Received Draft EA	Draft EA Comments Received	Received Final EA
B. State Agencies					
Department of Accounting and General Services	X		X		
Department of Agriculture	X	X	X		
Department of Business, Economic Development & Tourism (DBEDT)	X		X		
DBEDT, Office of Planning	X		X		
Department of Defense	X		X		
Department of Education	X		X		
Department of Hawaiian Home Lands	X		X		
Department of Health (DOH)	X		X		
DOH, Hazard Evaluation and Emergency Response Office	X		X		
Hawaii Community Development Authority	X		X		
Department of Human Services	X		X		
Department of Labor and Industrial Relations	X		X		
Department of Land and Natural Resources (DLNR)	X		X		
DLNR, State Historic Preservation Division	X		X		
O‘ahu Island Burial Council	X		X		
Department of Transportation (DOT) Highways Division	X		X		
DOT Harbors Division	X		X		
Office of Environmental Quality Control	X		X		
Office of Hawaiian Affairs	X		X		
University of Hawai‘i, Water Resources Research Center	X		X		
University of Hawai‘i, Facilities Planning and Management Office	X		X		
University of Hawai‘i, West O‘ahu	X		X		

Distribution	HRS 343 Pre-Consultation	Pre-Consultation Comments Received	Received Draft EA	Draft EA Comments Received	Received Final EA
C. City and County of Honolulu					
Board of Water Supply	X	X	X		
Department of Design and Construction	X	X	X		
Department of Environmental Services	X	X	X		
Department of Facility Maintenance	X	X	X		
Department of Planning and Permitting	X	X	X		
Department of Parks and Recreation	X	X			
Department of Transportation Services	X	X	X		
Honolulu Authority for Rapid Transit (HART)	X	X	X		
Honolulu Emergency Services Department	X	X	X		
Department of Emergency Management (DEM)	X		X		
Honolulu Fire Department	X	X	X		
Honolulu Police Department	X	X	X		
Oahu Metropolitan Planning Organization (OMPO)	X		X		
Makakilo/Kapolei/Honokai Hale Neighborhood Bd. No. 34	X		X		
‘Ewa Neighborhood Bd. No. 23	X		X		
Waipahu Neighborhood Bd. No. 22	X		X		
D. Elected Officials					
U.S. Senator Mazie Hirono	X		X		
U.S. Senator Brian Schatz	X		X		
U.S. Representative Tulsi Gabbard	X		X		
U.S. Representative Ed Case	X		X		
State Senator Mike Gabbard (District 20)	X		X		
State House Representative Sharon E. Har (District 42)	X		X		

Distribution	HRS 343 Pre-Consultation	Pre-Consultation Comments Received	Received Draft EA	Draft EA Comments Received	Received Final EA
Councilmember Kymberly Marcos Pine (District 1)	X		X		
E. Libraries					
Hawai‘i State Library			X		
Waipahu Public Library			X		
Kapolei Public Library			X		
F. Utilities					
Hawaiian Electric Company	X	X	X		
Hawaii Gas	X		X		
Hawaiian Telcom	X		X		
Spectrum	X	X	X		
AT&T Government Solutions-Hawaii	X		X		
Par Hawaii	X		X		
G. Organizations, Individuals and Businesses					
‘Ahahui Siwila Hawaii o Kapolei	X		X		
Kapolei Property Development, LLC	X		X		
The Queen’s Medical Center West O‘ahu	X		X		
D.R. Horton	X		X		
Grace Pacific Corporation	X		X		
James Campbell Company, LLC	X		X		
Aloun Farms	X		X		
Bayer Hawaii	X		X		
Kahi Mohala	X		X		
Kapolei Knolls Homeowners Association	X		X		
Villages of Kapolei Association	X		X		
American Lung Association of Hawaii	X		X		
Hawaii Audobon Society	X		X		
Hawaiian Historical Society	X		X		

Distribution	HRS 343 Pre-Consultation	Pre-Consultation Comments Received	Received Draft EA	Draft EA Comments Received	Received Final EA
Native Hawaiian Legal Corporation	X		X		
The Outdoor Circle	X		X		
Sierra Club, Hawaii Chapter	X		X		
Gentry Hawaii, Ltd.	X		X		
Haseko Hawaii, Inc.	X		X		
Kapolei Community Development Corporation	X		X		
Hawaii Bicycle League		X	X		
Keith Timson		X	X		
Frank Genadio		X	X		

Appendices

Appendix A

EA Comments and Responses

From: Earl.J.Yamamoto@hawaii.gov
To: Rachel Shaak
Cc: Noa.K.Ching@hawaii.gov
Subject: Re: Farrington Highway Improvements: HRS 343 EA Pre-consultation
Date: Thursday, August 22, 2013 11:25:40 AM

Hello, Rachel:
I believe the lands abutting Farrrington Hwy are in the Urban District, Ewa DP'd for non-ag uses, and is yet to be rezoned.
One key issue to be addressed in the EA is that there will be ongoing agricultural use of the lands adjacent to Farrington Hwy.
Farrington Hwy crosses the 1,500-acre Hoopili project site.
The developer (DR Horton/Schuler) is required by a condition of the Land Use Commission (Findings of Fact, Conclusions of Law, and Decision and Order, dated 6/2/1/12; Condition 1, page 168) to have the development phasing of the property accommodate farming activities until such time each phase is needed.
This suggests that farming activities may occur on both sides of Farrington hwy as the proposed improvements to the hwy are constructed.
Farm vehicles will likely continue to transit across the hwy and there will be traffic in and around an agricultural crop processing/packing/storage/distribution facility located on the mauka side of the hwy.

Earl Yamamoto
Planner
Dept. of Agriculture
(808) 973-9466
email: earl.j.yamamoto@hawaii.gov

From: Rachel Shaak <rshaak@group70int.com>
To: "'earl.j.yamamoto@hawaii.gov'" <earl.j.yamamoto@hawaii.gov>,
Cc: "Ryan M. Char" <rchar@group70int.com>, Jeff Overton <jho@group70int.com>
Date: 08/22/2013 09:00 AM
Subject: Farrington Highway Improvements: HRS 343 EA Pre-consultation

---

Earl,
Thank you for your message this morning and your email address. I've attached a project description and location map for your use. On behalf of DDC, HDOT and FHWA, we are conducting HRS 343 pre-consultation for an Environmental Assessment (EA) for the Farrington Highway Improvements project. We are looking for DOA's input on issues that should be addressed in the EA. From what you mentioned in your voicemail, the location has appropriate urban land use designations. If DOA has any other concerns, please email me or call me directly at 441-2160. Thank you for your assistance.
Mahalo!
Rachel

Group 70 International
Architecture | Civil Engineering | Interior Design | Planning & Environment | Technology
Rachel Shaak, AICP, LEED AP

Senior Planner

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808.523.5866
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rshaak@group70int.com

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[attachment "Farrington_Preconsultation_handout_080713_FHWA-SDOT.pdf" deleted by Earl J Yamamoto/DOA/StateHiUS]

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www.g70.design

June 16, 2020

Earl J. Yamamoto, Planner
Department of Agriculture
State of Hawai'i
Via email: earl.j.yamamoto@hawaii.gov

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Mr. Yamamoto:

Thank you for your comment letter dated August 22, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

We understand that there will be ongoing agricultural use of the lands adjacent to Farrington Highway. Farm vehicles currently transit Farrington Highway in the vicinity of the crop processing and distribution facility mauka of the highway. Farming activities are anticipated to continue through project construction. The project improvements are not expected to result in significant adverse impacts to existing crop production; however, minor impacts to farming operations may occur if the crossing of Farrington Highway is temporarily obstructed during construction. To mitigate potential related impacts, a Construction Staging and Phasing Plan will be prepared to allow for continuous crossing of farm vehicles during project construction.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

KIRK CALDWELL, MAYOR

DUANE R. MIYASHIRO, Chairman
MAHEALANI CYPHER, Vice Chair
THERESIA C. McMURDO
ADAM C. WONG
KAULANA H. R. PARK

ROSS S. SASAMURA, Ex-Officio
GLENN M. OKIMOTO, Ex-Officio

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

ELLEN E. KITAMURA, P.E.
Deputy Manager and Chief Engineer

August 6, 2013

RECEIVED

AUG 14 2013

GROUP 70 INTL

Mr. Jeffrey H. Overton, AICP, LEED AP
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Your Letter Dated June 14, 2013, Environmental Assessment Pre-Consultation for the Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road, Kapolei, Oahu

Thank you for the opportunity to comment on the proposed road widening project and for meeting with our staff on the pre-assessment of roadway routing alternatives. We have the following comments:

1. The Board of Water Supply (BWS) owns and maintains major potable water transmission infrastructure along Farrington Highway that provides regional transport of Waipahu and Kunia water to Ewa, Kapolei and Waianae. Continuous water service must be maintained throughout the widening project.

2. We recommend widening on the mauka side of the roadway to avoid impacting our water facilities. However, should widening on the makai side of the roadway be required, our Honouliuli and Kapolei Line Booster Stations will be in direct conflict. The developer will then be required to relocate the line booster stations along with connecting pipelines, valves, power, telemetry, and appurtenances at their cost. Additional land must also be acquired and dedicated to BWS to accommodate the relocated facilities.

3. The environmental assessment (EA) should disclose the widening alternatives, estimated costs, detailed evaluation criteria and analyses for selecting the preferred routing alternative.

4. We are analyzing the existing water system and operations to determine the optimum configuration to maximize adequacy, reliability and efficiency. The design engineers should work closely with the BWS during the design of the roadway improvements.

5. The roadway design is required to incorporate all planned potable and nonpotable water pipelines and crossings of Farrington Highway including the BWS East Kapolei 215' Nonpotable Reservoir connection mauka of the UH West Oahu Campus in accordance with the approved Ewa Nonpotable Water Master Plan, dated January 2007, and for the Hoopili development that are planned to be dedicated to BWS.

6. The roadway design will be required to adhere to BWS Water System Standards, in particular the minimum and maximum allowable pipeline depths of 3 feet and 8 feet, respectively.

7. Nonpotable water is required for the irrigation of the proposed roadway landscape areas. If nonpotable water is unavailable during design, potable water can be used in the interim; however, provisions for the transfer from potable to nonpotable water connections should be incorporated into the roadway design. When water is made available, the applicant will be required to pay our Water Systems Facilities Charge for resource development, transmission and daily storage.

8. The construction drawings should be submitted for our review and approval. The construction schedule should be phased and coordinated to minimize impact to the water system.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Ernest Y.W. Lau, P.E.
Manager and Chief Engineer
Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, Hawai'i 96843

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Mr. Lau:

Thank you for your comment letter dated August 6, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

1. We understand that the Board of Water Supply (BWS) owns and maintains major potable water transmission infrastructure along Farrington Highway that provides regional transport of water to 'Ewa, Kapolei, and Wai'anae. The project improvements are being coordinated with BWS to evaluate ways to minimize impacts to water service throughout the construction of the highway.

2. We acknowledge your recommendation for the project improvements. The design of the expanded roadway will minimize impacts to the existing BWS system to the extent possible. We will continue to work with BWS as the project design progresses.

3. A high level of project design alternatives which meet the requirements of Chapter 343, HRS, will be included in the Draft EA. A copy of the Draft EA will be provided to BWS for review of the project.

4. The project improvements and design team will coordinate with BWS during the design phase of the roadway improvements to support BWS existing water system that maximizes adequacy, reliability, and efficiency.

5. We understand that the roadway design will be required to incorporate all planned potable and non-potable water pipelines and crossings of Farrington Highway, in accordance with the 'Ewa Nonpotable Water Master Plan (January 2007) and for the Ho'opili Development that are planned to be dedicated to BWS.

6. We understand that the roadway design will be required to adhere to BWS Water System Standards, in particular the minimum and maximum allowable pipeline depths.

7. We understand the provisions relating to the use of nonpotable/potable water for irrigation of the roadway landscaped areas. When water is made available, Water System Facilities Charges will be paid for by the applicant for resource development, transmission and daily storage.

8. Construction drawings for the Farrington Highway Improvements project will be submitted to BWS for review and approval. A construction phasing plan will also be prepared and coordinated to minimize impact to the water system.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

CHRIS T. TAKASHIGE, P.E., CCM
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

July 2, 2013

RECEIVED
JUL - 5 2013
GROUP 70 INTL

Group 70 International
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Attn: Jeffrey H. Overton, AICP, LEED AP

Dear Mr. Overton:

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, Oahu, Hawaii)

The Department of Design and Construction does not have any comments to offer on the pre-consultation process.

Thank you for the opportunity to review and comment. Should there be any questions, please contact me at 768-8480.

Sincerely,

for M. Yonamine

Chris T. Takashige, P.E., CCM
Director

CTT: cf (518767)

111 S. King Street
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Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Mark Yonamine, Director
Department of Design and Construction
City & County of Honolulu
650 South King Street, 11th Floor
Honolulu, Hawai'i 96843

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Mr. Yonamine:

Thank you for your comment letter dated July 2, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We understand that the Department of Design and Construction has no comments at this time.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3466 • FAX: (808) 768-3487 • WEBSITE: http://envhonolulu.org

KIRK CALDWELL
MAYOR

LORI M.K. KAHIKINA, P.E.
DIRECTOR

TIMOTHY A. HOUGHTON
DEPUTY DIRECTOR

ROSS S. TANIMOTO, P.E.
DEPUTY DIRECTOR

IN REPLY REFER TO
PRO 13-058

RECEIVED
AUG - 7 2013
GROUP 70 INTL

August 1, 2013

Mr. Jeffrey H. Overton
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, HI 96813-4307

Dear Mr. Overton:

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, O'ahu, Hawai'i)

We have reviewed the subject pre-consultation EA as transmitted to us by your letter dated June 14, 2013, and we have the following comments:

1. The EA/EIS should address the minimizing erosion and sediment during construction; the Department of Planning and Permitting Revised Rules Relating to Drainages Standards that address low impact development (LID); and Total Maximum Daily Load (TMDL) wasteload allocations (WLAs) for discharges to state waters.

Should you have any questions, please call Liz Lau, Civil Engineer, at 768-3470.

Sincerely,

Lori M.K. Kahikina, P.E.
Director

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
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June 16, 2020

Lori M.K. Kahikina, P.E.
Director
Department of Environmental Services
City & County of Honolulu
1000 Uluohia Street, Suite 308
Kapolei, Hawai'i 96707

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Ms. Kahikina:

Thank you for your comment letter dated August 1, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

The project design will comply with the all applicable State and County rules and regulations relating to water quality. The EA will include a discussion on minimizing erosion and sediment during construction and will be designed to meet the City Department of Planning and Permitting Revised Rules Relating to Drainage Standards that address low impact development (LID).

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Ulu`ohia Street, Suite 215, Kapolei, Hawaii 96707
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Website: www.honolulu.gov

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JUL 11 2013

GROUP 70 INTL

KIRK CALDWELL
MAYOR

ROSS S. SASAMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 13-625

July 8, 2013

Mr. Jeffrey H. Overton, Principal Planner
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Pre-Consultation of Chapter 343, HRS Environmental Assessment; Farrington Highway Widening between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, Oahu, Hawaii)

Thank you for the opportunity to review and comment on the subject "Farrington Highway Widening (Fort Weaver Road to Kapolei Golf Course Road) Pre-Consultation Package for Environmental Assessment" dated June 14, 2013.

These are our comments at this time:

- Which government agency will have maintenance responsibility for the Farrington Highway Road's right-of-way when completed? If the City Department of Facility Maintenance (DFM) is determined to be responsible for maintenance of road right-of-way, DFM would like or request the following:
    - All Landscape maintenance, including medians, be handled by Agency(s) with knowledge of plants and irrigation systems.
    - Recommend that the maintenance of all sidewalk frontages, along both sides of the subject Farrington Highway be solely governed under the City's Sidewalk Ordinance, Section 20-4.1 "Cleaning of Sidewalks".

If you have any questions, please call Kyle Oyasato of the Division of Road Maintenance, at 768-3697.

Sincerely,

Ross S. Sasamura, P.E.
Director and Chief Engineer

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Ross S. Sasamura, P.E.
Director and Chief Engineer
Department of Facility Maintenance
City & County of Honolulu
1000 Ulu‘ohia Street, Suite 215
Kapolei, Hawai‘i 96707

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O‘ahu, Hawai‘i)

Dear Mr. Sasamura:

Thank you for your comment letter dated July 8, 2013 concerning the Pre-Consultation for Chapter 343, Hawai‘i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

The Department of Facility Maintenance (DFM) will have the maintenance responsibility for the Farrington Highway Road’s right-of-way. As appropriate, landscape maintenance will be handled by the appropriate agency(s) who have knowledge of plants and irrigation systems. In addition, all sidewalk frontages will meet the City’s Sidewalk Ordinance, Section 20-4.1 “Cleaning of Sidewalks”.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
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KIRK CALDWELL
MAYOR

GEORGE I. ATTA, FAICP
DIRECTOR

ARTHUR D. CHALLACOMBE
DEPUTY DIRECTOR

2013/ELOG-1198 (mh)

July 22, 2013

RECEIVED

JUL 25 2013

GROUP 70 INTL

Mr. Jeff Overton
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

This is in response to your letter of June 14, 2013, regarding a pre-consultation for Chapter 343, HRS Environmental Assessment (EA) for Farrington Highway Widening between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, Oahu, Hawaii). We offer the following comments:

1. The EA should discuss the consistency of the proposed project with Section 2.1 Vision Statement and Section 4.1 Transportation Systems of the updated Ewa Development Plan (Bill 65 (2012), CD1), which passed Third Reading by the City Council on July 10, 2013.

2. The EA should consider the proposal's relationship and impact on and from adjacent sites and the planned rail system and stations. Two pertinent City planning documents that should be reviewed and evaluated include:

   a. East Kapolei Neighborhood Transit-Oriented Development (TOD) Plan – Draft (April 2010). The Draft is available for viewing at www.todhonolulu.org.

   b. University of Hawaii West Oahu (UHWO) Non-Campus Lands Urban Design Plan (November 2011). A compact disc is enclosed for your information and use.

3. The EA should discuss the Ewa Public Infrastructure Map (PIM). It shows PIM Symbols for the Farrington Highway Improvement (North-South Road to Fort Weaver Road) and Farrington Highway Widening Project. A PIM revision is not required for the subject project.

4. Please submit construction plans for review and comment.

Should you have any questions, please call Matt Higashida at 768-8045.

Very truly yours,

for George I. Atta, FAICP
Director

GIA:js

Enclosure

Pre-ConsultFarringtonHwy

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Kathy K. Sokugawa, Acting Director
Department Planning and Permitting
City & County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawai'i 96813

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Ms. Sokugawa:

Thank you for your comment letter dated July 22, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

1. Section 4.7 of the EA provides an evaluation of the project's consistency with the 'Ewa Development Plan, including Section 2.1 Vision Statement and Section 4.1 Transportation Systems.

2. The project has considered the project's relationship and impact on and from adjacent sites and the planned rail system and stations.

    a. Section 4.15 of the EA provides a discussion of the project's consistency with the East Kapolei Neighborhood Transit-Oriented Development (TOD) Plan (Public Review Draft #2).
    b. Section 4.16 of the EA provides a discussion of the project's relationship and impact on and from the University of Hawaii West Oahu (UHWO) Non-Campus Lands Urban Design Plan (November 2011).

3. As you have noted, the 'Ewa Public Infrastructure Map (PIM) shows symbols for the Farrington Highway Widening project. Section 4.8 of the EA provides a discussion of the project's consistency with the 'Ewa PIM.

4. Construction plans will be submitted to the Department of Planning and Permitting for review and comment at the appropriate time.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
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KIRK CALDWELL
MAYOR

TONI P. ROBINSON
DIRECTOR

JEANNE C. ISHIKAWA
DEPUTY DIRECTOR

July 10, 2013

RECEIVED

JUL 15 2013

GROUP 70 INTL

Mr. Jeffrey H. Overton, AICP, LEED AP
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, Oahu, Hawaii)

Thank you for the opportunity to review and comment at the Pre-Consultation stage of the proposed Farrington Highway Widening between Fort Weaver Road and Kapolei Golf Course Road.

The Department of Parks and Recreation has no comment. As the proposed project will have no impact on any program or facility of the Department, you may remove us as a consulted party to the balance of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner at 768-3017.

Sincerely,

Toni P. Robinson

Toni P. Robinson
Director

TPR:jr
(518874)

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808.523.5866
www.g70.design

June 16, 2020

Michele K. Nekota, Director
Department of Parks and Recreation
City & County of Honolulu
1000 Uluohia Street, Suite 309
Kapolei, Hawai‘i 96707

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O‘ahu, Hawai‘i)

Dear Ms. Nekota:

Thank you for your comment letter dated July 10, 2013 concerning the Pre-Consultation for Chapter 343, Hawai‘i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We understand that the Department of Parks and Recreation has no comment, as the project will have no impacts on the Department’s programs or facilities. Per your request, you will be removed as a consulted party.

Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.honolulu.gov

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP6/13-519045R

July 15, 2013

RECEIVED
JUL 18 2013
GROUP 70 INTL

Mr. Jeff Overton
Project Manager
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: Pre-Consultation for Draft Environmental Assessment (DEA) Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road; Kapolei, Oahu, Hawaii

In response to your letter dated June 14, 2013, we have the following comments:

- The DEA should include a traffic impact assessment report (TIAR). The TIAR should discuss traffic impacts on the surrounding City roadways as a result of the project, including short-term impacts during construction, short and long term proposed mitigating measures, and complete streets concepts.

- The area Neighborhood Board, as well as the area residents, businesses, etc., should be kept apprised of the details of the proposed project and the impacts, particularly during construction, the project may have on the adjoining local street area network.

- A street usage permit from the City's Department of Transportation Services (DTS) should be obtained for construction-related work that may impact City streets.

- The DEA should include a description of Public Transit and the impact of your project on Public Transit bus and paratransit operations during construction. Several City bus transit routes use that section of Farrington Highway and several bus stops are located along it. Basic information is available on our websites: www.thebus.org and www.honolulu.gov/dts. Because your project may affect bus routes and services, you should contact our staff at 768-8370 to coordinate your planned activities.

- Construction notes should include the following note regarding transit services:

  "This project may affect bus routes, bus stops, and paratransit operations, therefore, the Contractor shall notify the Department of Transportation Services, Public Transit Division at 768-8396 and Oahu Transit Services, Inc. (bus operations: 848-4578 or 852-6016 and paratransit operations: 454-5041 or 454-5020) of the scope of work, location, proposed closure of any street, traffic lane, sidewalk, or bus stop and duration of project at least two weeks prior to construction."

We reserve further comment pending submission of the DEA.

Thank you for the opportunity to review this matter. Should you have any further questions, please contact Michael Murphy of my staff at 768-8359.

Very truly yours,

Michael D. Formby
Director

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Wes Frysztacki, Director
Department of Transportation Services
City & County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawai'i 96813

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Mr. Frysztacki:

Thank you for your comment letter dated July 15, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

1. The Draft EA will include a Traffic Impact Assessment Report (TIAR) that will discuss traffic impacts on the surrounding City roadways that occur as a result of the project, including short-term construction related impacts and long-term operations, mitigation measures and the complete streets concepts.

2. The project improvements have been shared as part of a public informational meeting that was held for the project. Presentations to the appropriate neighborhood boards will continue to be made as the project progresses. The EA will also be made available as a public review document accessible to area residents and businesses.

3. At the appropriate time, a street usage permit from the City's Department of Transportation Services (DTS) will be obtained for construction-related work that may impact City streets.

4. The Draft EA will include a description of Public Transit and potential related impacts on Public Transit bus and paratransit operations during construction. Coordination with the Department of Transportation Services will continue to be conducted as the project design progresses.

5. Construction notes will include the specified details provided in your letter relating to transit services.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

HART
HONOLULU AUTHORITY for RAPID TRANSPORTATION

IN REPLY REFER TO:
CMS-AP00ENV-00266

Daniel A. Grabauskas
EXECUTIVE DIRECTOR AND CEO

BOARD OF DIRECTORS

Carrie K.S. Okinaga, Esq.
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Glenn M. Okimoto, Ph.D.

July 8, 2013

RECEIVED
JUL 15 2013
GROUP 70 INTL

Jeffrey H. Overton, AICP, LEED AP
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton,

Subject: PRE-CONSULTATION FOR CHAPTER 343, HRS
ENVIRONMENTAL ASSESSMENT
FARRINGTON HIGHWAY WIDENING, KUNIA-FORT
WEAVER ROAD TO KAPOLEI GC ROAD

This is in response to your June 14, 2013 letter request for Honolulu Authority for Rapid Transportation's (HART) review of and comments on the Farrington Highway widening project in Ewa; the segment between Kunia-Fort Weaver Road and the Kapolei Golf Course Road.

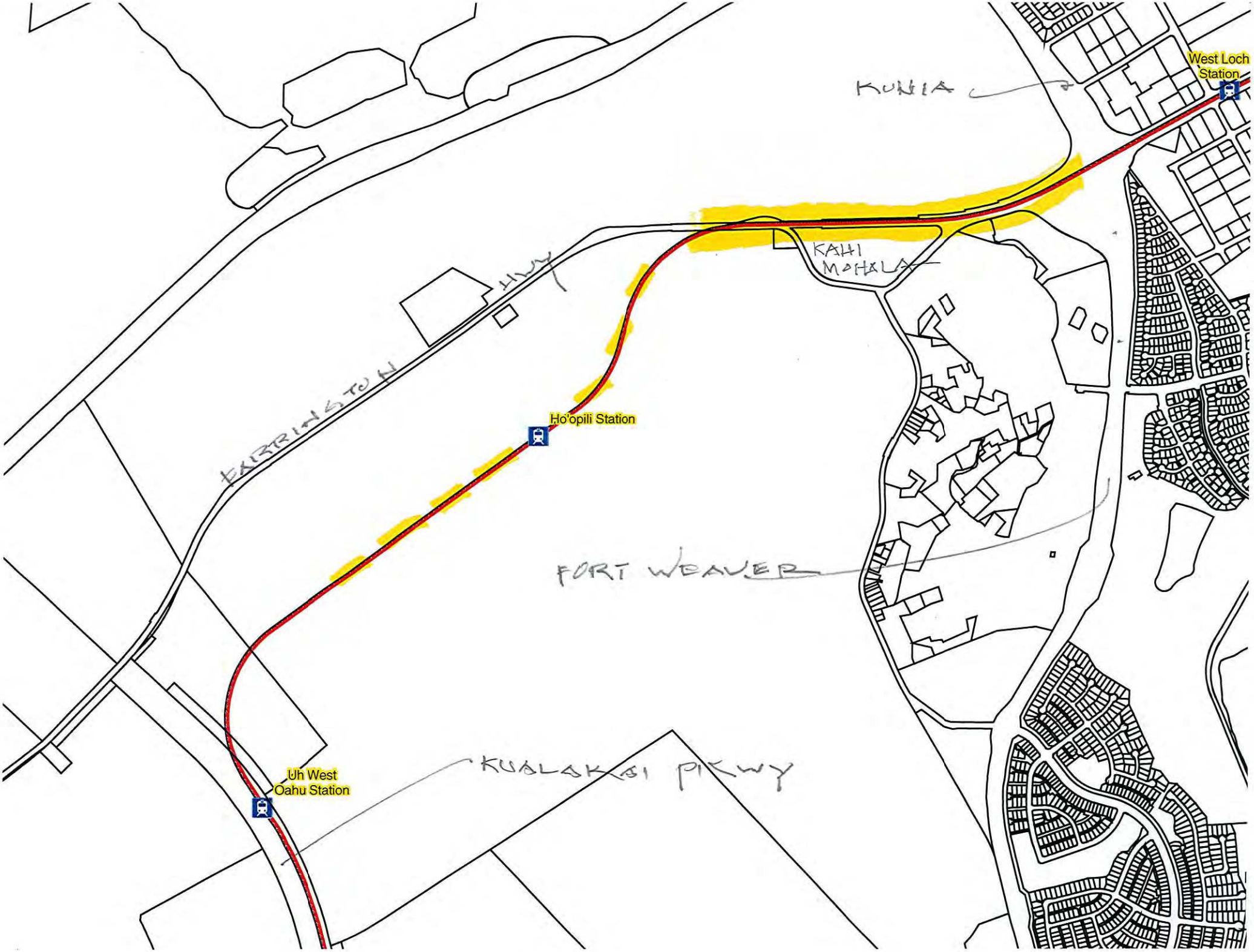
The Honolulu Rail Transit Project transitions from Kualakai Parkway and the Hoopili Development area (existing agricultural fields, Aloun Farms) to Farrington Highway in the vicinity of Kahi Mohala (see map). As the guideway is to be constructed in the planned highway median, HART continues to coordinate the design work with the Department of Design and Construction.

For purpose of the highway project environmental assessment, should you need any information, please contact Bruce Nagao of our planning staff at 768-8351.

Sincerely,

for Daniel A. Grabauskas
Executive Director and CEO

Attachment


West Loch Station
KUNIA
KAHI MOHALA
HWY
FARRINGTON
Ho'opili Station
FORT WEAVER
KUALAKAI PKWY
Uh West Oahu Station

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Andrew Robbins, Executive Director & CEO
Honolulu Authority for Rapid Transportation
City & County of Honolulu
1099 Alakea Street, 17th Floor
Honolulu, Hawaii, 96813

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, Oʻahu, Hawaiʻi)

Dear Mr. Robbins:

Thank you for your comment letter dated July 8, 2013 concerning the Pre-Consultation for Chapter 343, Hawaiʻi Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We appreciate you providing the Honolulu Rail Transit project station route map for this area near Farrington Highway. We understand that the guideway will be constructed in the planned highway median. We will continue to coordinate with the Honolulu Authority for Rapid Transportation (HART) as the project progresses.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

HONOLULU EMERGENCY SERVICES DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET, SUITE H-450 • HONOLULU, HAWAII 96819-1869
Phone: (808) 723-7800 • Fax: (808) 833-3934

KIRK CALDWELL
MAYOR

MARK K. RIGG
DIRECTOR

IAN T.T. SANTEE
DEPUTY DIRECTOR

June 19, 2013

SENT VIA EMAIL

Mr. Jeffrey H. Overton
farhwy@group70int.com

Dear Mr. Overton:

Thank you for your letter dated June 14, 2013, regarding the Farrington Highway Widening.

The Honolulu Emergency Services Department supports the proposed widening of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Rd. With the expanding growth in this area, the communities have been equally increasing the requests for the Department's service. Emergency responders utilize this section of Farrington Highway to rapidly move through the areas of Waipahu and Kapolei.

The proposed changes to Farrington Highway will provide the opportunity for improved safety for emergency responders and the public, and also improve the capabilities for emergency responders to travel through densely populated communities in this area of West Oahu.

Please contact Wayne Kruse, Assistant Chief of EMS, at 723-7809.

Sincerely,

Mark K. Rigg
Director

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

James D. Howe, Jr., Director
Honolulu Emergency Services Department
City & County of Honolulu
3375 Koapaka Street, Suite H-450
Honolulu, Hawai'i 96819-1869

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, O'ahu, Hawai'i)

Dear Mr. Howe:

Thank you for your comment letter dated June 19, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road.

We understand the Emergency Services Department supports the proposed project improvements as it will better help to services the needs of the area. As you have noted, the expanded roadway will provide additional transportation capacity and improve capabilities for emergency responders to travel through densely populated communities in the 'Ewa region.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

KIRK CALDWELL
MAYOR

MANUEL P. NEVES
FIRE CHIEF

LIONEL CAMARA JR.
DEPUTY FIRE CHIEF

RECEIVED

JUL 11 2013

GROUP 70 INTL

July 9, 2013

Mr. Jeffrey Overton, AICP, LEED AP
Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Preconsultation for Environmental Assessment
Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road
Kapolei, Oahu, Hawaii

In response to your letter of June 14, 2013, regarding the above-mentioned subject, the Honolulu Fire Department determined that there will be no significant impact to our fire services.

Should you have questions, please contact Acting Battalion Chief Gary Lum of our Fire Prevention Bureau at 723-7152 or glum@honolulu,gov.

Sincerely,

MANUEL P. NEVES
Fire Chief

MPN/SY:bh

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Manuel P. Neves, Fire Chief
Honolulu Fire Department
City & County of Honolulu
636 South Street
Honolulu, Hawai'i 96813-5007

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Chief Neves:

Thank you for your comment letter dated July 9, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We understand that the Honolulu Fire Department has no comment, as the project will have no impact on the Department's services.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

KIRK W. CALDWELL
MAYOR

LOUIS M. KEALOHA
CHIEF

DAVE M. KAJIHIRO
MARIE A. McCAULEY
DEPUTY CHIEFS

OUR REFERENCE WK-WS

July 1, 2013

RECEIVED

JUL - 5 2013

GROUP 70 INTL

Mr. Jeffrey H. Overton, AICP, LEED AP
Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

This is in response to your letter dated June 14, 2013, requesting comments on the Pre-Consultation, Environmental Assessment, for the Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road project in Kapolei.

The Honolulu Police Department has no concerns at this time.

If there are any questions, please call Major Kerry Inouye of our District 8 (Kapolei) at 723-8403.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By Clayton G. Kau
CLAYTON G. KAU
Assistant Chief
Support Services Bureau

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Susan Ballard, Chief of Police
Police Department
City & County of Honolulu
801 South Beretania Street
Honolulu, Hawai'i 96813

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Chief Ballard:

Thank you for your comment letter dated July 1, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We understand that the Police Department has no comments on the project at this time.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

RECEIVED

JUL 23 2013

GROUP 70 INTL

July 19, 2013

Mr. Jeffrey Overton
Group 70 International, Inc.
925 Bethel St. 5th floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject **Pre-Consultation, Environmental Assessment**
Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company has no objections to the project. HECO has existing facilities on Farrington Highway within the project boundaries. Please include in the Environmental Assessment discussion on impacts to the existing electrical facilities.

We appreciate your efforts to keep us apprised of the proposed project in the planning process. As the Farrington Highway Widening project comes to fruition, please continue to keep us informed. Further along in the design, we will be better able to evaluate the effects on our system facilities.

If you have any questions, please call me at 543-7245.

Sincerely,

Rouen Q. W. Liu
Permits Engineer

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Rouen Q. W. Liu
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaiʻi 96840-0001

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, Oʻahu, Hawaiʻi)

Dear Mr. Liu:

Thank you for your comment letter dated July 19, 2013 concerning the Pre-Consultation for Chapter 343, Hawaiʻi Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project.

We understand that Hawaiian Electric Company, Inc. has no comments at this time. We will continue to coordinate with you and keep you informed as the project progresses.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

Transmittal

OCEANIC TIME WARNER CABLE
200 Akamainui Street ◆ Mililani HI 96789
(808) 625 - 2100

Date: *July 10th, 2013*

Review & Comment

To: *Group 70 International*
925 Bethel St., Fifth Floor
Honolulu, HI 96813-4307
(808) 523-5866

Attention: *Mr. Jeff Overton*

Pre-Consultation for CH. 343, HRS Environmental Assessment
Farrington Hwy Widening
Fort Weaver to Kapolei Golf Course
OTWC Project# R05803

GENTLEMEN: We are sending you the following:

- ☐ Pole / Conduit Application
- ☐ Permit Applications
- ☒ Copy of Letter
- ☐ Preliminary / Final Drawings
- ☐ Return Prints
- ☒ Other Review/Comment

Copies	Sht / Appl. #	Description
1	1	Letter of Review/Comment
1	3	Copy Original Pre-Consultation Letterhead
1	5	CATV Facility Reference Print

The Above is transmitted:

- ☐ For Your Approval
- ☐ For Review and Comment
- ☒ For Your Use / Records
- ☒ As Requested
- ☐ As Approved
- ☐ Other _____

Comments / Remarks: **As requested, here is the review for the above mentioned project.**

If you have any questions or concerns, please let me know:
kerick.fujimura@twcable.com or 625-9734 / 222-1019 Thank you.

CC: **Lori Iha**

Signed: **Kerick Fujimura**
Title: **OSP Engineer**

200 Akamainui Street
Mililani, Hawaii 96789-3999
Tel 808-625-2100
Fax 808-625-5888

OCEANIC TIME WARNER CABLE

July 10th, 2013

Group 70 International
925 Bethel Street, Fifth Floor
Honolulu, Hi 96813-4307
(808) 523-5866 Ext. 104

Attn: Mr. Jeff Overton

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening, Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, Oahu, Hawaii)

Dear Mr. Overton,

Thank you for including Oceanic Time Warner Cable (OTWC) in the initial stages of the Farrington Highway Widening Project. OTWC would like to participate in the planning of this project to determine the extent of any relocation to the existing aerial and underground facilities. OTWC is also requesting to be included in any coordination/planning meetings with the other utilities.

OTWC currently maintains coax and fiber facilities both aerial and underground within the project area; however, services provided for residential, commercial, DOE, State and County entities and the Island of Kauai extend beyond the projects boundaries. The affected areas in the immediate vicinity of the project are on the included prints.

The included prints and associated information are to be used for reference only. Should you have any questions or concerns, please feel free to contact me at 625-9734 or 222-1019, or email me at kerick.fujimura@twcable.com.

Sincerely,

Kerick Fujimura
OSP Engineer

GROUP 70
INTERNATIONAL

June 14, 2013

Dear Participant:

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Widening Between Fort Weaver Road and Kapolei
Golf Course Road (Kapolei, O'ahu, Hawai'i)

The City and County of Honolulu, Department of Design and Construction, the State of Hawai'i Department of Transportation, and the Federal Highway Administration, as co-lead agencies, are currently undertaking the preparation of an Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA) and Chapter 343, Hawai'i Revised Statutes (HRS), for the proposed Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road Project located in Kapolei, O'ahu, Hawai'i.

A pre-consultation process is being conducted to engage agencies and interested parties in the environmental review process. Enclosed, for your review and comment, is a project information summary and overview of the proposed action.

Please provide comments via telephone, email, fax, or U.S. Mail regarding the scope of this EA. We would like to receive these comments no later than 30 days from receipt of this letter or July 16, 2013. Comments received subsequent to this deadline will still be considered.

Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, HI 96813-4307
Attn: Jeff Overton
Email: farhwy@group70int.com
Tel: (808) 523-5866 Ext. 104
Fax: (808) 523-5874

Thank you for participating in pre-consultation for this environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

Enclosed: Pre-Consultation Handout

PRINCIPALS

Francis S. Oda, Arch.D., FAIA, AICP, LEED AP
Norman G.Y. Hong AIA
Sheryl B. Seaman AIA, ASID, LEED AP
Hitoshi Hida AIA
Roy H. Nihei AIA, CSI, LEED AP
James I. Nishimoto AIA
Stephen Yuen AIA
Linda C. Miki AIA
Charles Y. Kaneshiro AIA, LEED AP
Jeffrey H. Overton AICP, LEED AP
Christine Mendes Ruotola AICP, LEED AP
James L. Stone, Arch.D., AIA, LEED AP
Katherine M. MacNeil AIA, LEED AP
Tom Young, MBA AIA
Paul T. Matsuda PE, LEED AP

OF COUNSEL

Ralph E. Portmore FAICP

PROJECT INFORMATION SUMMARY

Project Name:	Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road
Co-Lead Agencies:	City and County of Honolulu Department of Design and Construction (DDC) Civil Division State of Hawaii Department of Transportation Highways Division Federal Highway Administration (FHWA)
Project Location:	Farrington Highway (Route 93), between Fort Weaver Road and Kapolei Golf Course Road, Kapolei, O'ahu, Hawai'i
Project Area:	3.1 mile roadway alignment
State Land Use District:	Agricultural and Urban
City & County of Honolulu Zoning:	AG-1
'Ewa Development Plan:	Low and Medium Density Residential, High Density Residential, Transit Node
Special Management Area (SMA):	Not in SMA
Flood Zone:	Zone D, X and A

Project Description

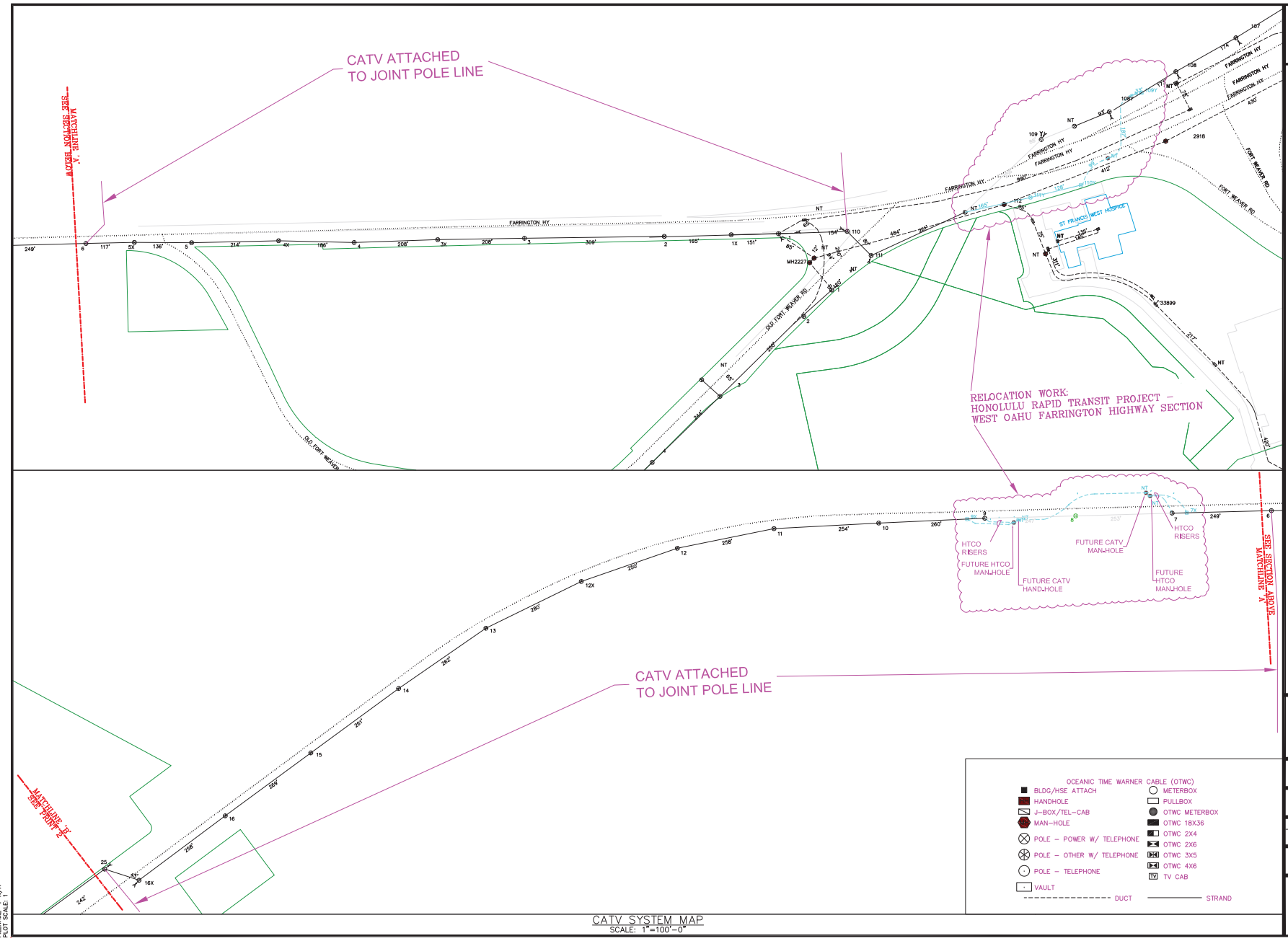
Farrington Highway Route 93 traverses leeward O'ahu connecting 'Ewa and the Wai'anae coast (Figure 1). It is a major east-west arterial route between Waipahu and Kapolei, frequently traveled as an alternative route to H-1. The State of Hawai'i (State) and the City and County of Honolulu (City) have ownership of the roadway alignment, and maintenance is provided by the City and State.

The 'Ewa region is steadily urbanizing and slowly outgrowing existing infrastructure. The purpose of the project is to provide additional roadway capacity, implement future transportation plans and accommodate future transportation demands along the 3 miles segment of Farrington Highway in the 'Ewa Region.

The proposed road widening improvements to the two-lane section of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road include widening the highway, utility and drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges modifications, and a landscaped median strip. Implementation of the proposed improvements is constrained by the presence of above-ground power transmission lines, electrical substation, bridges, culverts, underground utilities, structures, the State's underground energy corridor, Board of Water Supply (BWS) pumping station and main lines near Old Fort Weaver Road.

Purpose of Environmental Assessment

This Environmental Assessment (EA) is being prepared pursuant to State and Federal laws. The EA will comply with Hawai'i's Environmental Review Process, Hawai'i Revised Statutes (HRS), Chapter 343, which requires that any project that proposes the use of State land must undergo an environmental review. Since the project may seek federal funding, the forthcoming EA will also meet the requirements of the National Environmental Policy Act (NEPA). The EA will examine the potential environmental impacts of the project and seek agency and public comment on subject areas that should be addressed.



CATV SYSTEM MAP
SCALE: 1"=100'-0"

OCEANIC TIME WARNER CABLE (OTWC)

- BLDG/HSE ATTACH
- HANDHOLE
- J-BOX/TEL-CAB
- MAN-HOLE
- POLE – POWER W/ TELEPHONE
- POLE – OTHER W/ TELEPHONE
- POLE – TELEPHONE
- VAULT
- METERBOX
- PULLBOX
- OTWC METERBOX
- OTWC 18X36
- OTWC 2X4
- OTWC 2X6
- OTWC 3X5
- OTWC 4X6
- TV CAB
- DUCT
- STRAND

OCEANIC TIME WARNER CABLE
200 AKAMAINUI STREET
MILILANI, HI 96789-3999
PHONE # (808) 625-8100

FARRINGTON HWY WIDENING PROJECT

FARRINGTON HWY.
WAIPAHU – KAPOLEI, OAHU, HI

TITLE:
LOCATION MAP
NOTES
CATV RISER DIAGRAM
CATV SYSTEM MAP

DATE: 5/24/2013

SCALE: NTS

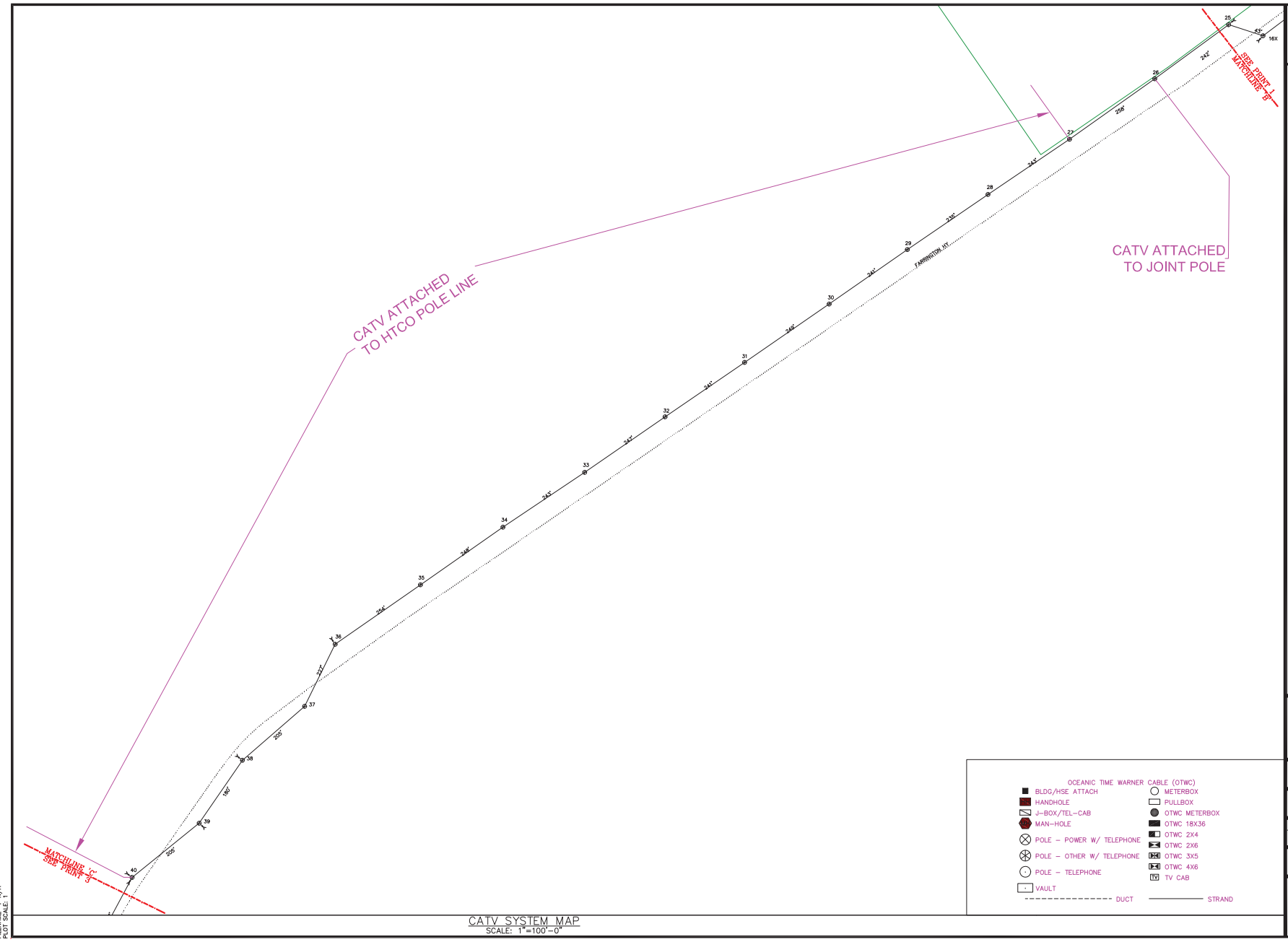
DES. BY	DR. BY	CHK. BY
KF	KF	KF

PROJECT NO: N/A

SHEET NO: 1

1 OF 5 SHEETS

FILENAME : N/A
PLOT SCALE: 1



CATV SYSTEM MAP
SCALE: 1"=100'-0"

FILENAME : N/A
PLOT SCALE: 1

OCEANIC TIME WARNER CABLE
200 AKAMAINUI STREET
MILILANI, HI 96789-3999
PHONE # (808) 625-8100

FARRINGTON HWY WIDENING PROJECT

FARRINGTON HWY.
WAIPAHU - KAPOLEI, OAHU, HI

TITLE:
LOCATION MAP
NOTES
CATV RISER DIAGRAM
CATV SYSTEM MAP

DATE: 5/24/2013

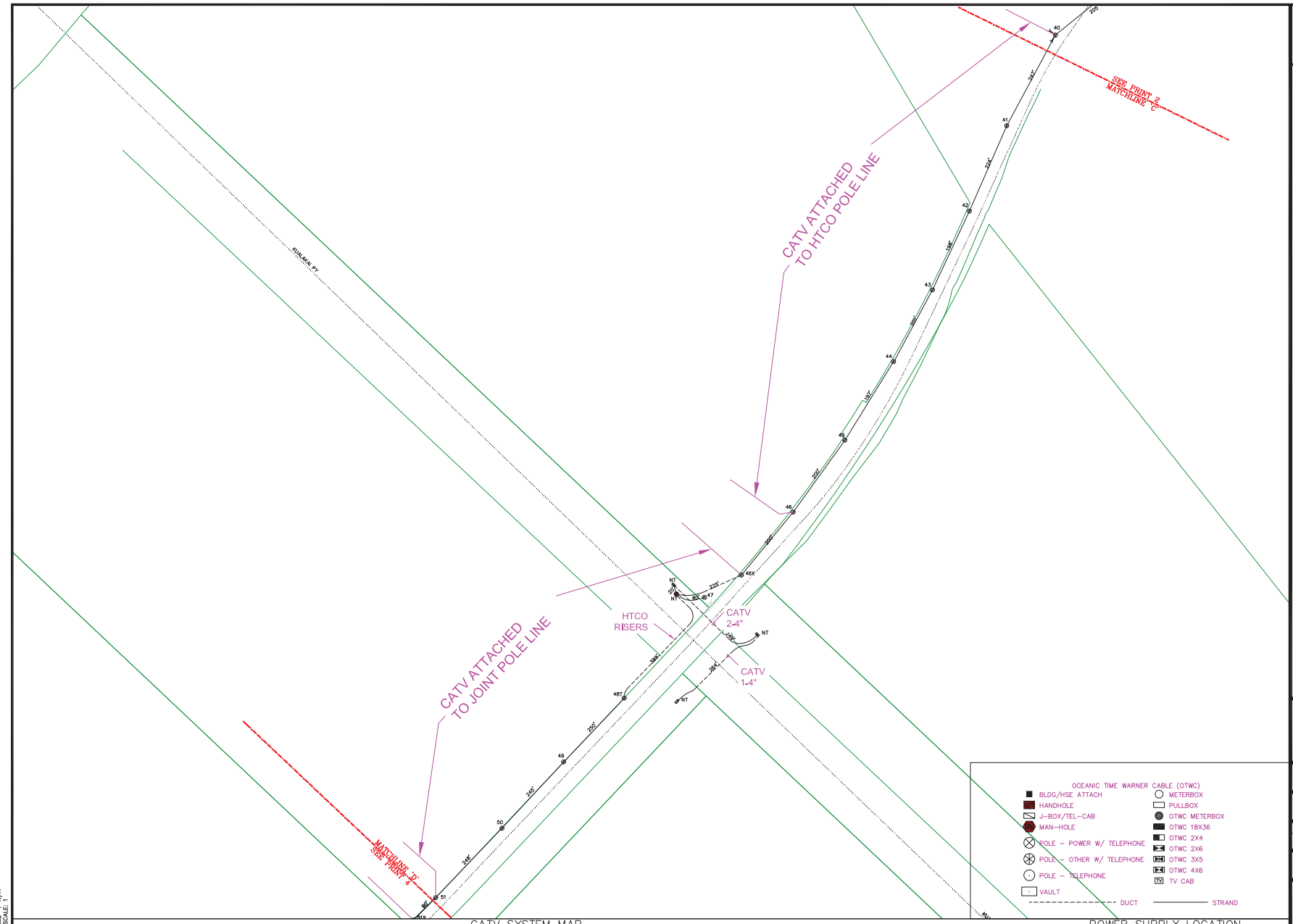
SCALE: NTS

DES. BY	DR. BY	CHK. BY
KF	KF	KF

PROJECT NO: N/A

SHEET NO: 2

2 OF 5 SHEETS



CATV SYSTEM MAP
SCALE: 1"=100'-0"

POWER SUPPLY LOCATION
SCALE: 1"=100'-0"

FILENAME : N/A
PLOT SCALE: 1

OCEANIC TIME WARNER CABLE
200 AKAMAINUI STREET
MILILANI, HI 96789-3999
PHONE # (808) 625-8100

FARRINGTON HWY WIDENING PROJECT

FARRINGTON HWY.
WAIPAHU - KAPOLEI, OAHU, HI

TITLE:
LOCATION MAP
NOTES
CATV RISER DIAGRAM
CATV SYSTEM MAP

DATE: 5/24/2013

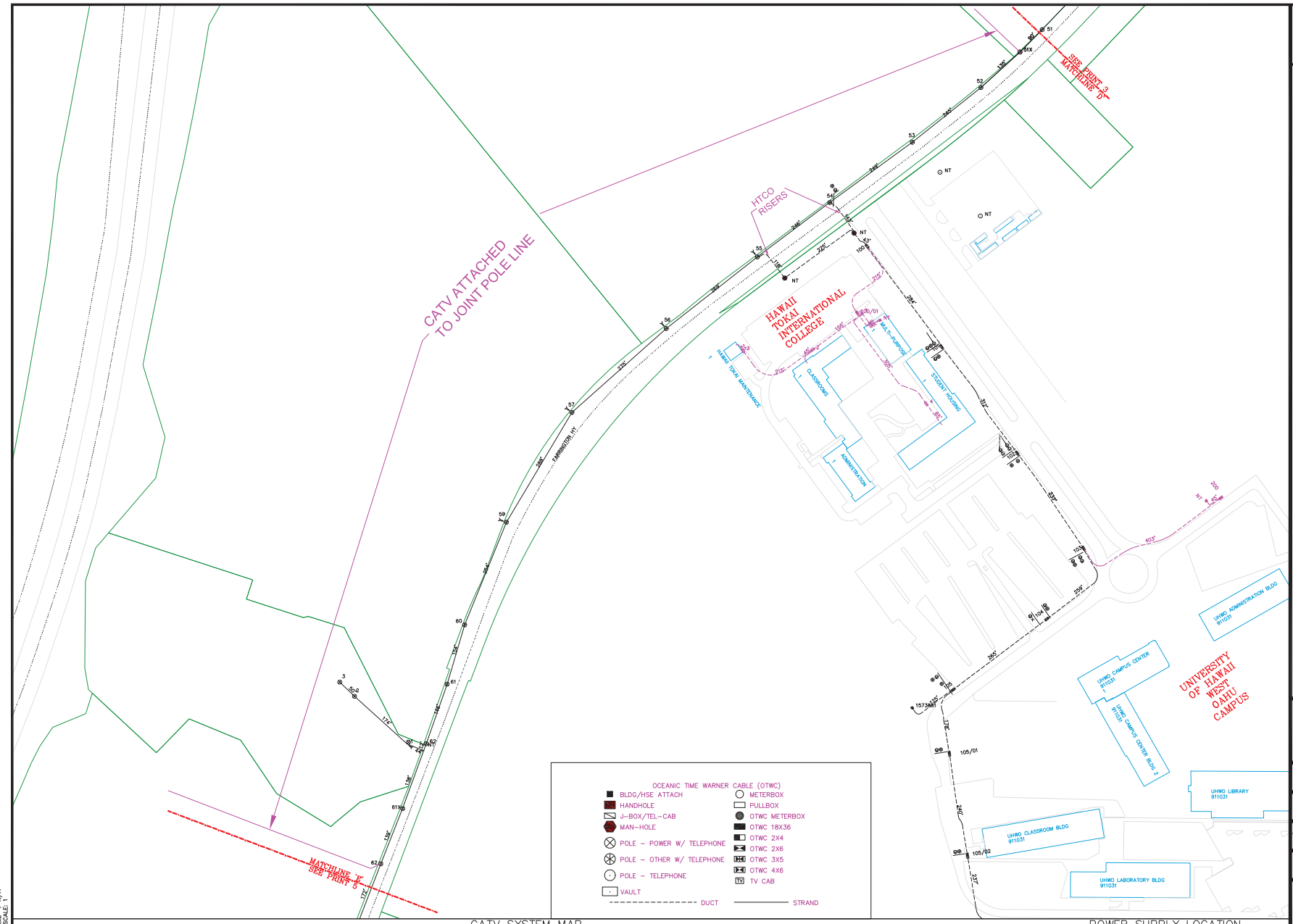
SCALE: NTS

DES. BY	DR. BY	CHK. BY
KF	KF	KF

PROJECT NO: N/A

SHEET NO: 3

3 OF 5 SHEETS



CATV SYSTEM MAP
SCALE: 1"=100'-0"

POWER SUPPLY LOCATION
SCALE: 1"=100'-0"

FILENAME : N/A
PLOT SCALE: 1

OCEANIC TIME WARNER CABLE
200 AKAMAINUI STREET
MILILANI, HI 96789-3999
PHONE # (808) 625-8100

FARRINGTON HWY WIDENING PROJECT

FARRINGTON HWY.
WAIPAHU – KAPOLEI, OAHU, HI

TITLE:
LOCATION MAP
NOTES
CATV RISER DIAGRAM
CATV SYSTEM MAP

DATE: 5/24/2013

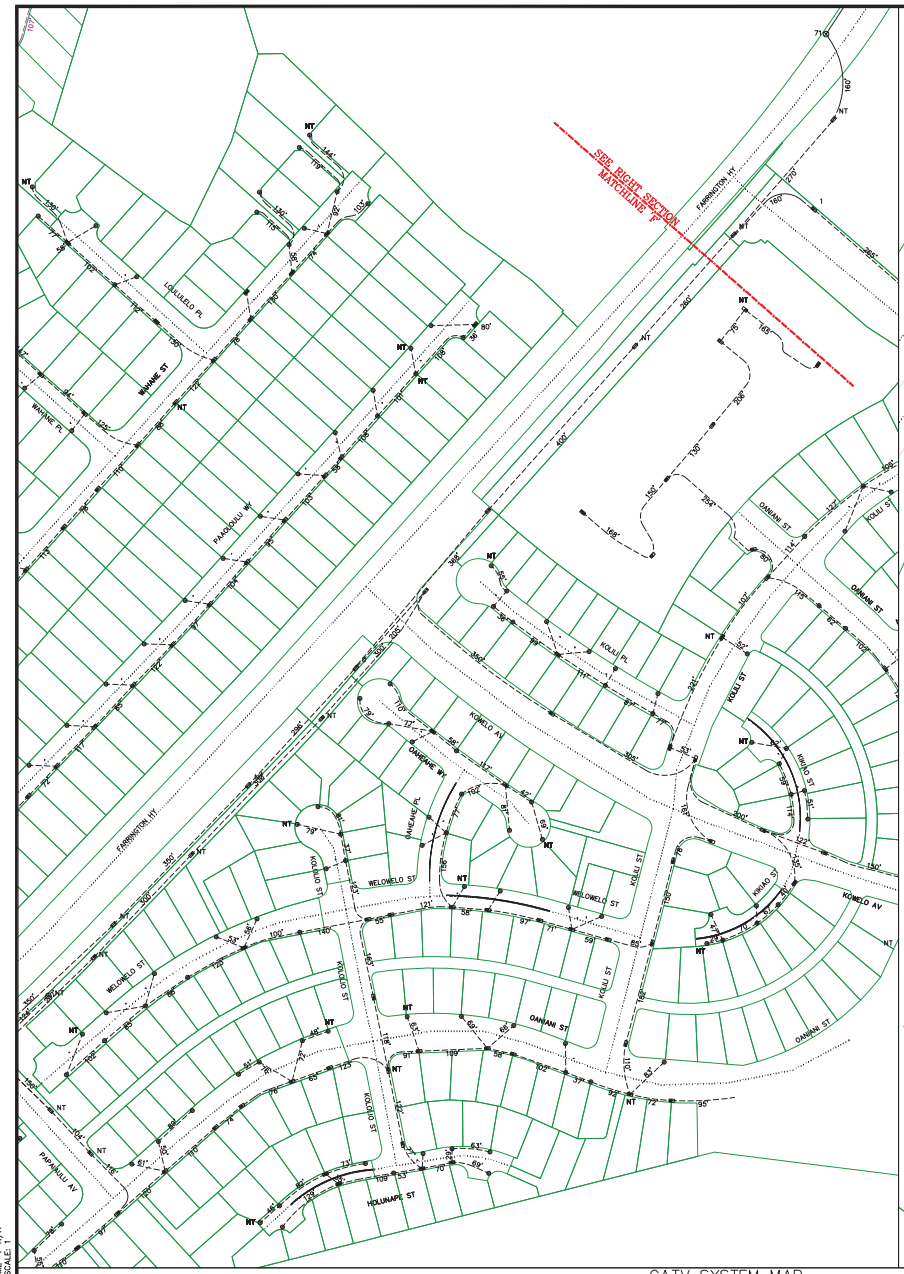
SCALE: NTS

DES. BY	DR. BY	CHK. BY
KF	KF	KF

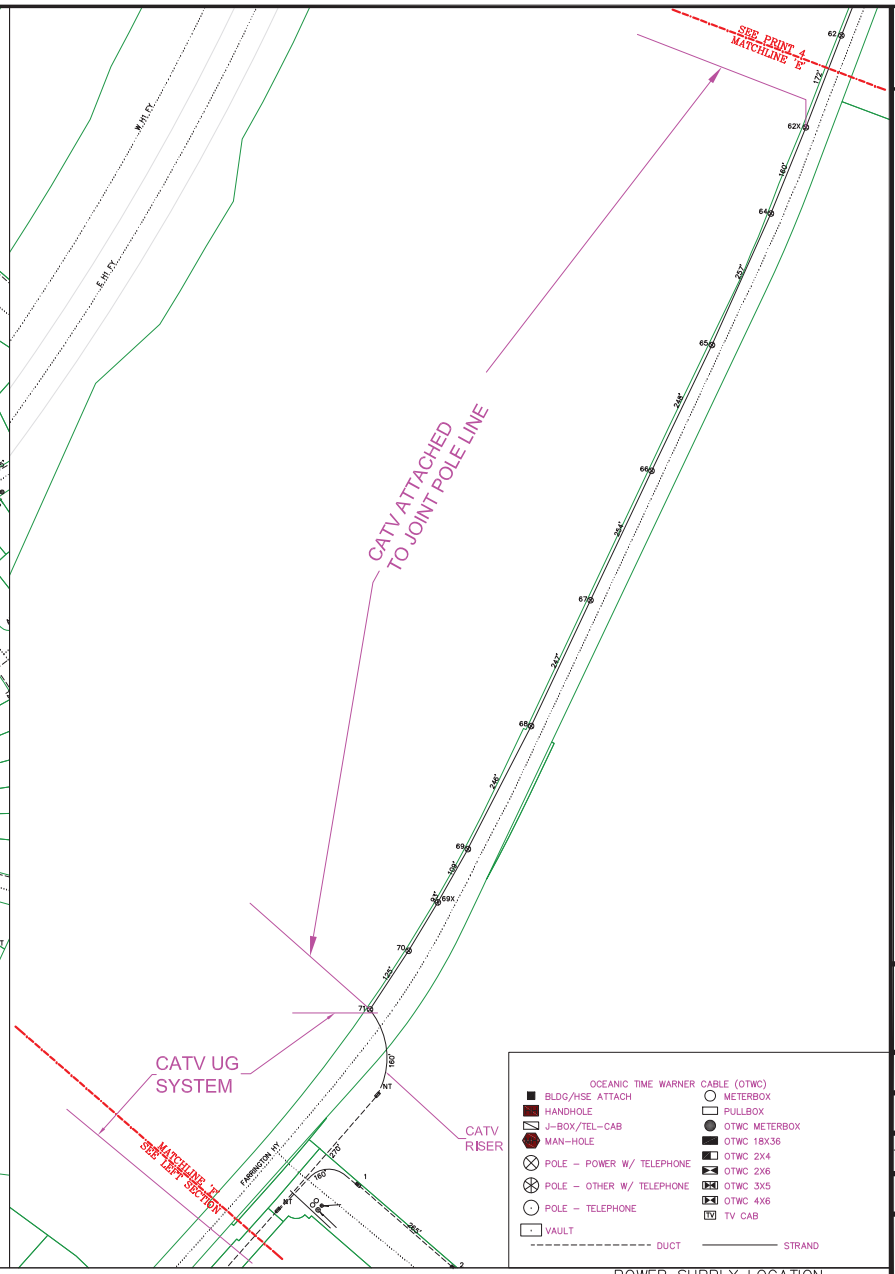
PROJECT NO: N/A

SHEET NO: 4

4 OF 5 SHEETS



CATV SYSTEM MAP
SCALE: 1"=100'-0"



POWER SUPPLY LOCATION
SCALE: 1"=100'-0"

OCEANIC TIME WARNER CABLE (OTWC)

- BLDG/HSE ATTACH
- HANDHOLE
- J-BOX/TEL-CAB
- MAN-HOLE
- POLE – POWER W/ TELEPHONE
- POLE – OTHER W/ TELEPHONE
- POLE – TELEPHONE
- VAULT
- METERBOX
- PULLBOX
- OTWC METERBOX
- OTWC 18X36
- OTWC 2X4
- OTWC 2X6
- OTWC 3X5
- OTWC 4X6
- TV CAB
- DUCT
- STRAND

OCEANIC TIME WARNER CABLE
200 AKAMAINUI STREET
MILILANI, HI 96789-3999
PHONE # (808) 625-8100

FARRINGTON HWY WIDENING PROJECT

FARRINGTON HWY.
WAIPAHU – KAPOLEI, OAHU, HI

TITLE:
LOCATION MAP
NOTES
CATV RISER DIAGRAM
CATV SYSTEM MAP

DATE: 5/24/2013

SCALE: NTS

DES. BY	DR. BY	CHK. BY
KF	KF	KF

PROJECT NO: N/A

SHEET NO: 5

5 OF 5 SHEETS

FILENAME : N/A
PLOT SCALE: 1

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Kerick Fujimura, OSP Engineer
Spectrum
200 Akamainui Street
Mililani, Hawai'i 96789

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, O'ahu, Hawai'i)

Dear Mr. Fujimura:

Thank you for your comment letter dated July 10, 2013 concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

The project improvements will continue to be coordinated with Spectrum (formerly Oceanic Time Warner Cable) as the EA and design process, particularly regarding the extent of any relocation of aerial and underground facilities. Spectrum will be contacted to participate in future coordination meeting with other utilities.

We understand that Spectrum maintains coax and fiber facilities within the project area. We appreciate you providing information (prints) relating to the affected areas in the immediate vicinity of the project for our reference.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

From:	Chad Taniguchi
To:	Farrington Highway Project
Cc:	Patrick Kelly
Subject:	Fwd: bikerackmap.com
Date:	Sunday, August 25, 2013 7:44:43 PM
Attachments:	IMAG0686.jpg

Aloha Ryan Char 523 5866

We missed the public informational meeting on Farr Hwy widening between Ft Weaver Rd and Kapolei GC Rd and are concerned about the effect it may have on the planned Leeward Bike Path.

May we review information you may have and perhaps meet with you?

Bicycle Aloha! Chad

Everyone has the right to be safe on Hawaii's roads.
Mamalahoe Kanawai, Kamehameha's Law of the Splintered Paddle 1797, Hawaii state constitution 1978

Executive Director Hawaii Bicycling League 3442 Waialae Ave Suite 1, Honolulu, HI 96816
chad@hbl.org *cell 808 255 8271* office 808 735 5756 fax 808 735 7989
www.hbl.org

Here's a comment from a cyclist.

Now that I look at it, I realize that in addition to just making sure the bike lane is included, something will need to happen at the Farrington/Ft Weaver tangle. Right now it is possible to cycle through there, but we should push for getting upgraded markings/signage thru there. At the Kapolei end, there is no issue, because well-marked and signed bicycle lanes already exist, and it'll just join up. But I can imagine the Farrington/Ft Weaver mess being a mental block for a lot of cyclists, if there are no clearly marked paths/sharrows/something.

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Chad Taniguchi, Executive Director
Hawaii Bicycling League
3442 Waiʻalae Avenue, Suite 1
Honolulu, Hawaiʻi 96816
Email: chad@hbl.org

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment
Farrington Highway Improvements-Kapolei Golf Course Road to Fort Weaver Road
(Kapolei, Oʻahu, Hawaiʻi)

Dear Mr. Taniguchi:

Thank you for your comment letter dated August 25, 2013 concerning the Pre-Consultation for Chapter 343, Hawaiʻi Revised Statutes (HRS) Environmental Assessment (EA) for the Farrington Highway Improvements - Kapolei Golf Course Road and Fort Weaver Road project. The following response is offered to your comments.

The Leeward Bike Path is not planned along Farrington Highway. Detailed information of the project will be included in the Draft EA. We will provide your office with a copy of the Draft EA, and a 30-day comment period will follow the publication of the document.

Regarding the comment provided by the cyclist, bike lanes will be provided as part of the project design. The Fort Weaver connection will also be reviewed to account for vehicles, pedestrians, and cyclist.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

FARRINGTON HIGHWAY IMPROVEMENTS – ENVIRONMENTAL ASSESSMENT(EA)

Public Meeting – July 16, 2013

Applicant:
City and County of Honolulu
Department of Design and Construction
Civil Division
650 South King Street, 15th Floor
Honolulu, Hawai'i 96813
Contact: Charmaine Tadjvar
Project Manager
(808) 768-8820

Planning/Engineering Consultant:
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawai'i 96813
Contact: Jeff Overton, AICP, LEED AP
Principal Planner
(808) 523-5866
FarHwy@Group70int.com

The City and County of Honolulu, Department of Design and Construction is currently undertaking the preparation of an Environmental Assessment (EA) on proposed improvements to Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road. The proposed project is 3 miles long (see map on reverse page).

The purpose of the improvements is to provide additional roadway capacity to address the anticipated and planned growth in the 'Ewa and Kapolei regions.

COMMENT

Name: Keith Timson Organization:
Address: 92-684 Nohona Kapolei HI 96707

Phone: 221-6307 Email: magichale@aol.com
Comments:
BEEN HERE OVER 45 YEARS.
+ Farrington only improved by paving
This Project NEEDS to happen.

***** Return to Group 70 International. Please Submit Comments by August 16th, 2013 *****

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Keith Timson
92-684 Nohona Street
Kapolei, Hawai'i 96707
Email: magichale@aol.com

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, O'ahu, Hawai'i)

Dear Mr. Timson:

Thank you for your comment letter concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road.

We appreciate your support for the project and will continue to keep you informed as the project progresses

We will provide you with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

Applicant:
City and County of Honolulu
Department of Design and Construction
Civil Division
650 South King Street, 15th Floor
Honolulu, Hawai'i 96813
Contact: Charmaine Tadjvar
Project Manager
(808) 768-8820

Planning/Engineering Consultant:
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawai'i 96813
Contact: Jeff Overton, AICP, LEED AP
Principal Planner
(808) 523-5866
FarHwy@Group70int.com

The City and County of Honolulu, Department of Design and Construction is currently undertaking the preparation of an Environmental Assessment (EA) on proposed improvements to Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road. The proposed project is 3 miles long (see map on reverse page).

The purpose of the improvements is to provide additional roadway capacity to address the anticipated and planned growth in the 'Ewa and Kapolei regions.

COMMENT

Name: FRANK GENADIO Organization: (NONE)
Address: 92-1370 KIKAHA STREET
KAPOLEI, HI 96707
Phone: 672-9170 Email: GENADIOF001@HAWAII.RR.COM
Comments: YOUR TRAFFIC STUDY SHOULD LOOK BEYOND THE NEAR TERM. AN OVERPASS (N-S OR E-W) MAY BE QUITE IMPORTANT TO TRAFFIC FLOW AT THE FARRINGTON-KUALAKAI INTERSECTION BY 2030. (FOR EXAMPLE, A MAKAKILO DRIVE "FLYOVER" AT FARRINGTON HIGHWAY WOULD ALREADY IMPROVE TRAFFIC FLOW AT THAT INTERSECTION — DRAMATICALLY.)

***** Return to Group 70 International. Please Submit Comments by August 16th, 2013 *****

111 S. King Street
Suite 170
Honolulu, HI 96813
808.523.5866
www.g70.design

June 16, 2020

Frank Genadio
92-1370 Kikaha Street
Kapolei, Hawai'i 96707
Email: genadiof001@hawaii.rr.com

Subject: Pre-Consultation for Chapter 343, HRS Environmental Assessment Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road (Kapolei, O'ahu, Hawai'i)

Dear Mr. Genadio:

Thank you for your comment letter concerning the Pre-Consultation for Chapter 343, Hawai'i Revised Statutes (HRS) Environmental Assessment (EA) for Farrington Highway Widening Between Fort Weaver Road and Kapolei Golf Course Road.

The Traffic Impact Analysis Report (TIAR) conducted for the project will look at the projected growth and traffic needs of the area. The TIAR will analyze current traffic along the existing roadway, as well as, the planned land developments in the area to project future needs.

We will provide your office with a copy of the Draft EA. Thank you for your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC., dba G70

Tracy Camuso, AICP
Associate Principal

Appendix B

Natural Resource Survey

Natural resources surveys for Farrington Highway improvements between Fort Weaver Road and Kapolei Golf Course Road on Oʻahu[1]

March 14, 2019 *AECOS* No. 1356B

Eric Guinther and Reginald David
AECOS Inc.
45-939 Kamehameha Highway, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: guinther@aecos.com

Introduction

Farrington Highway is a major vehicular route in west Oʻahu, on the north shore extending westward from Thompson Corner near Wailua to beyond Camp Erdman and from Yokohama Bay on the Waianae coast southeastward to Kapolei then more eastward to the far-east end of Waipahu. The segment between Kapolei and Waipahu is two lanes from the Kapolei Golf Course entrance road to just east of Old Fort Weaver Road. Plans are to improve this segment of the roadway (the "Project"). This report provides results of a survey (and resurvey) of natural resources (plants and vertebrates) within this stretch of the highway right of way.

The Area of Potential Effect (APE) provided as a map and GIS shapefile provided by Group70 constituted our survey area and is shown in Figure 2. Approximate length of the 300-ft wide APE is 17,400 feet (or 3.3 miles). The survey was conducted in June 2013. The present report is an update of the original, based on a reconnaissance survey undertaken in May 2018.

Methods

During both surveys, traffic load varied considerably throughout the morning, influenced by traffic signals at Fort Weaver Road and at Kualakaʻi Parkway,

[1] This report was prepared for G70 to be used as needed for environmental entitlements and will become part of the public record.

resulting in short bursts of vehicles passing in one direction or the other, with periods of no or light traffic between. Weather conditions in June 2013 were good with only minor sprinkles and winds of between 1 and 15 kilometers per hour. Weather conditions in May 2018 were likewise good for surveying biota within the APE.

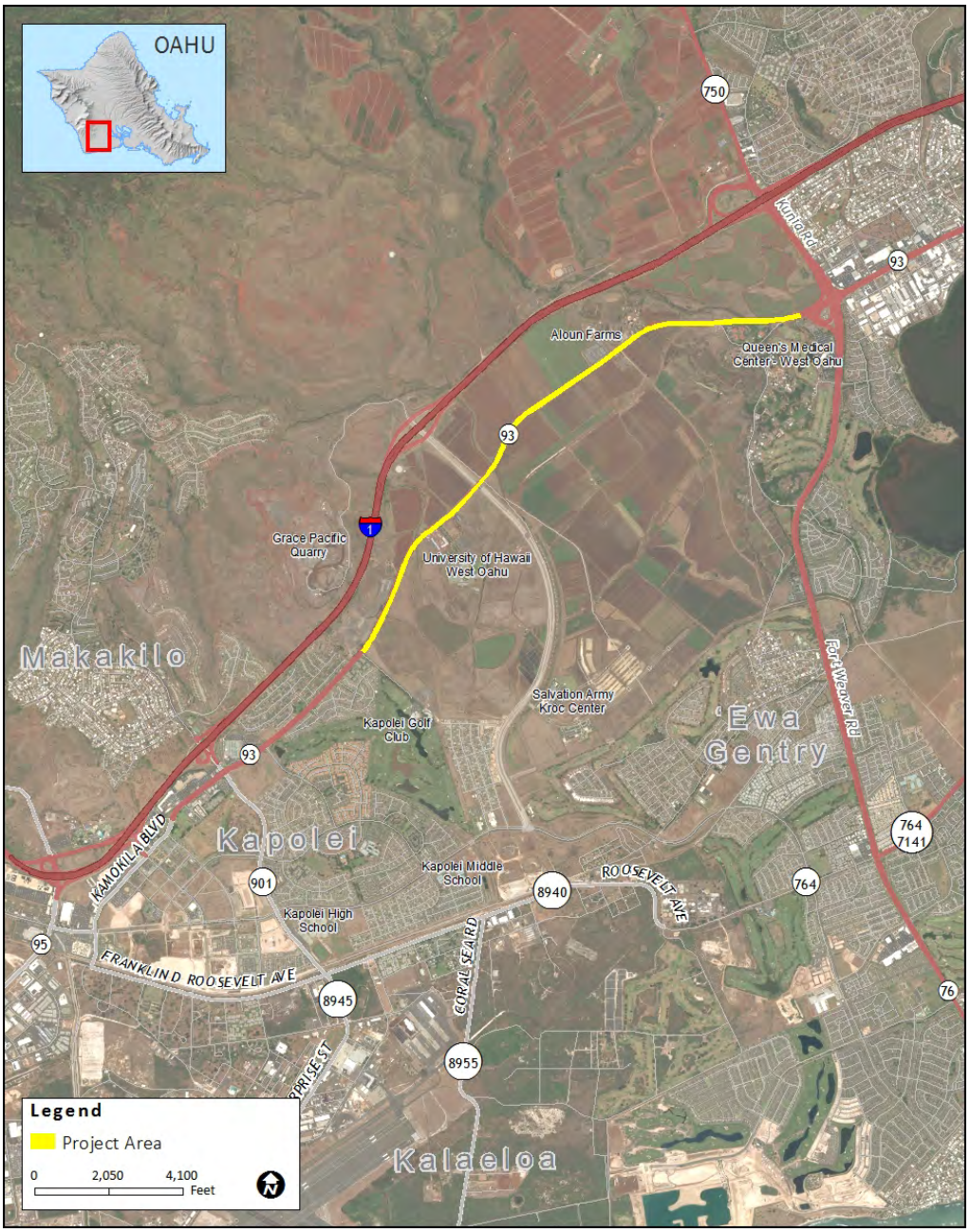


Figure 1. Location of the Project area (yellow) on map of 'Ewa.

Figure 2. Satellite image of Project vicinity with APE outlined as cross-hatched white line.

Botanical Survey

The original botanical survey was conducted on June 7, 2013 and consisted of walking the entire length of the Project APE. Since both sides of the highway were to be surveyed (in addition to areas well away from the verges and existing highway right-of-way) a roughly circular and somewhat sinuous traverse was followed. The traverse attempted to visit all areas along the corridor, although less attention was paid to developed areas (including active crop fields) and more to areas that appeared to have not been recently disturbed. The follow-on survey on May 1, 2018 and reported herein, is intended to determine that the flora has not changed significantly over the intervening 5 years. For this survey, pedestrian transects were concentrated in several specific areas where native flora was determined previously to have been present. In addition, the first author recently completed a pedestrian survey of the Farrington Highway verge for a BWS pipeline for approximately 300 ft (100 m) west of Kualakaʻi Parkway (*AECOS*, 2017). Plant names used in this report generally follow Staples and Herbst (2005) and Wagner, Herbst, and Sohmers (1990, 1999). Recent name changes follow Imada (2012).

Avian Survey

In 2013, seventeen avian count stations were sited approximately 300 m (~985 ft) apart along the length of the APE. A single six-minute avian point count was made at each count station. Field observations were made with the aid of Leica 10 X 42 binoculars and by listening for vocalizations. The point counts were conducted between 6:20 am and 10:00 am on June 7, 2013 to encompass the peak period of bird activity. An additional reconnaissance survey was conducted on May 1, 2018 to update the 2013 survey. Similar methods were followed with eight of the original 2013 stations resurveyed. When not conducting point counts, the zoologist searched the APE for species and habitats not detected during the point counts.

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 58th 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, 2012, 2013, 2014, 2015, 2016, 2017).

Mammalian Survey

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *ʻōpeʻapeʻa* as it is known locally, all terrestrial mammals currently

found on the Island of Oʻahu are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial vertebrate mammalian species detected within the project area. Mammal scientific names follow Tomich (1986).

Survey Results

Area Description

Farrington Highway in Project area cuts across the gently-sloped alluvial fan of the upper ʻEwa Plain. The route is gently curved and changes little in elevation. Roadway elevation on the west end is around 110 ft (34 m) above sea level (ASL) and, at the east end, about 80 ft (24 m) ASL. Between, the roadway reaches a maximum elevation of 173 ft (53 m) ASL. The terrain within the APE varies somewhat more with a vertical range on the order of 120 ft (35 m), being most variable at the east end in the vicinity of Honouliuli Stream (see Figures 3 and 4).

Most of the land bordering the existing Farrington Highway right-of-way is in agricultural use: croplands of Aloun Farms planted in corn, basil, watermelon, or fallow at the time of the survey. In linear terms, 45% of the north side and fully 70% of the south side of the highway in the APE borders active or recently abandoned agriculture fields. Developed properties along the route include Kahi Mohala (a behavioral health clinic), a Board of Water Supply pump station (Honouliuli Line Booster), a Hawaiian Electric Co. substation, the University of Hawaii, West Oʻahu Campus new entrance road, and the Grace Pacific Lower Quarry entrance area. The APE includes a small part of the Malawai Iki neighborhood in Kapolei. Other activities within or just outside of the APE are those related to farm operations and early construction of the Honolulu Area Rapid Transit (HART) track support structures. The only major intersection in the APE is that with Kualakaʻi Parkway. The only other public connections along the route are two Old Fort Weaver Road intersections located at either end of Kahi Mohala.

A total of four dry water courses cross the APE. These features are (east to west): Honouliuli, Kaloʻi, Hunehune, and Palehua. With the exception of Honouliuli, the other three are narrow, banked drainage channels built long ago to control the flow of runoff through agriculture fields (formerly sugar cane fields) that covered the ʻEwa Plain. These "streams" are discussed further in the subsection on Jurisdictional Waters in the Discussion section of our report.

Figure 3. Farrington Highway at Honouliuli Stream bridge looking west in June 2013. Large eucalyptus trees are on Kahi Mohala property.

Figure 4. Same general view as in Fig, 3, but from a bit further east in May 2018. HART guideway now dominates the scene.

Vegetation

The vegetation in the Farrington Highway right-of-way comprises mostly ruderal weeds in the highway verges and mostly grasses and scattered shrubs on soil berms that lay between the road and farm fields along much of the right-of-way. These berms are typically 2-3 m (6 to 9 ft) in height and separate farming operations from traffic along the roadway (Figure 5). Within the APE occur landscaping in developed areas and either cultivated crops or extensive weeds in agricultural areas (Figure 6), which include fallow fields and recently abandoned fields in the vicinity of the UH campus. Areas not disturbed for years are mostly limited to the dry gulches, where shrubs and small trees (mostly *koa haole* or *Leucaena leucocephala*) predominate. The only significant area of trees is in the landscaping at Kahi Mohala. A row of palm trees marks the berm in front of Aloun Farms. The only large trees located close to the highway verge are monkeypod (*Albizia saman*), *koa haole*, *'opiuma* (*Pithecelobium dulce*), *kiawe* (*Prosopis pallida*), and an African tulip (*Spathodea campanulata*). All are introduced species.

The following description from *AECOS* (2010, p. 4) covers land where the proposed Honolulu Area Rail Transit (HART) parallels Farrington Highway in the APE (see Fig. 4):

> Immediately west of the [Fort Weaver Road] interchange, Farrington Highway traverses a largely undeveloped area all the way to Kapolei. Here, the guideway runs along the north side of the highway, before turning southwest across Aloun Farms. Maintenance of the highway verge occurs regularly in this section, but a short distance beyond the narrow verge, the vegetation is not maintained and dominated by *koa haole* (*Leucaena leucocephala*) shrub and buffelgrass (*Cenchrus ciliaris*). Similar vegetation occupies patches of undisturbed ground between cultivated fields at Aloun Farms, where bananas (*Musa* cultivars) and fields of onions (*Allium cepa* cultivars) were observed as recent or ongoing crops.

Flora

A listing of all plants observed during the June 2013 survey (within the APE) is given here as Table 1. Presence and qualitative abundance of each plant species is given in the abundance column, as described in the key at the end of the table. Because a complete list of plants observed in 2018 was not made, only minor modifications have been made to the table to correct deletions (*Hibiscus clayi*) and additions (*Pritchardia pacifica*). A total of 116 plant taxa are listed. These

Figure 5. Fallow crop land on north side of Farrington Highway with farm road in APE. A vegetated soil berm separates farming from the highway verge.

Figure 6. View of active cropland (Aloun Farms), here on south side of Farrington Highway where sweet basil is being grown.

Table 1. Plant species identified from June 7, 2013 survey of the APE for the Farrington Highway Improvements Project, Kapolei to Waipahu.

Species listed by family	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
Asystasia gangetica (L.) T. Anderson	Chinese violet	Nat	O	
Barleria repens C. Nees	pink-ruellia	Orn	R	<1>
AIZOACEAE				
Trianthema tetragonioides (Pall.) Kuntze	---	Nat	C3	
AMARANTHACEAE				
Achyranthes aspera L.	---	Nat	R	
Alternanthera pungens Kunth	khaki weed	Nat	C	
Amaranthus spinosus L.	spiny amaranth	Nat	C	
Amaranthus viridus L.	slender amaranth	Nat	R	
ANACARDIACEAE				
Schinus terebinthefolius Raddi	Christmas berry	Nat	U	
APOCYNACEAE				
Cascabella thevetia (L.) Lippold	be-still	Nat	R3	<1>
Nerium oleander L.	oleander	Orn	R2	<1>
ASTERACEAE (COMPOSITAE)				
Bidens alba (L.) DC.	---	Nat	R1	
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat	R	
Lactuca serriola L.	prickly lettuce	Nat	O	
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat	U3	
Sonchus oleraceus L.	sow thistle	Nat	U	
Spagneticola trilobata (L.) Pruski	wedelia	Nat	U3	
Tridax procumbens L.	coat buttons	Nat	O2	
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	C	
Xanthium strumarium L.	*kīkānia*, cockleburr	Nat	U1	
BIGNONIACEAE				
Spathodea campanulata P. Beauv.	African tulip tree	Nat	R	

Table 1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
BORAGINACEAE				
Cordia subcordata Lam.	*kou*	**Ind**	R	<1>
Heliotropum procumbens Mill.	---	Nat	U3	
BRASSICACEAE				
Lepidium virginicum L.	---	Nat	U3	
CARICACEAE				
Carica papaya L.	papaya	Nat	R	
CHENOPODIACEAE				
Atriplex suberecta Verd.	---	Nat	A	
Salsola tragus L.	tumbleweed	Nat	O3	
CONVOLVULACEAE				
Ipomoea obscura (L.) Ker-Gawl	---	Nat	C	
Ipomoea triloba L.	little bell	Nat	U3	
CUCURBITACEAE				
Citrullus lanatus (Thunb.) Matsumura & Nakai	watermelon	Orn	A	<1>
Coccinia grandis (L.) Voigt	scarlet-fruited gourd	Nat	R	
EUPHORBIACEAE				
Euphorbia hirta L.	garden spurge	Nat	U2	
Euphorbia hypericifolia L.	graceful spurge	Nat	U	
Euphorbia prostrata Aiton	prostrate spurge	Nat	U	
Euphorbia heterophylla L.	*kaliko*	Nat	U1	
Ricinus communis L.	castor bean	Nat	O2	
FABACEAE				
Acacia confusa Merr.	Formosa *koa*	Nat	R	<1>
Albizia saman F. Muell.	monkeypod	Nat	U	
Bauhania sp.	orchid tree	Orn	R	<1>
Cassia x *nealiae* H.S. Irwin & Barneby	rainbow shower tree	Orn	U1	<1>
Crotalaria incana L.	fuzzy rattlepod	Nat	U2	
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	O	
Indigofera hendicaphyla Jacq.	creeping indigo	Nat	U	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	C3	
Macroptilium atropurpureum (DC.) Urb.	---	Nat	C3	
Mimosa pudica L.	sensitive plant	Nat	R1	
Pithecelobium dulce (Roxb.) Benth.	*'opiuma*	Nat	O	

Table 1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
FABACEAE (continued)				
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat	C	
Senna surattensis (N.L. Burm.) H. Irwin & Barneby	scrambled egg plant	Nat	R	
Vachellia farnesiana (L.) Wight & Arnott	*klu*	Nat	R	<2>
LAMIACEAE				
Hyptis pectinata (L.) Poit.	comb hyptis	Nat	R	
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat	C	
Ocimum basilicum L.	sweet basil	Nat	A	<1>
MALVACEAE				
Abutilon grandifolium (Wild.) Sweet	hairy abutilon	Nat	U	
Abutilon incanum (Link) Sweet	*ma'o*	**Ind?**	R	
Hibiscus arnottianus A. Gray	*koki'o ke'oke'o*	**End**	R	<1>
Hibiscus rosa-sinensis L.	Chinese hibiscus cult.	Orn	R	
Hibiscus tiliaceus L.	*hau* cult.	Orn	R1	<1>
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	O1	
Sida ciliaris L.	---	Nat	C3	
Sida rhombifolia L.	Cuba jute	Nat	U	
Sida spinosa L.	prickly sida	Nat	O1	
Waltheria indica L.	*'uhaloa*	**Ind?**	C	
MORACEAE				
Ficus microcarpa L. f.	Chinese banyan	Nat	R	
MYRTACEAE				
Eucalyptus deglupta Blume	kamarere	Nat	R2	<1>
Meleleuca quinquenervia (Cav.) S.T. Blake	paperbark	Nat	R	<1>
Metrosideros sp.	*'ōhi'a*	**End**	R	<1>
Syzigium cumini L.	Java plum	Nat	R	
NYCTAGINACEAE				
Boerhavia coccinea L.	false *alena*	Nat	O3	
Bougainvillea spectabilis Wild.	bougainvillea	Orn	U	<1>
OXALIDACEAE				
Oxalis corniculata L.	yellow wood sorrel	**Pol?**	R	
PASSIFLORACEAE				
Passiflora foetida L.	running pop	Nat	U	

Table 1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
PLANTAGINACEAE				
Plantago lanceolata L.	nrw-lvd. plantain	Nat	U3	
PORTULACEAE				
Portulaca oleracea L.	pigweed	Nat	U3	
ROSACEAE				
Osteomelies anthyllidifolia (Sm.) Lindl.	*ʻūlei*	**Ind**	R	<1>
RUTACEAE				
Murraya paniculata (L.) W. Jack	mock orange	Nat	R	<1>
SAPINDACEAE				
Filicium decipiens (Wight & Arnott) Thwaites ex J. D. Hook.	fern tree	Nat	R	<1>
SCROPHULARIACEAE				
Bacopa monnieri (L.) Pennell	*ʻaeʻae*	**Ind**	R1	<1>
SOLANACEAE				
Nicandra physalodes (L.) Gaertn.	apple of Peru	Nat	O2	
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner, G. Anderson, & Jansen	wild cherry tomato	Nat	O	
Solanum melongena L.	egg plant	Orn	R	<1>
Solanum americanum Mill.	*pōpolo*	**Ind?**	U	
VERBENACEAE				
Stachytarpheta australis Moldenke	---	Nat	U	
Vitex rotundifolia L. fil.	*pōhinahina*	**Ind**	U3	<1>
ZYGOPHYLLACEAE				
Tribulus terrestris L.	puncture vine	Nat	R	
FLOWERING PLANTS				
MONOCOTYLEDONES				
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki,* ti	**Pol**	R	<1>
ARACEAE				
Colocasia esculenta (L.) Schott.	*kalo*	**Pol**	R	<1>
ARECACEAE				
Dypsis lutescens (H. Wendl.) Beentje & J. Dransfield	areca palm	Orn	R	<1>
Livistonia chinensis (Jacq.) R. Br. ex Mart.	Chinese fan palm	Nat	R	
Pritchardia pacifica Seemann & H. Wendland	Fiji fan palm	Orn	U	

Table 1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
ARECACEAE (continued)				
Pritchardia thurstonii F. Mueller & Drude	Pacific fan palm	Orn	U1	<2>
Roystonia regia (Kunth) O.F. Cook	Cuban royal palm	Orn	R3	<1,2>
CYPERACEAE				
Carex wahuensis C.A. Mey	---	**End**	U3	<1>
Cyperus polystachyos Rottb.	---	**Ind**	R	
Kylinga nemoralis (J.R. Forster & G. Forster) Dandy ex Hutchinson & Dalziel	*kili'o'opu*	Nat	U	
POACEAE				
Axonopus compressus (Swartz) P. Beauv.	brd-lvd. carpetgrass	Nat	R3	<1>
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	Nat	U3	
Cenchrus ciliaris L.	buffelgrass	Nat	AA	
Cenchrus echinatus L.	sand bur	Nat	C	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	O3	
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	C	
Cynodon x magennisii Hurcombe	hybrid Bermuda	Orn	U3	
Echinochloa colona (L.) Link	jungle-rice	Nat	U	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	O3	
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	A	
Eremochloa ophiuroides (Munro) Hackel	centipede grass	Orn	R3	<1,2>
Megathyrsus maximus (Jacq.) B.K. Simons & E.L. Jacobs	Guinea grass	Nat	AA	
Megathyrsus maximus var. *trichoglume* (K. Schum.) C.E. Hibberd	green panic grass	Nat	U3	
Paspalum conjugatum Bergius	Hilo grass	Nat	U1	<1>
Paspalum diliatatum Poir.	Dallis grass	Nat	R	
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	AA	
Sorghum halapense (L.) Pers.	Johnson grass	Nat	U3	<1>
Sorghum hybrid	---	Orn	R	<1>
Sporobolus sp.	rattail grass	Nat	U	
Zea mays L.	sweet corn	Orn	A	<1>
Zoysia hybrid	zoysia grass	Orn	R3	<1>

Table 1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
ZINGIBERACEAE				
Alpinia purpurata (Viel.) K. Schum.	torch ginger	Orn	R	<1>

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

End = endemic; native to the Hawaiian Islands and uniquely so.
Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
Ind? = possibly indigenous. Manner of introduction unknown.
Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
Orn = A cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawai'i.
Pol = species introduced purposefully or accidentally by early Polynesian migrants. **Pol?** = probable Polynesian introduction.

ABUNDANCE = occurrence ratings for plant species:

-- - Species not present in area.
R – Rare seen in only one or perhaps two locations.
U - Uncommon seen at most in several locations
O - Occasional seen with some regularity
C - Common observed numerous times during the survey
A - Abundant found in large numbers; may be locally dominant.
AA - Very abundant abundant and dominant; defining vegetation type.

Numbers (1 – 3) following qualitative rating of abundance indicate localized abundance is greater than occurrence rating. For example, R3 would be a species encountered only once or twice, but very numerous where encountered.

NOTES: <1> – Landscape or garden planting.
<2> – Plant lacking key diagnostic characteristics (flower, fruit); identification, therefore, somewhat uncertain.

breakdown as follows: 11 species (9%) are native to the Hawaiian Islands (status is indigenous or endemic); three (2.5%) are thought to be early Polynesian introductions (canoe plants); and 20 (16%) are regarded as ornamentals. Many more plants are present in the APE serving as ornamentals (that is, are planted and maintained as part of a landscape); however, ornamental status refers only to plants that are not known to grow in Hawai'i outside of cultivation. On the other hand, sweet basil (*Ocimum basilicum*), extensively cultivated in and beyond the APE, is listed as a naturalized species because it is occasionally found growing in the wild on O'ahu. In fact, considering the list of indigenous and endemic species (12 natives) encountered during the survey, only four are present in the APE outside of

having been planted as ornamentals. These four are: *ma'o* (*Abutilon incanum*), *pōpolo* (*Solanum americanum*), *'uhaloa* (*Waltheria indica*), and a sedge (*Cyperus polystachyos*); all relatively common species in lowland dry areas on O'ahu. For the similar area surveyed in 2010 for the HART route (but not including any landscaped areas aside from crop lands), the total plant taxa recorded was 74, of which only 3 (4%) were indigenous species (*AECOS*, 2010), comparable to the 3% of the present survey that are native and not in landscaping there.

Avian Survey

A total of 1353 individual birds of 25 species, representing 14 separate families, were recorded during station counts on June 6, 2013. All 25 species detected are alien to the Hawaiian Islands (Table 2).

Table 2 – Avian species detected on June 7, 2013 in point counts, Farrington Highway Improvements Project.

Common Name	Scientific Name	ST	RA
	GALLIFORMES		
	PHASIANIDAE – Pheasants & Partridges		
	Phasianinae – Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	A	1.95
Black Francolin	*Francolinus francolinus*	A	0.17
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Rock Pigeon	*Columba livia*	A	1.44
Spotted Dove	*Streptopelia chinensis*	A	4.44
Zebra Dove	*Geopelia striata*	A	8.94
Mourning Dove	*Zenaida macroura*	A	0.11
	PELECANIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	2.22
	PSITTACIFORMES		
	PSITTACIDAE - African and New World Parrots		
	PSITTACULIDAE - Lories, Lovebirds, and Indomalayan and Papua-Australasian Parrots		
	Psittaculineae - Indomalayan and Papua-Australsian Parrots		
Rose-ringed Parakeet[2]	*Psittacula krameri*	A	-

[2] Rose-ringed Parakeet was not recorded during the 2013 survey. On the 2018 survey, we recorded a RA of 0.63 for this alien parrot species.

Table 2 (continued).

Common Name	Scientific Name	ST	RA
	PASSERIFORMES		
	ALAUDIDAE - Larks		
Eurasian Skylark	*Alauda arvensis*	A	0.89
	PYCNONOTIDAE – Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	A	6.67
Red-whiskered Bulbul	*Pycnonotus jocosus*	A	0.22
	ZOSTEROPIDAE – White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	1.11
	TURDIDAE - Thrushes		
White-rumped Shama	*Copsychus malabaricus*	A	0.06
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	3.56
	EMBERIZIDAE – Emberizids		
Red-crested Cardinal	*Paroaria coronata*	A	0.39
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	0.67
	FRINGILLIDAE - Fringilline and Carduline Finches & Allies		
	Carduelinae - Carduline Finches and Hawaiian Honeycreepers		
House Finch	*Haemorhous mexicanus*	A	5.17
Yellow-fronted Canary	*Serinus mozambicus*	A	0.11
	PASSERIDAE - Old World Sparrows		
House Sparrow	*Passer domesticus*	A	4.28
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	0.67
	THRAUPIDAE - Tanagers		
	Thraupinae - Core Tanagers		
Red-crested Cardinal	*Paroaria coronata*	A	0.39
	ESTRILDIDAE – Estrildid Finches		
Common Waxbill	*Estrilda astrild*	A	2.93
Red Avadavat[3]	*Amandava amandava*	A	1.39
African Silverbill	*Euodice cantans*	A	0.17
Java Sparrow	*Lonchura oryzivora*	A	15.44
Scaly-breasted Munia	*Lonchura punctulata*	A	0.22
Chestnut Munia	*Lonchura atricapilla*	A	1.67

Legend to Table 2

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 (17)

[3] Red Avadavat was recorded during the 2013 survey but not during the 2018 survey.

Avian diversity and densities were in keeping with the highly disturbed nature of the habitats present in the area, and the location on the ʻEwa Plain. Three species: Java Sparrow (*Padda oryzivora*), Common Waxbill (*Estrilda astrild*), and Zebra Dove (*Geopilia striata*) accounted for slightly more than 50% of the total number of birds recorded during point counts. Java Sparrows were the most commonly recorded species, accounting for 21% percent of the individual birds recorded during the course of this survey. During the 2018 reconnaissance survey, we recorded all but one of 25 species recorded in the 2013 survey: Red-Avadavat (*Amandava amandava*). And, during the 2018 survey we recorded Rose-ringed Parakeet (*Psittacula krameri*), a bird not seen in 2013. Avian diversities and densities recorded in 2018 were nearly the same as recorded in 2013.

Mammalian Survey

Three terrestrial mammalian species were detected within the APE during the course of this survey. One dog (*Canis f. familiaris*) was seen, and scat, tracks and sign of dogs were encountered in a number of locations within the APE. Two small Indian mongoose (*Herpestes a. auropunctatus*) were encountered, as was scat and tracks of this species. One cat (*Felis catus*) was seen, as was cat scat. No other mammalian species was recorded during the course of the 2018 survey.

Discussion

The purpose of our survey was to document the presence/absence of any important biological resources and, particularly, the presence or absence of species listed as threatened or endangered in state and federal statutes.

Botanical Resources

None of the plants encountered in our surveys enjoys protected status. In two areas in the APE, native plants have been used extensively in landscaping: 1) the entrance to the Kapolei Golf Course and, 2) the new entrance road into the UH West Hawaiʻi campus. These two areas account for the majority (7 species) of native plant species recorded during the survey and were revisited in 2018. Recent surveys for listed plant species in project areas for the HART guideway crossing the ʻEwa Plain found no plant species of interest or concern (*AECOS* and Parsons Brinckerhoff, 2010; *AECOS*, 2011; Greg Mansker, DLNR, pers. comm.).

The single exception for the Farrington Highway improvements project in 2013 was a cluster of *Hibicus clayi* (no Hawaiian name) plants on Grace Pacific property (TMK: 9-1-016:004) within the APE. This planted grouping of small shrubs is close to the Grace Pacific lower quarry entrance. A high berm separates the quarry from Farrington Highway and this berm is planted in various shrubs and trees (mostly oleander [*Nerium oleander*] and hau [*Hibiscus tiliaceus* ornamental cultivar]). A broad, flat to low-sloping area extends from the base of the berm to the highway verge. This area is regularly maintained (mowed). Within this area to the east of the quarry entrance was a planting of the listed hibiscus invaded by *koa haole* shrubs (Figure 7). Counting basal stems suggests there were perhaps as many as 9 individual hibiscus planted in a circle no more than 6 ft (2 m) across. The shrubs were around 5 ft (1.5 m) tall. A few flowers were present on June 7, 2013, but when revisited on June 19, 2013 the cluster was displaying several dozen open flowers. Clearly this native, endemic to Kaua'i, was been planted and maintained at this location; the species is not part of the native flora of O'ahu. The plants have since been removed (Figure 8).

Avian Resources

The findings of the avian survey are consistent with the results of several other recent faunal surveys conducted in similar habitats on the 'Ewa plain (David, 2004, 2005a, b, 2007a, b, c, d, e, 2011; David and Guinther, 2006). And with the highly disturbed habitat present on and adjacent to the road-way-corridor. During the course of this survey 25 avian species were detected, all of these are alien to the Hawaiian Islands (Table 2). The two commonest species detected, Java Sparrow, and Common Waxbill, are estrildid finches native to sub-Saharan Africa and southern Asia respectively, both are seed eaters commonly associated with seeding grass, rice, and other similar agricultural crops.

No avian species proposed for listing or listed under the federal endangered species act of 1973, as amended or the State of Hawai'i, H.R.S. 195D, were recorded during the course of either survey (DLNR, 1998; USFWS; 2005a, 2005b, undated).

No migratory shorebirds were recorded during the course of either survey and none would be expected due to the timing of the survey. Pacific Golden-Plover (*Pluvialis fulva*) is regularly recorded in this area between September and late April each year (David, 2013). Pacific Golden-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. The birds usually leave Hawai'i for the trip back to the Arctic in late April or the very early part of May.

Figure 7. Cluster of *Hibiscus clayi* as it appeared on June 6, 2013. A few blooms are evident, but *koa haole* seed pods dominate the growth.

Figure 8. May 2018 photo of location shown in Fig. 6. Area of shrubs in June 2013 is at the two white poles, barely visible in Fig. 7.

Although no seabirds were detected during the course of the survey, several seabird species potentially overfly the site on occasion in low numbers. The primary cause of mortality in resident seabirds 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 in locally nesting seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, these young birds may collide with manmade structures, and if not killed outright, dazed or injured birds become 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). Of the resident seabird species present on Oʻahu, no known nesting colonies occur within proximity of the project corridor.

The Oʻahu population of White-Tern (*Gygis alba*) is listed as an endangered species by the State of Hawaiʻi; it is not listed under federal statute. This ephemeral species was not recorded during our surveys, nor was it expected. The current resident population of White Terns on O'ahu is found on the leeward side of the Island concentrated in the Waikīkī area.

Mammalian Resources

The findings of the mammalian survey are consistent with the results of several other recent faunal surveys conducted in similar habitats on the ʻEwa Plain (David, 2004, 2005a, b, c, d, e, 2011; David and Guinther, 2006), given the highly disturbed habitats present in the APE. Although no rodents were detected, it is likely that the four established alien Muridae found on Oʻahu—roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*), and Polynesian rat (*Rattus exulans hawaiiensis*)—use various resources found within the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and native faunal species.

No mammalian species currently protected or proposed for protection under either the federal or State of Hawaiʻi endangered species programs (DLNR, 1998; USFWS; 2005a, 2005b, undated) was detected during the course of this survey, nor would any be expected. Considering the paucity of documented records of Hawaiian hoary bat from the ʻEwa Plain, the chances that this listed mammalian species uses resources in the APE are extremely low (USFWS, 1998; David, 2013). Additionally there are minimal, suitable roosting sites (trees of

suitable size) within the APE. As noted above, tall trees here are associated with landscaping at Kahi Mohala.

Jurisdictional Waters

Neither wetlands nor tidal waters are present in the Project area. The road crosses four separate "streams" (from east to west): Honouliuli, Kaloʻi, Hunehune, and Palehua. Honouliuli is a normally dry (intermittent) stream with a stream bed and banks that flows eventually into West Loch, Pearl Harbor. Kaloʻi, Hunehune, and Palehua are highly modified channels that connect the gulches by these names to agricultural ditches. These ditches eventually terminate downslope on the ʻEwa Plain, without reaching the Pacific Ocean. Palehua drains the Grace Pacific facility on the north side of Farrington Hwy., and connects to Hunehuna a short distance south of the highway; Hunehune flows southward then southeastward where it joins the lower remnant of Kaloʻi; and these combined drainage ways feed into a retention basin on the west side of Kualakaʻi Parkway. The upper part of Kaloʻi is now diverted into a large drainage feature that parallels Kualakaʻi Parkway, terminating in a retention basin. As these features are confined to man-made channels through the agricultural landscape, terminate far short of the Pacific Ocean shore (a jurisdictional water), and only infrequently carry runoff, they are not jurisdictional.

Critical Habitat

Federally delineated Critical Habitat is not present in the APE (USFWS, 2012). Thus, the Project will not impinge on federally designated Critical Habitat. No equivalent designation exists under state law

Recommendations

- Several shrubs of the listed species, *Hibiscus clayi,* previously identified (AECOS, 2013) within the Project APE as "ornamental" plantings are no longer present at the location.

- If night-time construction activity and/or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

- If streetlights or exterior facility lighting are installed in conjunction with the project, it is recommended that the lights be shielded to reduce the potential for interactions between nocturnally flying seabirds and external lights and/or man-made structures (Reed et al., 1985; Telfer et al., 1987).

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Appendix C

Air Quality Study

B.D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

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May 18, 2020

Attn: Ms. Tracy Camuso
Group 70 International, Inc.
111 S. King Street, Suite 170
Honolulu, Hawaii 96813

Subject: Farrington Highway Widening Project
2035 Air Quality Impacts

Dear Ms. Camuso:

As you are aware, we prepared an air quality study dated June 6, 2019 that addressed the potential air quality impacts due to the widening of Farrington Highway at the intersection of Kualakai Parkway in the year 2028. The air quality study focused on carbon monoxide emissions from motor vehicle traffic. With the proposed roadway improvements and with the mitigation measures recommended in the project traffic study, it was found that maximum carbon monoxide concentrations in the vicinity of the intersection of Farrington Highway and Kualakai Parkway would be well within the state and federal standards. The estimated maximum concentrations would not exceed about 20 percent of the state standards and about 5 to 10 percent of the federal standards. This is based on the forecast traffic level-of-service (LOS) of D with a delay of about 49 seconds during the morning peak hour and LOS of E with a delay of about 79 seconds during the afternoon peak hour.

Traffic forecasts for the year 2035 have indicated that without further improvements at the intersection of Farrington Highway and Kualakai Parkway excessive traffic congestion may occur, causing both the morning and afternoon peak-hour traffic to degrade to LOS F and delay times to reach nearly 200 seconds or longer. With the additional improvements and mitigation recommended in the project traffic study, peak-hour delay times would be significantly reduced to about 68 seconds in the morning and 95 seconds in the afternoon. LOS would be at E in the morning and F in the afternoon. Compared to 2028 with the project and with traffic mitigation, this suggests that traffic flow forecast for 2035 would be somewhat reduced.

The air quality study did not quantitatively evaluate conditions for the year 2035, but a qualitative assessment can be made based on the available information. Further widening of the Farrington Highway/Kualakai Parkway intersection will result in more motor vehicles being concentrated within the intersection vicinity, potentially increasing carbon monoxide concentrations. As noted in the air quality study, average motor vehicle emissions tend to decrease with time due to the retirement of older, more-polluting vehicles, which may at least partially offset the increase in traffic or congestion. It is also expected that more electric vehicles will enter the fleet in the future, further reducing traffic-related air quality impacts. Given that the quantitative analysis for 2028 shows that maximum carbon monoxide concentrations would reach only a small fraction of the state and federal air quality standards, it appears probable that with the proposed improvements in 2035, air quality standards would continue to be met.

Please contact me if you have any questions.

Very truly yours,

Barry D. Neal
Certified Consulting
Meteorologist

AIR QUALITY STUDY

FOR THE PROPOSED

FARRINGTON HIGHWAY WIDENING PROJECT

KAPOLEI, OAHU, HAWAII

Prepared for:

Group 70 International, Inc.

June 6, 2019

B.D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

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1.0 SUMMARY

The City and County of Honolulu, Department of Design and Construction, is proposing improvements to Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed improvements to Farrington Highway consist of a 4-lane roadway section, with two lanes in each direction, a 20-foot wide curbed median, bike lanes and 20-foot shoulders. The project development area will be wide enough to accommodate a future 6-lane roadway. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, six parameters are regulated by the U.S. Environmental Protection Agency including: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The Hawaii Department of Health regulates these same six parameters in addition to hydrogen sulfide. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the Kapolei area is very much affected by its leeward and coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when

the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time. Temperatures in leeward areas of Oahu are generally very moderate with average daily temperatures ranging from about 70°F to 84°F. The extreme minimum temperature recorded at nearby Daniel K. Inouye International Airport is 54°F, while the extreme maximum temperature is 95°F. This area of Oahu is one of the drier locations in the state with rainfall often highly variable from one year to the next. Monthly rainfall has been measured to vary from as little as a trace to as much as 10 inches or more. Average annual rainfall amounts to about 18 inches with summer months being the driest.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion, the present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met.

If the proposed project is implemented, there may be some short- and/or long-term impacts on air quality that may occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust could occur during the project construction phases. To a lesser extent, exhaust emissions from construction equipment, from the minor disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust

emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures to consider include limiting the area that is disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, a computerized air quality modeling study was undertaken using the U.S. EPA's MOVES2014b and CAL3QHC emissions and dispersion models. The air quality modeling study estimated current highest concentrations of carbon monoxide at the intersection of Farrington Highway and Kualakai Parkway and predicted future levels both with and without the proposed project based on the project traffic study. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas other air pollutants from motor vehicles most often are regional issues that cannot be addressed by a single project. Model results indicated that present 1-hour and 8-hour highest estimated carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2028 without the

project, maximum modeled carbon monoxide concentrations were predicted to decrease (improve) slightly despite an increase in traffic, and concentrations would remain well within standards. This is because emissions from the increase in traffic will be more than offset by the retirement of older, more-polluting vehicles over time. New vehicles emit only a small fraction of the carbon monoxide emitted from vehicles manufactured 20 years ago. With the project in the year 2028, the highest estimated carbon monoxide concentrations increased only slightly compared to the without project case and remained nearly unchanged compared to the existing case. Concentrations should remain well within standards through the year 2028 with or without the project. Due to the negligible impact the project is expected to have, implementing mitigation measures for long-term traffic-related air quality impacts would be unnecessary.

2.0 INTRODUCTION

The City and County of Honolulu, Department of Design and Construction (DDC), is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road (see Figure 1 for general project location). This approximately three-mile section of roadway is the final remaining piece of Farrington Highway, between Kapolei and Waipahu, that is currently unimproved, with no sidewalks, curbs, gutters, medians, turn lanes, or bike lanes. Considered a secondary route connecting the two regions, this section of highway serves as a potential bottleneck between Kapolei and Waipahu, where Farrington Highway currently consists of four lanes. It also serves the last portion of the ‘Ewa region that remains undeveloped in terms of land use, consisting of areas of agriculture and light industry uses.

The proposed action includes widening of the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area, such as the UHWO, the Ho‘opili master planned community, and a section of the anticipated rapid transit system.

Implementation of the proposed project is constrained by existing infrastructure including above-ground power transmission lines, an electrical substation, two Board of Water Supply pump stations, water transmission lines, the State’s Energy Corridor, other underground transmission and distribution utilities, structures, bridges, and roadway culverts. Additional constraints include the narrow and varying width of the City and County of Honolulu’s right-of-way and efforts to protect in-place the existing Kahi Mohala and Queen’s Medical Center West Oahu, Hawai‘i Tokai International College and UHWO, and the existing HART Railway Alignment along Farrington Highway near the east end of the project fronting Hoopili and Kahi Mohala.

The proposed improvements to Farrington Highway will construct a 4-lane roadway section, consisting of 2 lanes in each direction, a 20-foot wide curbed median, bike lanes, and 20-foot shoulders. The landscaped median will serve to provide a more aesthetically pleasing look for the planned urban arterial highway, allow for

additional turning lanes, and a potential reduction of traffic speeds that will result in enhanced traffic safety.

The project improvements will meet traffic mitigation requirements identified in previous City and County of Honolulu traffic planning studies, various development plans, as well as the Jacobs (CH2MHill) Transportation Impact Analysis Report (TIAR).

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Measures to mitigate project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants.

National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

The national AAQS are reviewed periodically, and multiple revisions have occurred over the past 30 years. The latest revisions include the nitrogen dioxide and sulfur dioxide standards in 2010, the particulate matter standards in 2012 and the ozone standard in 2015. In general, the national AAQS have become more stringent with the passage of time and as more information and evidence become available concerning the detrimental effects of air pollution. Changes to the Hawaii AAQS over the past several years have tended to follow revisions to the national AAQS, making several of the Hawaii AAQS the same as the national AAQS.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high-pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. The site of the proposed project is located in the leeward area of the Koolau Mountains.

Wind frequency data for the Daniel K. Inouye International Airport (HNL) (formerly known as Honolulu International Airport), which is located about 8 miles to the east of the project site, are given in Table 2. These data, which were collected several years ago, can be expected to be reasonably representative of the project area, although there is some evidence that northeast trade winds have diminished slightly and east trade winds have increased. Wind frequency for HNL show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind was from this direction, and more than 62 percent of the time the wind was in the northeast quadrant. Winds from the south were infrequent occurring only a few days during the year and mostly in winter in association with kona storms. Wind speeds averaged about 10 knots (12 mph) and mostly vary between about 5 and 15 knots (6 and 17 mph).

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Within the temperature range in Hawaii, cooler temperatures tend to result in lower emissions of carbon monoxide from automobiles, lower concentrations of photochemical smog and lower ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variations of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. Based on more than 25 years of data collected at the Daniel K. Inouye International Airport, average annual daily

minimum and maximum temperatures in the project area are about 70°F and 84°F, respectively [1]. The extreme minimum temperature on record at the airport is 54°F, and the extreme maximum is 95°F.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. Stability class 6 typically occurs in rural areas during the night when there is a lot of cooling of the surface due radiative processes. Urban and suburban areas with a lot of paved surfaces tend to inhibit stability class 6. In the project area, which is largely suburban, stability class 5 is probably the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of

the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land.

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The project area is one of the drier areas on Oahu due to its leeward and near sea level location. Average annual rainfall measured at nearby Daniel K. Inouye International Airport amounts to about 18 inches [1]. Most of the rainfall usually occurs during the winter months. Monthly rainfall may vary from as little as a trace to more than 10 inches. Recent studies have shown that over the past 30 to 40 years, northeast trade wind days have tended to decrease. In contrast, east trade winds were found to increase in frequency, though this increase did not fully offset the decrease in northeast trade winds. This has resulted in a trend of decreasing northeast trade wind speeds and decreasing trade wind rainfall.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles due to the suburban situation. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 2014. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from

natural sources are not included. Much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants, refineries and other industrial sources. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. In the specific project area, there are currently manmade emissions from ongoing mass transit construction, ships and aircraft. Pollutant emissions from these types of activities are generally accounted for in Table 3. Due to the distances of these activities from the study areas and (in the case of the mass transit construction) temporary nature of the activity, they are not expected to measurably affect pollutant emissions levels relevant to this study and are not quantitatively assessed.

Natural sources of air pollution emissions that could affect the project area at times but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 2011

through 2015. These are the most recent data that are currently available.

As indicated in Table 4, during the 2011-2015 period, sulfur dioxide, particulate, carbon monoxide and nitrogen dioxide were monitored by the State Department of Health at an air quality station located at Kapolei and ozone was monitored at Sand Island. The concentrations reported were consistently low compared to the standards for all parameters except for ozone. Maximum 8-hour ozone concentrations reached up to about 75% of the standard. Ozone concentrations tend to be high in Hawaii due to the abundant sunshine and the island setting.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement, soil excavation and demolition activities; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by roadway lane closures.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with demolition, site clearing and

preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. State of Hawaii Air Pollution Control Regulations [2] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this

equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus, for construction projects that typically do not extend beyond a year or two, it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways. Motor vehicle traffic on roadways is mostly powered by gasoline engines, which inherently emit more carbon monoxide than diesel engines.

Project construction activities, if unmitigated, can obstruct the normal flow of traffic for short periods of time such that overall vehicular emissions in the project area could temporarily increase. This potential problem should be avoided by keeping roadways open during peak traffic hours and by moving heavy construction equipment and workers to and from construction areas during periods of low traffic volume.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, use of the proposed facilities may result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments of 1990, which revised and expanded the Act and provided the U.S. Environmental Protection Agency broader authority to implement and enforce regulations reducing air pollutant emissions. This legislation required further emission reductions from stationary and mobile sources, which have been phased in since 1994 (e.g., Title IV of the 1990 Amendments to the Clean Air Act Acid Rain Deposition Control, which began in 1995). Additional restrictions were signed into law during the Clinton administration (e.g., 40 CFR Part 50 National Ambient Air Quality Standards for Particulate Matter in 1997), and these began to take effect during the following decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. For example, under the Obama Administration, fuel economy standards for new cars and light trucks were issued for model years 2017-2025 (known as corporate average fuel economy [CAFE] standards) were issued, which would nearly double the fuel efficiency of new cars and light trucks over that of similar vehicles that were currently on the road. These restrictions are factored into the emissions estimates for the project discussed later. In August 2018, the Trump Administration proposed a pause in the rate of emissions reductions established by the CAFE program. The Trump Administration’s proposal would freeze the fuel economy standards at 2020 levels. Even if the Trump Administration proposal were implemented, the reductions in pollutant emissions required under prior provisions would result in substantial improvements (i.e., declines in pollutant emissions).

To evaluate the potential long-term ambient air quality impact of motor vehicle traffic using the proposed new roadway facilities, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways within the project area. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single project.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2018 with present conditions, (2) year 2028 without the project, and (3) year 2028 with the project. To begin the modeling study of the threee scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, the single key intersection identified in the traffic study [3] was selected for air quality analysis: Farrington Highway at Kualakai Parkway. The traffic study describes the existing and projected future traffic conditions and laneage configurations of the study intersection in detail. In performing the air quality impact analysis, all of the traffic mitigation measures recommended in the traffic study were assumed.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario was made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated both morning and afternoon peak-traffic periods. Typically, afternoon peak-hour traffic volumes are higher, but atmospheric dispersion conditions are generally worse during the morning. Thus, the air quality study evaluated both morning and afternoon peak-traffic periods.

Vehicular carbon monoxide emissions for each year studied were calculated using EPA's Motor Vehicle Emission Simulator (MOVES) computer model [4]. Federal Corporate Fuel Economy (CAFE) standards as well as other federal emission regulations are factored into MOVES. The Trump Administration recently proposed changes to the CAFE standards, but it is not expected that this will have a significant affect on the conclusions reached in this study.

MOVES was configured for a project-level analysis specifically for Hawaii. Assumptions included a suburban, unrestricted road type, default fuel supply and fuel formulation, default vehicle age distribution and morning and afternoon ambient temperatures of

70°F and 90°F, respectively. MOVES emission factors were generated both for idling and for moving traffic.

After computing vehicular carbon monoxide emissions through the use of MOVES, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [5] currently recommend that the computer model CAL3QHC [6] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [7] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings. All emission factors that were input to CAL3QHC for

free-flow traffic on roadways were obtained from MOVES based on assumed free-flow vehicle speeds corresponding to the posted or design speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all three scenarios. This acknowledges that pedestrian sidewalks already exist or may exist in the future in these locations. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" or highest estimated results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 5 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within suburban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at reasonably low levels. Department of Health monitoring stations for locations on Oahu report average carbon monoxide concentrations of about 1 to 2 ppm. Background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were conservatively accounted for by adding a background concentration of 1 ppm to all predicted concentrations for 2018. Although increased traffic is expected to occur within the project area within the next few years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time due to the probable retirement of older vehicles that emit more air pollution. Hence, a background value of 1 ppm was assumed to persist for the future scenarios studied.

Predicted Highest 1-Hour Concentrations

Table 5 summarizes the final results of the modeling study in the form of the estimated highest 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated highest carbon monoxide concentrations are presented in the table for three scenarios: year 2018 with existing traffic, year 2028 without the project, and year 2028 with the project. The locations of these estimated highest 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration for the single intersection studied (Farrington Highway at Kualakai Parkway) for the present (2018) case was 1.9 ppm. This was projected to occur during the afternoon peak traffic hour and was well within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2028 without the proposed project, the highest 1-hour carbon monoxide concentration at the intersection of Farrington Highway and Kualakai Parkway was predicted to reach 1.4 ppm. This was predicted to occur during the afternoon peak traffic hour. Compared to the existing case, the predicted highest concentration for the year 2028 without the project decreased (improved), and the maximum-modeled concentrations remained well within the state and national standards. This suggests that emissions from higher traffic volumes and increased traffic congestion in the next several years will likely be more than offset by the retirement of older, more-polluting vehicles over time.

Predicted 1-hour maximum-modeled concentrations for the 2028 with project scenario increased slightly at the study intersection compared to the without project case, suggesting the air quality impacts of implementing the project will be relatively insignificant. The forecast highest morning and afternoon concentrations remained well within the state and federal standards.

Predicted Maximum 8-Hour Concentrations

Maximum 8-hour carbon monoxide concentrations were estimated by multiplying the maximum-modeled 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [8] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [9] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [10] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated highest 8-hour concentrations are indicated in Table 6. For the 2018 scenario, the estimated highest 8-hour carbon monoxide concentration at the intersection of Farrington Highway and Kualakai Parkway was 1.0 ppm. This is well within both the state standard of 4.4 ppm and the national limit of 9 ppm. For the year 2028 without project scenario, the predicted maximum concentration at the study intersection was 0.7 ppm, decreasing (improving) compared to the existing scenario. For the 2028 with project scenario, the maximum-

modeled concentration increased slightly to 0.9 ppm but remained below (better) than the highest estimated existing concentration. All predicted concentrations were within the standards.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second (2 miles per hour or 1.9 knots) with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second (4.5 miles per hour or 3.5 knots), for example, computed carbon monoxide concentrations would be only about half the values given above.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on ambient air quality data that are available from the Department of Health, it is likely that all state and federal ambient air quality standards are currently being met in the project area.

Project-related short-term impacts on air quality may occur from the emission of fugitive dust during construction phases. To control dust, the project construction contractor should prepare a dust control plan that will ensure that state regulations related

to fugitive dust will be met. Typical dust control measures include:

- Watering of active work areas and any temporary unpaved work roads at least twice daily on days without rainfall
- Use of wind screens around the project perimeter and/or limiting the area that is disturbed at any given time
- Mulching or use of chemical soil stabilizers to control wind erosion of inactive areas of the site that have been disturbed
- Covering of dirt-hauling trucks when traveling on roadways to prevent windage
- Implementing a routine road cleaning and/or tire washing program to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area
- Establishment of landscaping early in the construction schedule.

The specific dust control measures used will depend, in part, on the amount and nature of earthwork that is needed, soil type, wind and precipitation conditions, and the nearness of neighbors.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, any long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be negligible. Maximum concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is unnecessary.

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6. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

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DeLorme Street Atlas USA® 2011

Figure 1 - Project Location

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MN (9.5° E)

0 2 4 6 8 10 mi

Data Zoom 9-0

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Maximum Allowable Concentration		
		National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	Annual 24 Hours	– 150 μg/m³ (a)	– 150 μg/m³ (a)	50 μg/m³ 150 μg/m³ (b)
Particulate Matter (<2.5 microns)	Annual 24 Hours	12 μg/m³ (c) 35 μg/m³ (d)	15 μg/m³ (c) 35 μg/m³ (d)	– –
Sulfur Dioxide	Annual 24 Hours 3 Hours 1 Hour	– – – 0.075 ppm (e)	– – 0.5 ppm (b) –	80 μg/m³ 365 μg/m³ (b) 1300 μg/m³ (b) –
Nitrogen Dioxide	Annual 1 Hour	0.053 ppm 0.100 ppm (f)	0.053 ppm –	70 μg/m³ –
Carbon Monoxide	8 Hours 1 Hour	9 ppm (b) 35 ppm (b)	– –	5 mg/m³ (b) 10 mg/m³ (b)
Ozone	8 Hours	0.070 ppm (g)	0.070 ppm (g)	157 μg/m³ (b)
Lead	3 Months Quarter	0.15 μg/m³(h) -	0.15 μg/m³(h) –	– 1.5 μg/m³
Hydrogen Sulfide	1 Hour	–	–	35 μg/m³ (b)

[a] Not to be exceeded more than once per year on average over a 3-year period.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual 99th percentile daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Maximum arithmetic 3-month mean concentration for a 3-year period.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT 1965-1974 (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 2014

Air Pollutant	Total (tons/year)
Particulate (PM10)	16,685
Particulate (PM2.5)	4,649
Sulfur Oxides	14,778
Nitrogen Oxides	29,337
Carbon Monoxide	108,267
Hydrocarbons	23,289

Source: U.S. EPA, National Emissions Inventory, 2014

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST FARRINGTON HIGHWAY WIDENING PROJECT

Parameter / Location	2011	2012	2013	2014	2015
Sulfur Dioxide / Kapolei					
1-Hour Averaging Period:					
Highest Concentration (ppm)	0.019	0.012	0.016	0.024	0.026
99th Percentile Concentration (ppm)	–	–	–	0.021	0.013
No. of Averages Greater than 0.075 ppm	0	0	0	0	0
3-Hour Averaging Period:					
Highest Concentration (ppm)	0.013	0.007	0.011	0.019	0.015
2nd Highest Concentration (ppm)	0.004	0.006	0.011	0.013	0.011
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
Highest Concentration (ppm)	0.003	0.004	0.005	0.008	0.004
2nd Highest Concentration (ppm)	0.003	0.004	0.005	0.005	0.004
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (ppm)	0.002	0.002	0.002	0.002	0.001
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	51	40	39	32	32
2nd Highest Concentration ($\mu g/m^3$)	38	36	39	32	32
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	16	16	14	15	16
Particulate (PM-2.5) / Kapolei					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	21	24	16	14	17
98th Percentile Concentration ($\mu g/m^3$)	13	15	16	11	14
No. of Averages Greater than 35 $\mu g/m^3$	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	5	7	3	4	4
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
Highest Concentration (ppm)	1.2	1.5	1.3	2.7	2.4
2nd Highest Concentration (ppm)	1.2	1.3	1.3	1.4	2.1
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
Highest Concentration (ppm)	1.0	1.1	1.0	1.3	1.7
2nd Highest Concentration (ppm)	1.0	1.1	1.0	1.3	1.6
No. of State AAQS Exceedances	0	0	0	0	0

Table 4 (cont.)

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST FARRINGTON HIGHWAY WIDENING PROJECT

Parameter / Location	2011	2012	2013	2014	2015
Nitrogen Dioxide / Kapolei					
1-Hour Averaging Period:					
Highest Concentration (ppm)	0.025	0.027	0.031	0.043	0.031
98th Percentile Concentration (ppm)	0.025	0.023	0.030	0.025	0.022
No. of Averages Greater than 0.100 ppm	0	0	0	0	0
Annual Average Concentration (ppm)	0.003	0.003	0.003	0.004	0.004
Ozone / Sand Island					
8-Hour Averaging Period:					
Highest Concentration (ppm)	0.047	0.045	0.051	0.062	0.052
2nd Highest Concentration (ppm)	0.047	0.044	0.050	0.061	0.050
4th Highest Concentration (ppm)	0.046	0.044	0.047	0.057	0.049
No. of Daily Max 8-hr Ave > 0.075 ppm	0	0	0	0	0

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2011 - 2015"

Table 5

ESTIMATED HIGHEST 1-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR INTERSECTIONS INCLUDED WITHIN FARRINGTON HIGHWAY WIDENING PROJECT (parts per million)

Roadway Intersection	Year/Scenario					
	2018 Present		2028 Without Project		2028 With Project	
	AM	PM	AM	PM	AM	PM
Farrington Highway at Kualakai Parkway	1.4	1.9	1.2	1.4	1.4	1.8

Hawaii State AAQS: 9 National AAQS: 35

Table 6

ESTIMATED HIGHEST 8-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR INTERSECTIONS INCLUDED WITHIN FARRINGTON HIGHWAY WIDENING PROJECT (parts per million)

Roadway Intersection	Year/Scenario		
	2018 Present	2028 Without Project	2028 With Project
Farrington Highway at Kualakai Parkway	1.0	0.7	0.9

Hawaii State AAQS: 4.4 National AAQS: 9

Appendix D

Acoustic Study

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YEA Job #50.027
May 18, 2020

G70
111 South King Street, Suite 170
Honolulu, Hawaii 96813

Attention: Ms. Tracy Camuso, AICP
Associate Principal

Subject: Opinions Regarding Probable Effects of 6-Lane Improvements to Farrington Highway By CY 2035; Farrington Highway Improvements Project, Kapolei Golf Course Road to Fort Weaver Road, Oahu, Hawaii

Dear Ms. Camuso:

I reviewed the available information in the study's updated Traffic Noise Impact Study (May 8, 2020) regarding the assumed addition of 2 through lanes between the Kualakai Parkway and Old Fort Weaver Road (East) intersections of Farrington Highway by Calendar Year (CY) 2035. The probable increases which will occur by CY 2035 with the addition of the 2 additional through lanes are as follows:

A. As long as CY 2035 average traffic speeds and vehicle mixes do not change from those assumed for CY 2028, future increases in traffic noise levels will be controlled by the 2.9 to 4.6 dB increases associated with the 193 to 290 percent increases in peak hour traffic volumes between the Kualakai Parkway and Old Fort Weaver Road (East) intersections. These noise level increases are expected to occur with or without the 2 additional through lanes.

C. Adding 1 additional lane in each direction alongside the centermost lanes and within the available median space in CY 2035 is predicted to increase predicted CY 2038 noise levels by 0.0 to 0.7 dB above those predicted in Paragraph A. above. No increase is anticipated to occur as a result of the addition of 1 lane in each direction within 70 to 90 feet of the centerline because of the redistribution of traffic toward the median and away from the Rights-of-Way. Also, no increase is anticipated to occur as a result of the addition of 1 lane in each direction at very large distances from the centerline because of the lack of influence of the distribution of traffic within the Rights-of-Way at large distances from the highway centerline.

D. Because the 2 additional traffic lanes will be physically located between the

original 4 traffic lanes of the widened Farrington Highway, the 0.0 to 0.7 dB increase in traffic noise levels outside the Rights-of-Way and attributed to the addition of the 2 additional traffic are predicted to be much lower than those associated with the increase in traffic volumes (2.9 to 4.6 dB) between CY 2028 and CY 2035.

E. Total increases in traffic noise levels from 2028 to 2035 between the Kualakai Parkway and Old Fort Weaver Road (East) intersections of Farrington Highway are expected to range from 3.6 to 5.3 dB if the 2 additional through lanes are implemented in 2035. Worst case setback distances to the 66 Leq contour are predicted to approach 175 to 200 feet from the centerline of the highway by 2035. Planned noise sensitive developments along Farrington Highway will be affected by the growth of the 66 Leq traffic noise contours from CY 2028 to CY 2035.

F. Traffic noise levels will continue to exceed 66 Leq at the Sullivan Care Center by CY 2035. Traffic noise levels will probably remain at less than 66 Leq at Kahi Mohala and Hawaii Tokai International College, where 5.7 to 6.0 dB of margin was forecast by CY 2028 at these other two existing noise sensitive properties.

Let me know if you have any questions regarding these findings.

Sincerely,

Yoichi Ebisu, P.E.

ACOUSTIC STUDY FOR THE FARRINGTON HIGHWAY IMPROVEMENTS PROJECT, KAPOLEI GOLF COURSE ROAD TO FORT WEAVER ROAD; OAHU, HAWAII

Prepared for:

G70

Prepared by:

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JUNE 2019

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CHAPTER 1. SUMMARY

The existing and future traffic noise levels in the environs of the proposed Farrington Highway Improvements Project on the island of Oahu between Kapolei Golf Course Road and Fort Weaver Road were studied to evaluate potential noise impacts associated with the proposed improvements, hereinafter referred to as the Build Alternative. Noise measurements were obtained, traffic noise predictions developed, and potential noise impacts evaluated in accordance with the current Hawaii State Department of Transportation, Highways Division (HDOT) noise impact criteria.

Existing traffic noise levels in the project area currently do not exceed the U.S. Federal Highway Administration (FHWA) and Hawaii State Department of Transportation, Highways Division (HDOT) noise abatement criteria at the closest noise sensitive receptors (Kahi Mohala and Hawaii Tokai International College). Existing traffic noise levels do exceed that criteria at the Sullivan Care Center On the Queen's Medical Center - West Oahu Campus (abbreviated as Sullivan Care Center in this report). This facility is currently being used as a patient treatment facility at the Queen's Medical Center. Future (CY 2028) traffic noise levels with the proposed highway improvement project will continue to exceed the 66 Leq HDOT noise abatement criteria at the Sullivan Care Center. The 66 Leq criteria may also be exceeded at planned future noise sensitive developments along Farrington Highway in CY 2028.

Traffic noise mitigation measures in the form of noise barrier construction may be applied at the Sullivan Care Center. At planned noise sensitive developments along Farrington Highway, the use of adequate setbacks and/or sound attenuating walls may also be applied. The use of sound attenuating walls may not be practical at two-story receptors due to the excessive wall heights (10 to 12 feet) required to attenuate traffic noise at the second floor.

The following general conclusions can be made in respect to the number of impacted structures and lands which can be expected by CY 2028 under the Build Alternative. These conclusions are valid as long as the future vehicle mixes and average speeds do not differ from the assumed values.

- HDOT's "greater than 15 dBA increase" criteria for substantial change in traffic noise levels will not be exceeded at any existing noise sensitive structure.

- With the proposed highway improvements, future traffic noise levels along the mauka and makai Rights-of-Way are expected to exceed the 66 Leq(h) criteria for Activity Categories B or C. At the Fort Weaver Road Intersection, where Rights-of-Way are at 110+ feet distances from the highway centerline, traffic noise levels may not exceed 66 Leq(h) along the Rights-of-Way.

- Planned noise sensitive developments along Farrington Highway may occur within the 66 Leq(h) noise contour, and if so, should incorporate the implementation of traffic noise mitigation measures. Critical distances from the

future highway centerline to the CY 2028 66 Leq(h) contours range from 93 to 119 feet.

- Risks of exceeding the HDOT 71 Leq(h) noise abatement criteria for commercial and light industrial land uses in Activity Category E are considered to be very low, with 72 feet being the setback distance from the highway centerline where the 71 Leq(h) future traffic noise contour is located.

- The additive noise contributions from HART rail transit noise should not be significant at the closest existing noise sensitive receptors at the east end of the project under the current design for HART.

Potential short term construction noise impacts are possible during the project construction period. Minimizing these types of noise impacts is possible using standard curfew periods, properly muffled equipment, administrative controls, and construction barriers as required. If work during the nighttime hours is required to minimize traffic congestion during the normal daytime period, noise impacts are possible at existing noise sensitive receptors located along the makai Right-of-Way. A variance from the existing state noise regulations will be required to perform nighttime work on this project.

In order to minimize construction noise impacts, it is suggested that construction of any sound attenuating wall programmed for this project precede the construction work on the highway improvements.

CHAPTER II. GENERAL STUDY METHODOLOGY

Noise Measurements. Existing traffic and background ambient noise levels at 13 locations in the project area were measured in September 2013 prior to the HART guideway construction at the east end of the project corridor. The traffic noise measurements were used to validate the traffic noise model which was used to calculate the Base Year (CY 2018) and future (CY 2028) traffic noise levels for conditions without and with the highway improvements project. The background ambient noise measurements were used to define existing noise levels at noise sensitive receptors which may be affected by the project. Also, the measurements were used in conjunction with forecast traffic noise levels to determine if future traffic noise levels are predicted to "substantially exceed" existing background ambient noise levels at these noise sensitive receptors, and therefore exceed FHWA and HDOT noise standards and criteria.

The noise measurement locations are shown in Figure II-1. The results of the traffic noise measurements are summarized in Table II-1. In Table II-1, the hourly counts of automobiles, buses, and heavy and medium trucks were obtained in the field during the traffic noise measurement periods. In the table, Leq represents the average (or equivalent), A-Weighted, Sound Level. A list and description of the acoustical terminology used are contained in Appendix B.

Traffic Noise Predictions. The Federal Highway Administration (FHWA) Traffic Noise Model, Version 2.5 (or TNM, see Reference 1 in Appendix A) was used as the primary method of calculating Base Year and future traffic noise levels, with model parameters adjusted to reflect terrain, ground cover, and local shielding conditions. At the 13 traffic noise measurement locations along the project corridor, the measured noise levels were compared with model predictions to insure that measured and calculated noise levels for the existing conditions were consistent and in general agreement.

In Table II-1, the average vehicle speeds entered into the TNM were adjusted to achieve agreement between measured noise levels and those calculated by the TNM. With these input speed adjustments, the agreement between measured and predicted traffic noise levels was considered to be reasonable and sufficiently accurate to formulate the Base Year and future year traffic noise levels. "Pavement" ground attenuation factor was used in the vicinity of measurement Locations Q1 and Q2, and "Loose Soil" ground attenuation factor was used at all other traffic noise measurement locations.

Base Year traffic noise levels were then calculated along the project corridor using Base Year (2018) traffic volume data for the AM and PM peak hours from Reference 2 in Appendix A. Traffic mix by vehicle types and average vehicle speeds for the various sections of the existing and future roadways were derived from observations during the noise monitoring periods and from Reference 2.

PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE II-1

PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

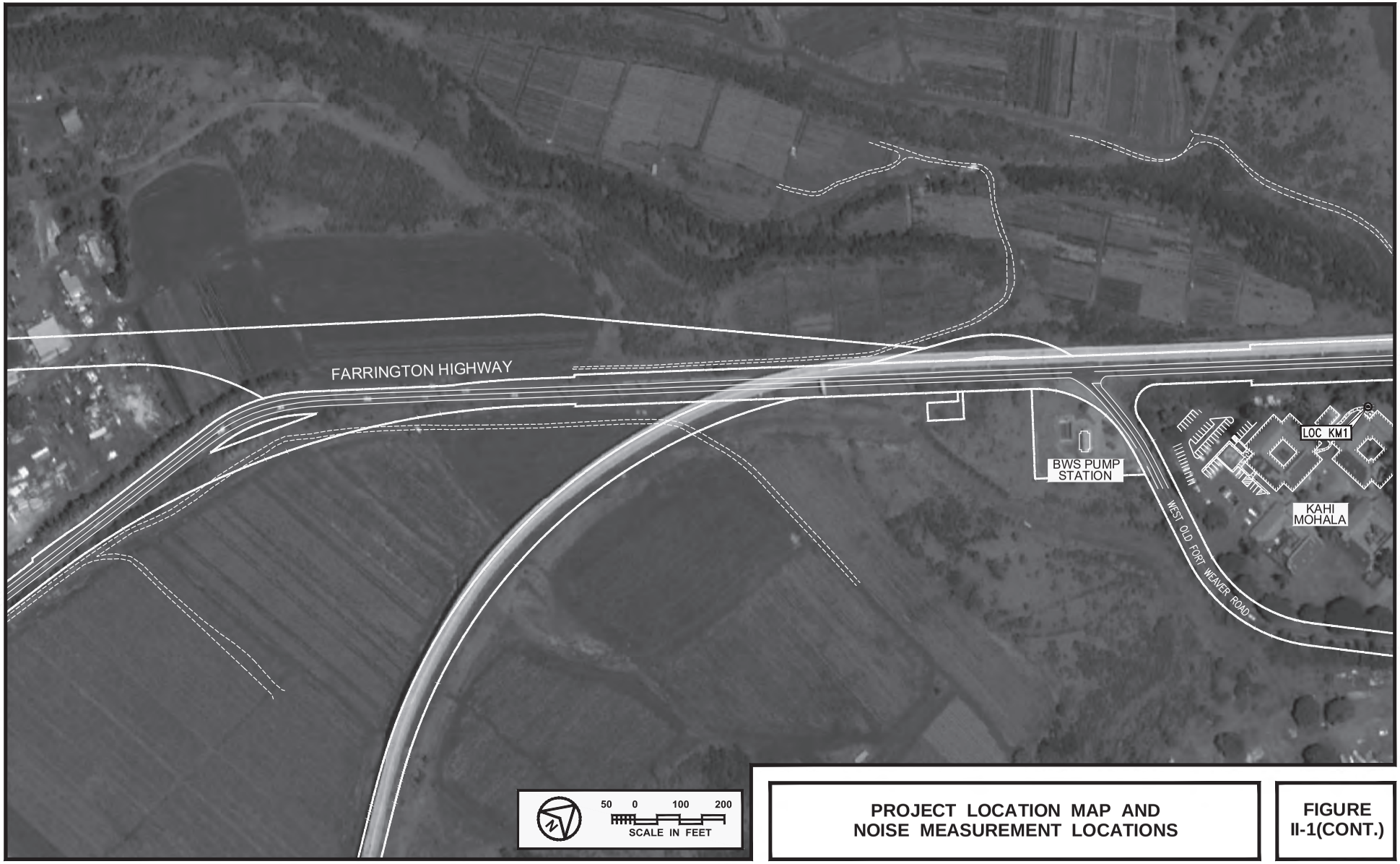
FIGURE II-1(CONT.)

PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE II-1(CONT.)

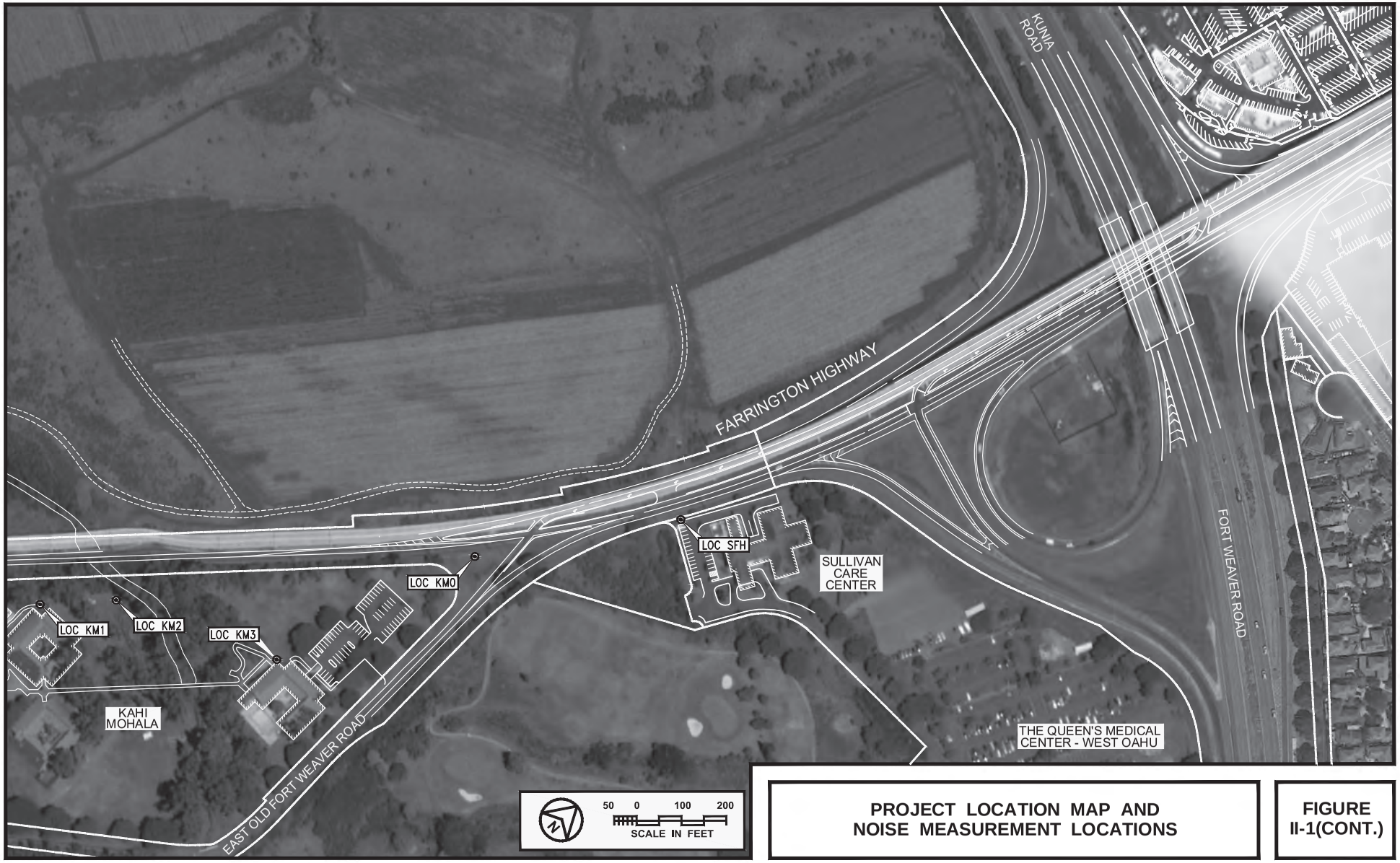
PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE II-1(CONT.)



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE II-1(CONT.)



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE II-1(CONT.)

TABLE II-1
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
Q1 50 FT from the center-line of Farrington High-way at Ameron Yard (9/20/13)	0645 TO 0745	44	469	7	14	65.1	65.2
Q1 50 FT from the center-line of Farrington High-way at Ameron Yard (9/12/13)	1120 TO 1220	45	500	16	16	65.6	66.1
Q2 100 FT from the center-line of Farrington High-way at Ameron Yard (9/12/13)	1120 TO 1220	45	500	16	16	63.1	63.0
Q1 50 FT from the center-line of Farrington High-way at Ameron Yard (9/13/13)	1152 TO 1252	48	554	16	7	66.6	66.6
Q1 50 FT from the center-line of Farrington High-way at Ameron Yard (9/11/13)	1455 TO 1555	43	734	10	8	65.5	66.1

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
Q2 100 FT from the center-line of Farrington Highway at Ameron Yard (9/11/13)	1455 TO 1555	43	734	10	8	63.7	63.0
Q1 50 FT from the center-line of Farrington Highway at Ameron Yard (9/11/13)	1615 TO 1715	44	787	6	4	65.9	66.4
Q2 100 FT from the center-line of Farrington Highway at Ameron Yard (9/11/13)	1615 TO 1715	44	787	6	4	63.9	63.3
Q1 50 FT from the center-line of Farrington Highway at Ameron Yard (9/20/13)	1615 TO 1715	46	621	8	16	66.8	66.8
UH1 50 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	0645 TO 0745	41	806	4	17	65.0	65.5

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
UH2 100 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	0645 TO 0745	41	806	4	17	59.9	59.4
UH1 50 FT from the center-line of Farrington Highway at UH West Oahu (9/12/13)	0819 TO 0919	45	622	10	29	65.0	66.3
UH2 100 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	0819 TO 0919	45	622	10	29	61.0	60.4
UHI 50 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	1200 TO 1300	32	601	10	18	62.6	62.0
UH2 100 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	1200 TO 1300	32	601	10	18	55.8	56.4

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
UH1 50 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	1615 TO 1715	38	891	3	15	64.9	64.6
UH2 100 FT from the center-line of Farrington Highway at UH West Oahu (9/13/13)	1615 TO 1715	38	891	3	15	58.3	58.6
FS1 50 FT from the center-line of Farrington Highway at Fruit Stand (9/12/13)	0948 TO 1048	46	348	11	20	64.5	64.5
FS2 100 FT from the center-line of Farrington Highway at Fruit Stand (9/12/13)	0948 TO 1048	46	348	11	20	58.9	58.7
FS1 50 FT from the center-line of Farrington Highway at Fruit Stand (9/12/13)	1315 TO 1415	51	387	8	27	65.6	66.3

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
FS2 100 FT from the center-line of Farrington Highway at Fruit Stand (9/12/13)	1315 TO 1415	51	387	8	27	61.3	60.4
FS1 50 FT from the center-line of Farrington Highway at Fruit Stand (9/13/13)	1615 TO 1715	44	565	11	6	64.5	64.5
SUB1 50 FT from the center-line of Farrington Highway at HECO Substation (9/13/13)	0702 TO 0802	40	1,172	33	15	67.0	67.1
SUB1 50 FT from the center-line of Farrington Highway at HECO Substation (9/12/13)	1428 TO 1528	40	467	10	10	62.2	63.0
SUB2 100 FT from the center-line of Farrington Highway at HECO Substation (9/12/13)	1428 TO 1528	40	467	10	10	58.0	57.0

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
SUB1 50 FT from the center-line of Farrington Highway at HECO Substation (9/11/13)	1500 TO 1600	47	555	13	15	66.4	65.9
SUB2 100 FT from the center-line of Farrington Highway at HECO Substation (9/11/13)	1500 TO 1600	47	555	13	15	59.2	59.8
SUB1 50 FT from the center-line of Farrington Highway at HECO Substation (9/11/13)	1615 TO 1715	51	553	2	6	65.9	65.9
SUB2 100 FT from the center-line of Farrington Highway at HECO Substation (9/11/13)	1615 TO 1715	51	553	2	6	59.5	59.6
KM0 50 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	0645 TO 0745	47	822	11	23	68.7	67.8

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
KM1	101 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	0645 TO 0745	47	822	11	23	60.4	61.4
KM2	98 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	0645 TO 0745	47	822	11	23	57.3	61.9
KM3	253 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	0645 TO 0745	47	822	11	23	57.7	53.6
KM0	50 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	1023 TO 1123	51	400	16	4	65.1	65.1
KM0	50 FT from the center-line of Farrington Highway At Kahi Mohala (9/13/13)	1430 TO 1530	45	534	18	10	65.5	65.3

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
KM0 50 FT from the center-line of Farrington Highway At Kahi Mohala (9/13/13)	1600 TO 1700	45	552	9	14	65.4	65.2
KM1 101 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	1600 TO 1700	45	552	9	14	58.7	59.0
KM2 98 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	1600 TO 1700	45	552	9	14	56.0	59.7
KM3 253 FT from the center-line of Farrington Highway At Kahi Mohala (9/12/13)	1600 TO 1700	45	552	9	14	55.1	51.6
SFH 74 FT from the center-line of Farrington Highway At Sullivan Care Center (9/13/13)	1023 TO 1123	50	504	14	21	66.9	64.6

TABLE II-1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
SFH	74 FT from the center-line of Farrington High-way At Sullivan Care Center (9/13/13)	1430 TO 1530	50	704	16	33	66.3	66.2

Determinations of the periods of highest hourly traffic volumes along the project corridor were made after reviewing the AM and PM peak hour traffic volumes from Reference 2.

The Equivalent (or Average) Hourly Sound Level [Leq(h)] noise descriptor was used to calculate the Base Year and CY 2028 traffic noise levels as required by Reference 4 in Appendix A. Aerial photo maps, topographic maps, and project plans (where available) of the area were used to determine terrain, ground cover, and local shielding effects from terrain features, which were entered into the noise prediction model.

Future year (2028) traffic noise levels were then developed for the Build Alternative using the future traffic assignments of Reference 3 in Appendix A and the topographic and existing development features described previously. Under the Build Alternative, Farrington Highway was modeled as a 4-lane roadway, with design and posted speed limits of 45 and 35 miles per hour, respectively. Appendix C contains the AM and PM peak hour traffic volumes along Farrington Highway for the Base Year, future year without the improvements, and future year with the highway improvements.

Existing and future traffic noise levels were calculated using the TNM at various existing receptors along Farrington Highway for Base Year and future year traffic volumes and speeds. The results of these calculations were used to identify existing receptor locations where the 66 Leq and 71 Leq HDOT noise abatement criteria levels (see Table II-2) are expected to be exceeded, as well as to indicate the future setback distances to the 66 Leq and 71 Leq HDOT noise abatement criteria levels at planned, but undeveloped lands which are within 250 feet of the future highway baseline.

Impact Assessments and Mitigation. Base Year traffic noise levels were calculated using the FHWA TNM Version 2.5 at existing noise sensitive front row receptors on the makai side of Farrington Highway to establish existing traffic noise levels at these receptors. All receptors were located within 250 feet of the highway's centerline. Existing receptors were located at ground level at the building walls fronting the highway. For undeveloped lands where future development in Activity Categories B, C, and E (see Table II-2) are planned, receptors were located at 90 to 250 foot distances from the future highway centerline to determine the locations of the future 71 and 66 Leq traffic noise contours. The Base Year traffic noise levels at the various receptor locations used in this study were used to identify those receptor locations where the HDOT "15 dBA increase" noise abatement criteria could be exceeded in 2028.

Following the calculations of the Base Year traffic noise levels at receptors within the front row lots, calculations of the 2028 traffic noise levels during the AM and PM peak hours were also made using the FHWA TNM Version 2. Comparisons of predicted future traffic noise levels with FHWA and HDOT noise abatement criteria (see Table II-2) were made to determine specific locations where the noise abatement criteria are expected to be exceeded. HDOT's 66 Leq(h) and the "15 dBA or more

TABLE II-2

FHWA NOISE ABATEMENT CRITERIA
[Hourly A–Weighted Sound Level––Decibels (dBA)]

ACTIVITY CATEGORY	LEQ (h)*	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extra–ordinary significance and serve an important public need and where the preservation of those qualities is essential if the areas are to continue to serve their intended purpose.
B	67 (Exterior)	Residential.
C	67 (Exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libra–ries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, and television studios.
E	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F. Includes undeve–loped lands permitted for this activity category.
F	None	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water re–sources, water treatment, electrical), and warehousing.
G	None	Undeveloped lands that are not permitted.

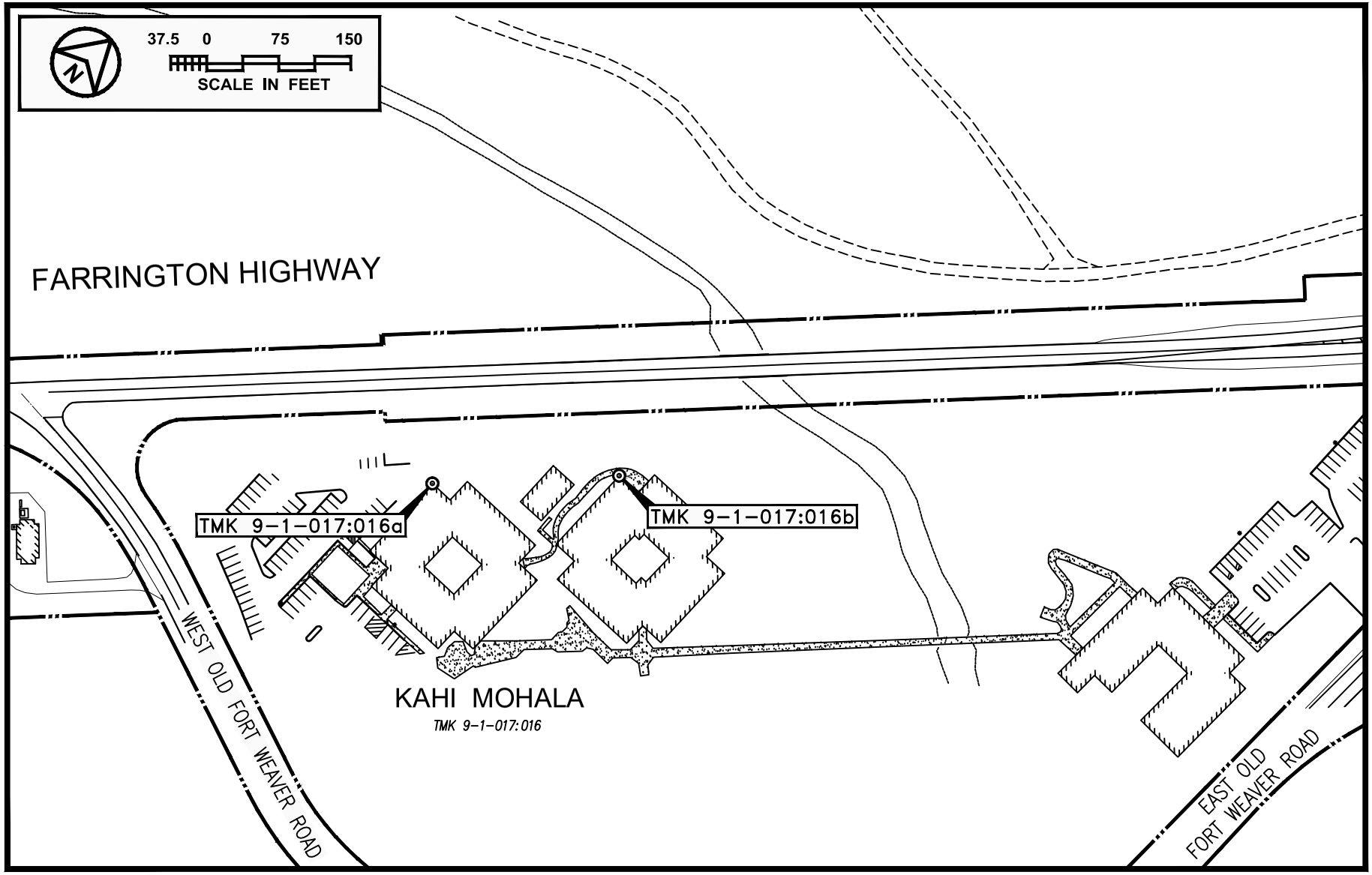
* The Hawaii State Department of Transportation, Highways Division, utilizes Noise Abatement Criteria levels which are 1 Leq unit less than the FHWA values shown.

increase" criteria were both applied to all noise sensitive buildings along the project corridor, since, by Reference 4, HDOT has replaced the FHWA 67 Leq(h) criteria with their 66 Leq(h) criteria. At the commercial or industrial establishments along the project corridor, HDOT's 71 Leq(h) noise abatement criteria was applied to identify commercial receptors where noise abatement measures may also be applied. Where noise mitigation measures may be applied for this project, the effectiveness of sound attenuating barriers and other possible noise mitigation measures were evaluated. The ability to reduce predicted 2028 traffic noise to levels below the HDOT's 66 Leq and 71 Leq were also examined as possible noise mitigation measures.

There were no existing noise sensitive receptors in Activity Category B (Residential) along the existing highway Rights-of-Way. The only existing noise sensitive receptors within 250 feet of the existing or future highway Rights-of-Way were in Activity Category C, at Kahi Mohala and the Sullivan Care Center at the east end of the project (see Figures II-2 and II-3), and at the Hawaii Tokai International College. For receptors in Activity Category C, ground level receptors were located at existing buildings fronting the highway.

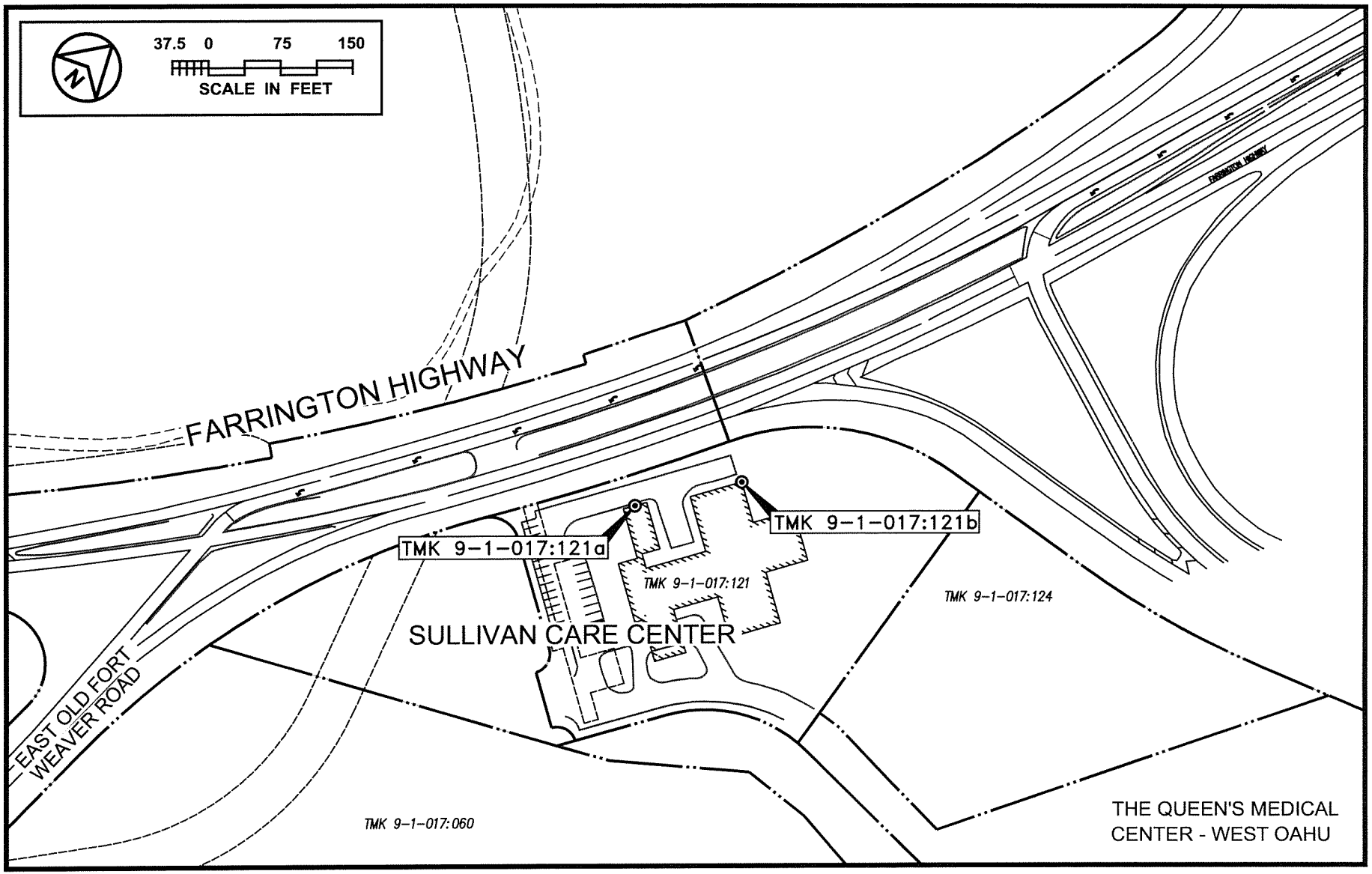
Future noise sensitive receptors in Activity Category B (Hoopili) are planned along the future highway Rights-of-Way where shown in Figure II-4. Also shown in Figure II-4 are the locations of planned commercial and light industrial uses along Farrington Highway. All future study receptors in the planned development areas along Farrington Highway where shown in Figure II-4 were located at 90 feet distance from the future centerline of Farrington Highway under the Build Alternative, or approximately 20 feet from the future Rights-of-Way.

Where the HDOT noise abatement criteria were predicted to be exceeded at existing noise sensitive receptor locations or at future receptor locations located 90 feet from the future highway centerline, the effectiveness of sound attenuating walls were examined as possible noise mitigation measures. These sound attenuating walls were not examined in accordance with the "reasonable" and "feasible" evaluation methodology described in Reference 4 in Appendix A because federal or state funding sources will not be used for this project.



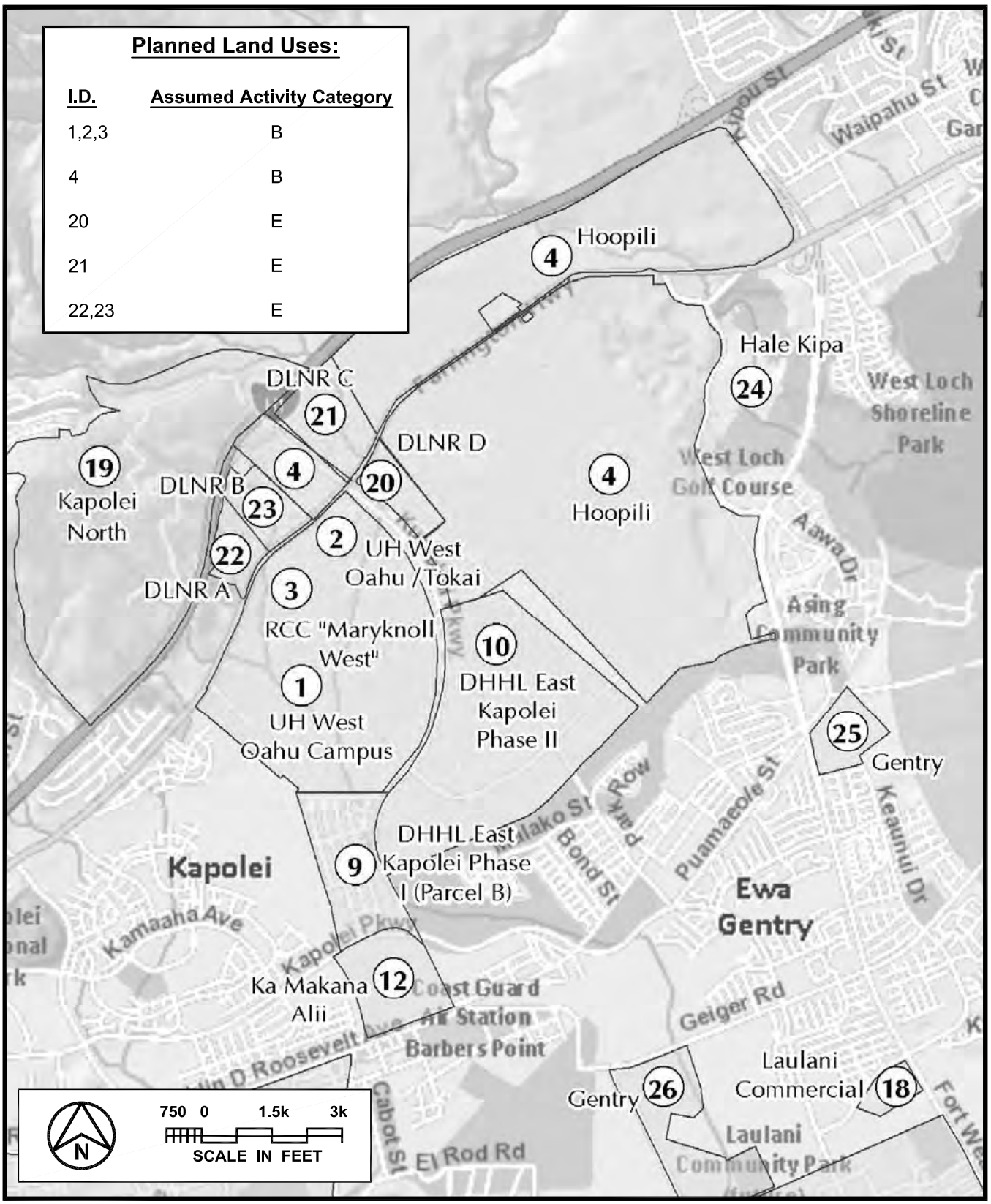
NOISE SENSITIVE RECEPTOR LOCATIONS AT KAHI MOHALA

FIGURE II-2



NOISE SENSITIVE RECEPTOR LOCATIONS AT SULLIVAN CARE CENTER

FIGURE II-3



PLANNED DEVELOPMENTS ALONG PROJECT CORRIDOR (2028)

FIGURE II-4

CHAPTER III. EXISTING ACOUSTICAL ENVIRONMENT

For the purposes of this study, 2018 was used as the Base Year for computing changes in traffic noise levels associated with the Build Alternative in CY 2028. The Base Year noise environment along the Farrington Highway project corridor from Kapolei Golf Course Road to Fort Weaver Road was described by computing the Hourly Equivalent Sound Levels [Leq(h)] along the existing highway during the AM and PM peak hour periods for the 2018 time period. During the Base Year, the only noise sensitive developments within the limits of project construction and within 250 feet of the highway centerline were Hawaii Tokai International College, Kahi Mohala, and the Sullivan Care Center, all located on the makai side of the highway. Hawaii Tokai International College is located southwest of the intersection with Kualakai Parkway, but at relatively large setback distance from the highway. Kahi Mohala and the Sullivan Care Center are both located at the east end of the project, and at relatively short distances from the highway. These existing noise sensitive developments are in Activity Category C (see Table II-2), and there were no noise sensitive developments in the residential Activity Category B during the Base Year. The remaining lands were in Activity Categories F (agriculture and utilities) and G (undeveloped).

Table III-1 presents the results of calculations of Base Year traffic noise levels at 50, 100, 150, 200, and 250 feet from the centerline of Farrington Highway during the AM and PM peak traffic hours. The assumptions for average speeds, hourly traffic volumes, and traffic mix for each roadway segment are also shown in Table III-1. Table III-2 presents the calculated setback distances of the 66 and 71 Leq traffic noise contours from the centerline of Farrington Highway during the Base Year.

Table III-3 presents the results of the calculations of existing traffic noise levels at all existing front row receptors in Activity Category C which are located on the makai side of Farrington Highway within 250 feet of the highway baseline and within the limits of project construction. Each receptor location is identified by the Tax Map Key of the parcel on which the receptor is located. Figures II-2 and II-3 depict the locations of the closest receptors to the highway at the east end of the project. Figure II-1 depicts the closest Multi-Purpose and Classroom buildings of Hawaii Tokai International College. Typically, the receptor was centered at a single building's wall (or corner) closest to the highway, and located on the building's wall (or corner) facing the highway.

Also included in Table III-3 is the applicable Activity Category (from Table II-2) at each receptor. Where existing or future traffic noise levels exceed the HDOT Noise Criteria level associated with each Activity Category, a single asterisk is shown for that receptor location. The Base Year traffic noise level calculations shown in Table III-1 were used to serve as existing traffic noise levels for determining the increase in future traffic noise levels at each receptor location by 2028 following completion of the proposed Farrington Highway Improvements Project.

TABLE III-1

EXISTING (CY 2018) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS SECTIONS OF FARRINGTON HIGHWAY (AM AND PM PEAK HOURS)

FARRINGTON HIGHWAY	SPEED (MPH)	TOTAL VPH	***** VOLUMES (VPH) ***** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq	250' Leq
AM PEAK:									
West of Kapolei Golf Course Rd.	44	660	632	9	19	66.4	63.3	59.9	58.7
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	41	667	650	3	14	64.5	59.0	53.2	50.8
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	40	872	838	17	17	65.6	60.1	54.3	51.9
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver R	47	859	825	11	23	67.6	62.1	56.1	53.6
East of E. Old Ft. Weaver Rd.	50	975	912	25	38	69.4	63.9	58.0	55.6
PM PEAK:									
West of Kapolei Golf Course Rd.	44	913	879	11	23	67.7	64.6	61.2	60.0
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	46	966	930	12	24	67.8	62.3	56.3	53.8
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	51	707	679	14	14	67.7	62.1	55.9	53.3
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver R	45	700	672	11	17	66.1	60.6	54.7	52.3
East of E. Old Ft. Weaver Rd.	50	928	868	19	41	69.3	63.8	57.9	55.5

TABLE III-2

YEAR 2018 AND 2028 DISTANCES TO 66 AND 71 LEQ CONTOURS (AM AND PM PEAK HOUR)

STREET SECTION	66 Leq SETBACK (FT)		71 Leq SETBACK (FT)	
	EXISTING	CY 2028	EXISTING	CY 2028
AM PEAK HOUR:				
West of Kapolei Golf Course Rd.	55	153	18	61
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	41	101	22	60
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	48	101	25	60
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver Rd.	61	94	33	57
East of E. Old Ft. Weaver Rd.	77	104	41	62
PM PEAK HOUR:				
West of Kapolei Golf Course Rd.	73	200	24	79
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	63	119	33	72
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	62	109	33	66
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver Rd.	51	93	27	56
East of E. Old Ft. Weaver Rd.	76	109	40	64

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See Tables III-1 and IV-1 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Pavement ground conditions assumed west of Kapolei Golf Course Road. Loose soil ground conditions assumed along all other sections of Farrington Highway.

TABLE III-3

EXISTING AND FUTURE TRAFFIC NOISE LEVELS
(4.92 FT RECEPTOR, PM PEAK HOUR)

RECEPTOR LOCATION (FARRINGTON HIGHWAY MAKAI)	ACTIVITY CATEGORY	EXISTING (CY 2018) Leq	FUTURE (CY 2028) Leq
Receiver TMK 9-1-017:016a (Kahi Mohala)	C	59.3	60.0
Receiver TMK 9-1-017:016b (Kahi Mohala)	C	59.5	60.3
Receiver TMK 9-1-017:121a (Sullivan Care Center)	C	66.2*	66.6*
Receiver TMK 9-1-017:121b (Sullivan Care Center)	C	64.9	65.6
Receiver TMK 9-1-016:221 (Multi-Purpose Bldg., Hawaii Tokai International College)	C	56.1	60.0

Note:

* Exceeds HDOT 66 Leq(h) noise abatement threshold.

From the results shown in Table III-3, it was concluded that the HDOT 66 Leq(h) noise abatement criteria was exceeded in the project area at one noise sensitive receptor location fronting the makai Right-of-Way during the Base Year at the Sullivan Care Center. Base Year traffic noise levels at the east end of the project corridor exceeded the HDOT abatement criteria of 66 Leq at the lands in Activity Category C (see Table II-2) which are within 61 to 77 feet of the highway baseline and which have direct lines of sight to the highway lanes.

East of Kapolei Golf Course Road, the majority of the existing areas planned for future development are currently in undeveloped, formerly agricultural lands. Lands which are currently developed along Farrington Highway are being used for industrial, agricultural, health care, and educational uses. Base Year noise levels at one of the two health care facilities currently exceed 66 Leq, primarily due to the relatively small setback distance to Farrington Highway. The Sullivan Care Center is the only noise sensitive receptor location where Base Year traffic noise levels currently exceed 66 Leq. The Kahi Mohala and two college facilities are located at adequate setback distances from Farrington Highway so as to not be impacted by traffic noise.

CHAPTER IV. DESCRIPTION OF FUTURE TRAFFIC NOISE LEVELS

The future traffic noise levels in the immediate vicinity of the project during CY 2028 were evaluated for the Build Alternative. Figure II-4 depicts the assumed land uses along Farrington Highway by CY 2028, with U.H. West Oahu and Tokai University (#1 and #2) considered existing land uses in 2018. Not shown in Figure II-4 are the existing Kahi Mohala and the Sullivan Care Center, which are located north of Hale Kipa (#24), and are shown along Farrington Highway in Figures II-2 and II-3.

The same methodology that was used to calculate the Base Year noise levels was also used to calculate the Year 2028 noise levels. Appendix C and Table IV-1 provide the 2028 traffic volumes, average speeds, and vehicle mixes which were used to calculate the future traffic noise levels following completion of the Farrington Highway Improvements Project. The AM morning traffic peak as well as the PM afternoon traffic peak were used to calculate future traffic noise levels at all receptors on the makai and mauka sides of the highway.

By 2028, Farrington Highway under the Build Alternative will have two eastbound and two westbound lanes with a 48' wide median, and typically located within a 140' wide Right-of-Way. Under the No Build Alternative, Farrington Highway will remain as a two-lane roadway. The primary objective of this noise study was to determine the future traffic noise levels following completion of the Farrington Highway Improvements Project in CY 2028, their potential noise impacts on existing and planned noise sensitive receptors, and to identify possible noise mitigation measures where future traffic noise levels exceed the HDOT noise abatement criteria.

Table IV-1 presents the results of the traffic noise level predictions for the AM and PM peak hours and at the front row receivers for 2028 following completion of the Farrington Highway Improvements Project without the addition of sound attenuating walls. The receptor elevations were assumed to be identical to the highway pavement, and located at 90, 150, 200, and 250 feet distances from the centerline of the improved highway. As indicated in Table IV-1, the HDOT 66 Leq(h) noise abatement threshold will be exceeded at 20 feet beyond the mauka and makai Rights-of-Way by CY 2028 under the Build Alternative. As indicated in Table III-2, the 66 Leq(h) traffic noise contour is anticipated to range from 93 to 119 feet from the highway centerline within the Limits of Project Construction between Kapolei Golf Course Road and Fort Weaver Road. Again from Table III-2, the 71 Leq(h) noise contour will typically remain within the highway Rights-of-Way or within the 10-foot setback line from the highway Rights-of-Way. Traffic noise mitigation measures should also be applied at any future receptor locations in Activity Categories B and C which are located within the applicable 66 Leq(h) traffic noise contour setback distances shown in Table III-2.

As shown in Table III-3, the 66 Leq(h) noise abatement threshold is expected to continue to be exceeded at the Sullivan Care Center. Traffic noise mitigation measures

TABLE IV-1

FUTURE (CY 2028) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS SECTIONS OF FARRINGTON HIGHWAY (BUILD; AM AND PM PEAK HOURS)

FARRINGTON HIGHWAY	SPEED (MPH)	TOTAL VPH	***** VOLUMES (VPH) ***** AUTOS	M TRUCKS	H TRUCKS	90' Leq	150' Leq	200' Leq	250' Leq
AM PEAK:									
West of Kapolei Golf Course Rd.	45	1,630	1,560	23	47	68.9	66.1	64.6	63.4
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	45	1,883	1,834	9	40	67.1	62.1	59.4	56.9
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	45	1,813	1,741	36	36	67.1	62.1	59.4	56.8
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver R	45	1,455	1,397	19	39	66.4	61.3	58.7	56.2
East of E. Old Ft. Weaver Rd.	45	1,600	1,496	42	62	67.4	62.4	59.8	57.4
PM PEAK:									
West of Kapolei Golf Course Rd.	45	2,360	2,273	28	59	70.3	67.5	66.0	64.9
Between Kapolei Golf Course Rd. & Kualakai Pkwy.	45	2,580	2,484	31	65	68.8	63.7	61.1	58.6
Between Kualakai Pkwy. & W. Old Ft. Weaver Rd.	45	2,135	2,049	43	43	67.9	62.8	60.1	57.6
Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver R	45	1,435	1,378	23	34	66.3	61.2	58.5	56.0
East of E. Old Ft. Weaver Rd.	45	1,740	1,626	37	77	67.8	62.9	60.3	58.0

may also be applied at this receptor location.

The following general conclusions can be made in respect to the number of impacted structures and lands which can be expected by CY 2028 under the Build Alternative. These conclusions are valid as long as the future vehicle mixes and average speeds do not differ from the assumed values.

- The only existing noise sensitive facility where future traffic noise levels are expected to exceed the HDOT 66 Leq(h) threshold is the Sullivan Care Center.

- Existing schools, parks, or other public use facilities should not be impacted by future traffic noise levels under the Build Alternative.

- Existing and future commercial and/or light industrial facilities are not expected to be impacted by future traffic noise levels under the Build Alternative.

- Planned noise sensitive residences and school buildings may be impacted by future traffic noise levels under the Build Alternative if they are located within the 66 Leq(h) traffic noise contour without noise mitigation measures. These planned receptors are identified in Figure II-4.

CHAPTER V. EVALUATIONS OF POSSIBLE NOISE MITIGATION MEASURES

In addition to the construction of sound attenuating walls along the mauka and makai sides of the highway, other possible noise mitigation measures considered included the following:

A. Restricting the Growth In the Number of Noisy Buses, Heavy Trucks, Motorcycles, and Automobiles with Defective Mufflers. The percentage contribution to the total traffic noise by heavy trucks, buses, and noisy vehicles is currently between 45 to 56 percent, and elimination of these noise sources would reduce total traffic noise levels by 2 to 4 Leq(h) units. However, restricting the growth rate of these heavy vehicles (to growth rates below passenger automobile growth rates) could produce noise reductions in the order of 1.2 dBA or less, which are not considered significant for the level of regulatory efforts required.

B. Alteration of the Horizontal Or Vertical Alignment of the Roadway. Major alterations of the horizontal or vertical alignment of the existing highway was not considered appropriate due to the scope of this roadway improvement project and due to the Right-of-Way constraints on both sides of the highway. The existing Hawaiian Electric Company substation mauka of Farrington Highway probably places highway realignment constraints toward the north. Future noise abatement measures may be required on both the mauka and makai sides of the highway. Most of the lands mauka and makai of Farrington Highway are currently undeveloped, so realignment of the highway is not a pressing requirement. At the east end of the project corridor, where future noise impacts are predicted at existing noise sensitive receptors, existing intersections place constraints on the horizontal or vertical realignment of Farrington Highway. For these reasons, realignment of Farrington Highway away from the affected noise sensitive structures was not considered to be a reasonable noise mitigation measure.

C. Acquisition of Property Rights for Construction of Noise Barriers, and/or Construction of Noise Barriers Along the Right-of-Way. For single story, noise sensitive buildings, construction of a sound attenuating wall along the Right-of-Way is normally the preferred noise mitigation measure. The 5 to 7 dBA of noise attenuation achievable with a 6 to 8 feet high wall may be sufficient for single story structures. Because the Sullivan Care Center is a one-story structure, construction of a sound attenuating barrier along the makai Right-of-Way could possibly provide sufficient noise reduction benefits at the affected low-rise structure which fronts the highway. It should also be noted that sound barriers will block the views to and from the highway and beyond which the tenants and/or land owner may enjoy and/or prefer. For these reasons, concurrence from the affected property owner and tenant should be obtained prior to construction of sound barriers as a noise mitigation measure.

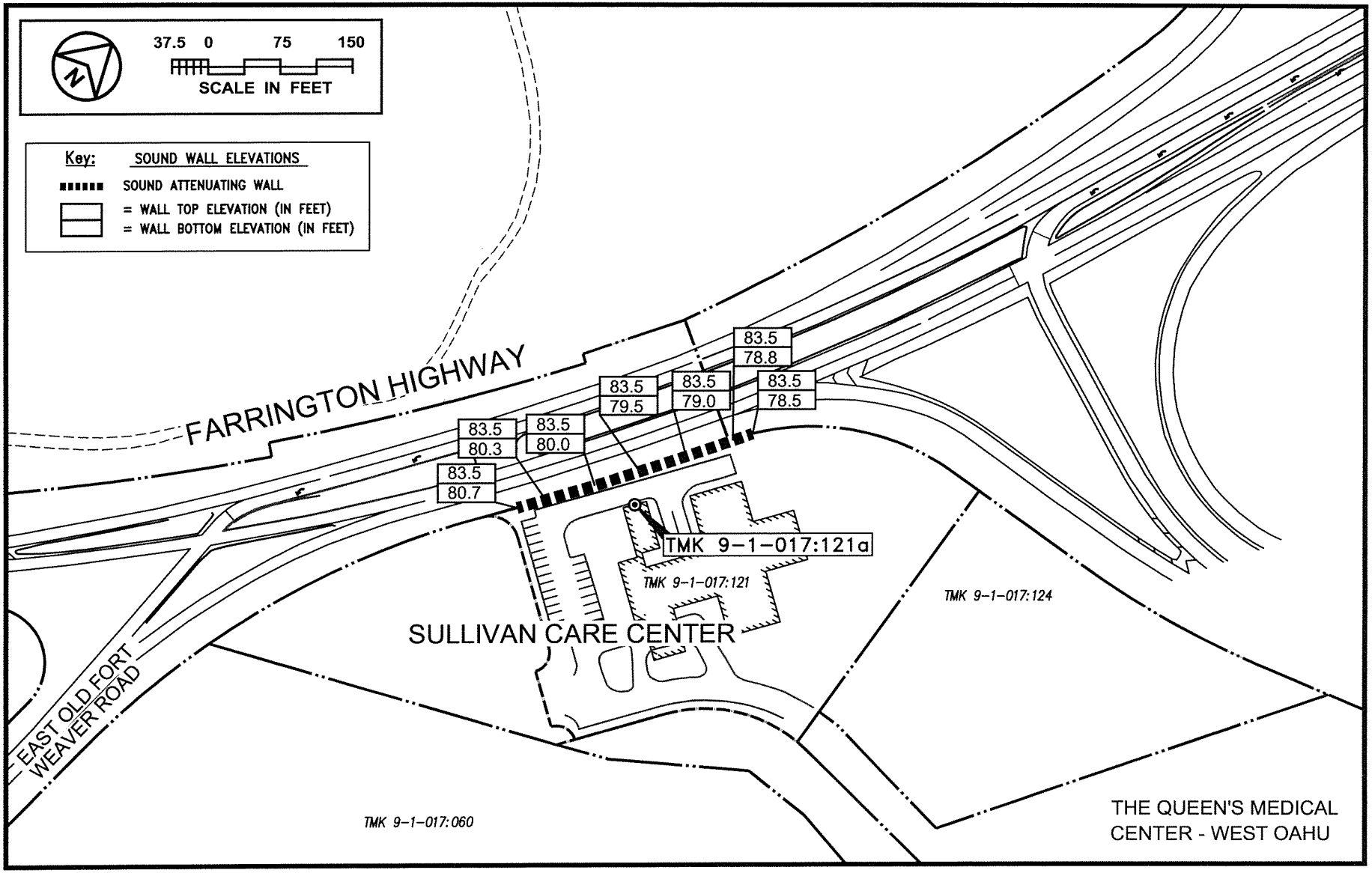
D. Acquisition of Real Property Interests To Serve As A Noise Buffer Zone. Where tall (or multistory) structures are expected to be impacted by future traffic noise, the use of sound attenuating barriers (see para. C above) will not be practical due to the excessive heights required to shield the upper levels from traffic noise. Acquisition of the real property interests to serve as noise buffer zones were considered. However, noise buffer zones extending approximately 93 to 119 feet from the highway's baseline and at substantial cost would be required to meet the HDOT 66 Leq criteria. In general, the acquisition of property for the creation of noise buffer zones for noise mitigation has seldom been applied in Hawaii.

E. Noise Insulation of Public Use or Nonprofit Institutional Structures. The noise insulation of public use buildings impacted by noise as a result of this project should also be considered as a noise abatement measure for this project. Noise insulation of public use or nonprofit institutional structures in the form of closure and air conditioning may be preferable over the construction of sound attenuating walls. The existing interior spaces of the Sullivan Care Center of Saint Francis Hospice presently benefits from closure and air conditioning. The application of sound attenuating walls has the added benefit of reducing traffic noise levels in the exterior areas of the public use properties.

Future traffic noise levels in CY 2028 which are expected to exceed the HDOT noise abatement criteria at existing noise sensitive receptor locations are indicated by a single asterisk in the rightmost column of Table III-3. The sound attenuation performance of a 5 feet tall sound barrier located on the makai Right-of-Way, was tested at one of the two receptor locations listed in Table III-3, and which is shown in Figure V-1. The 5 feet tall sound barrier shown in Figure V-1 is capable to reducing the future traffic noise levels from 66.6 to 65.2 Leq(h) and to less than 66 Leq(h) at the Sullivan Care Center of Saint Francis Hospice. Increasing the wall height shown in Figure V-1 by 2 feet should result in an additional 2 dB reduction in future traffic noise levels at the hospice.

At other locations along the project corridor where future noise sensitive residences in Activity Category B are planned, the minimum wall heights for one and two story dwellings were calculated for walls located along the highway Right-of-Way. These results are tentative, since final elevations of the future buildings are not known. For single story residences located at approximately 90 feet from the future highway centerline, a minimum wall height of 6 feet will be required along the highway Right-of-Way to reduce future traffic noise levels to less than 66 Leq(h). For upper floor receptors of two-story buildings, the corresponding minimum wall height increases to a range of 10 to 12 feet.

The HART (Honolulu Authority for Rapid Transportation) guideway is located near the centerline of Farrington Highway, and it will add to rail transit noise to the roadway traffic noise levels from the highway. Without mitigation of rail transit noise,



NOISE SENSITIVE RECEPTOR LOCATIONS AND HEIGHT OF SOUND ATTENUATING WALL AT SULLIVAN CARE CENTER

FIGURE V-1

the predicted contribution of rail noise during the PM peak traffic hour is estimated to be 59.7 Leq(h) at the Sullivan Care Center of Saint Francis Hospice. With mitigation of rail transit noise as designed (see Appendix A, Reference 5), the predicted contribution of rail noise during the PM peak traffic hour is estimated to be 13 dB lower at 46.7 Leq(h) at the Sullivan Care Center of Saint Francis Hospice. If such is the case, the contribution of HART rail transit noise should not increase total Farrington Highway plus HART noise levels above those used in this highway noise study for Farrington Highway alone.

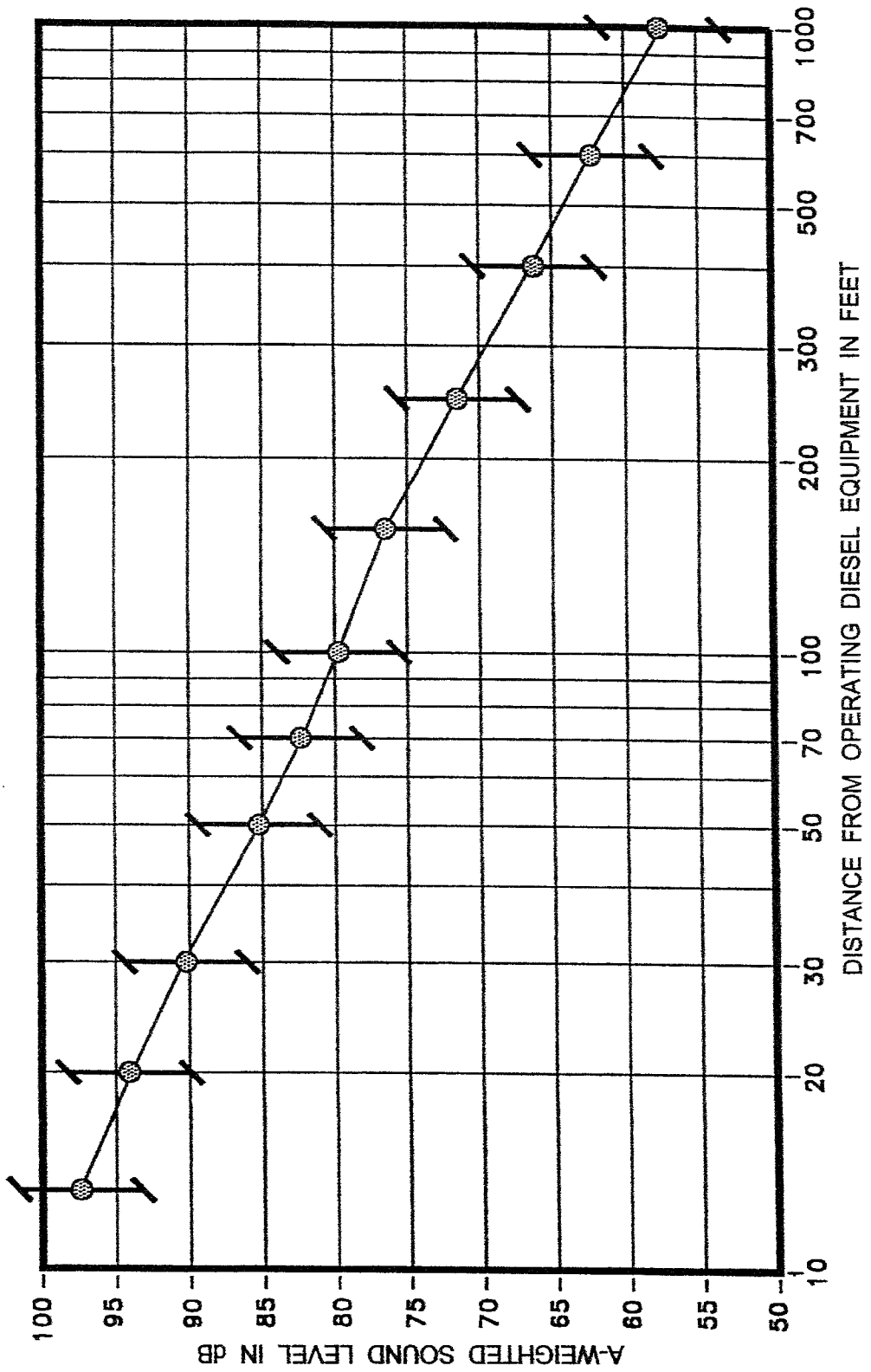
CHAPTER VI. CONSTRUCTION NOISE IMPACTS

Short-term noise impacts associated with construction activities along the highway corridor between Kapolei Golf Course Road and Fort Weaver Road may occur. The greatest impacts are expected to occur at the east end of the project corridor on the makai side of the project where existing noise sensitive receptors are located at relatively short distances from the makai Right-of-Way. Risks of adverse noise impacts during construction should be lower at the existing Hawaii Tokai International College, which is located at 200+ feet from highway centerline. The total duration of the construction period for the proposed project is not known, but noise exposure from construction activities at any one receptor location is not expected to be continuous during the total construction period.

Noise levels of diesel powered construction equipment typically range from 80 to 90 dBA at 50 FT distance. Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure VI-1. The maximum impulsive noise levels of rock breaking equipment (such as hoe rams) can be 5 to 8 dBA greater than those shown in Figure VI-1. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project work areas.

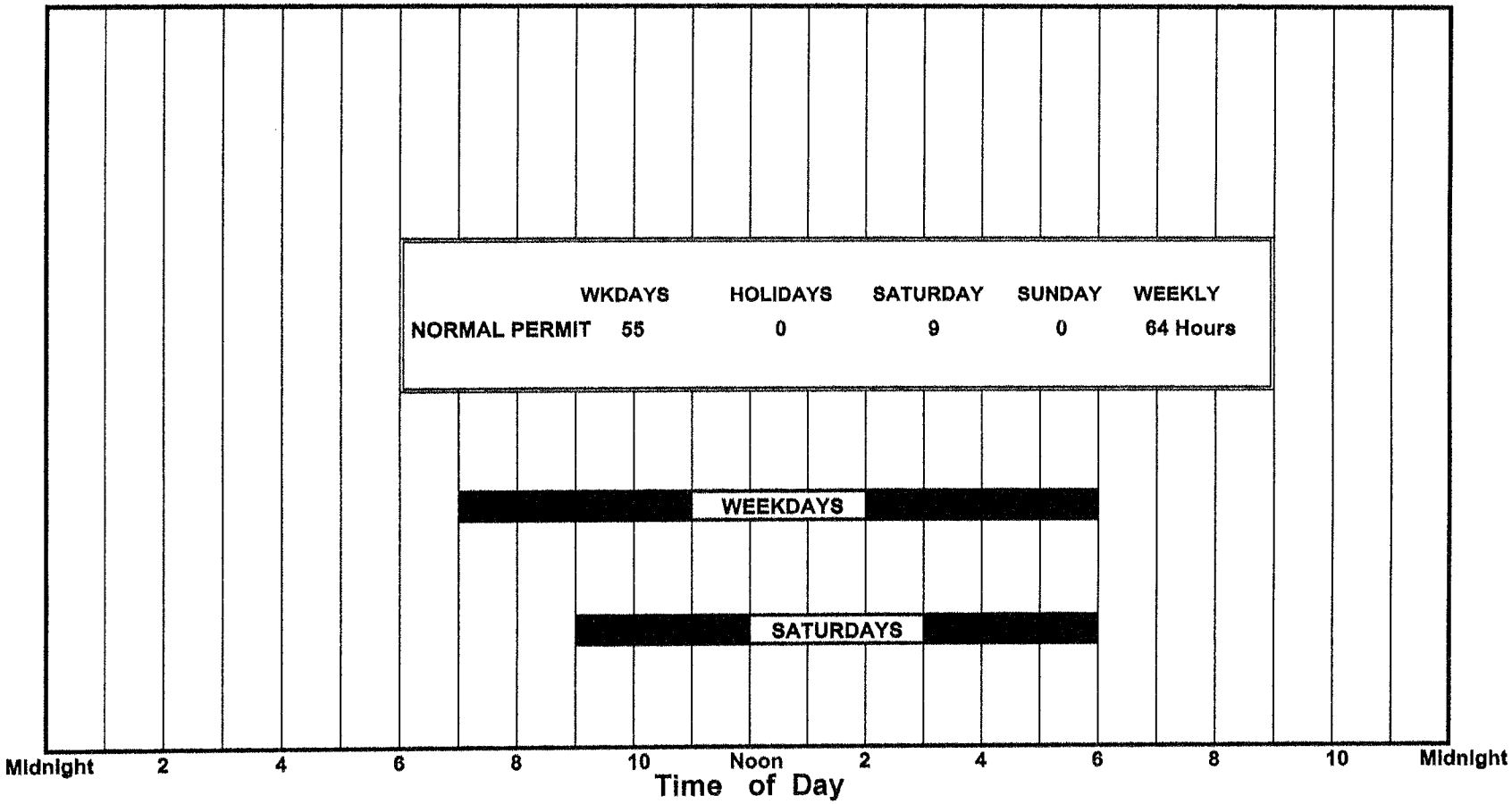
Construction noise levels at the closest existing structure of Sullivan Care Center can intermittently exceed 90 dBA when work is being performed at Farrington Highway's makai Right-of-Way. These noise levels are relatively high and may intermittently exceed 70 dBA within air conditioned spaces of the hospice. If a sound attenuating wall is programmed for this location to mitigate highway traffic noise, it should be constructed prior to major earthwork activities associated with the highway construction. The State Department of Health currently regulates noise from construction activities under a permit system (Reference 6). Under current permit procedures (see Figure VI-2), noisy construction activities are restricted to hours between 7:00 AM and 6:00 PM, from Monday through Friday, and exclude certain holidays. Noisy construction activities are normally restricted to the hours of 9:00 AM to 6:00 PM on Saturdays, with construction not permitted on Sundays. These restrictions minimize construction noise impacts on noise sensitive receptors (such as residences) along the roadway project corridor, and have generally been successfully applied. In this way, construction noise impacts on noise sensitive receptors can be minimized.

In addition, the use of quieted portable engine generators and diesel equipment should be specified for use within 500 FT of noise sensitive properties. Heavy truck and equipment staging areas should also be located at areas which are at least 500 FT from noise sensitive properties whenever possible. Truck routes which avoid residential communities should be identified wherever possible.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE VI-1



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE VI-2

APPENDIX A. REFERENCES

(1) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(2) May 8, 2018 AM and PM Traffic Counts at Existing Farrington Highway Intersections; Quality Counts, LLC; Received April 18, 2019 from G70.

(3) 2028 AM and PM Traffic Projections at Existing Farrington Highway Intersections for No-Build and Build Alternatives; Synchro 10 Report; Received April 24, 2019 from G70.

(4) "Highway Noise Policy and Abatement Guidelines;" State of Hawaii, Department of Transportation, Highways Division and U.S. Department of Transportation, Federal Highway Administration; April 18, 2016.

(5) "Noise and Vibration Technical Report;" Honolulu High-Capacity Transit Corridor Project; City and County of Honolulu; October 1, 2008.

(6) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR (2018) AND FUTURE YEAR (2028) TRAFFIC VOLUMES

ROADWAY LANES	**** EXISTING *****		NO BUILD (CY 2028)		BUILD (CY 2028)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Farrington Hwy.- West of Kapolei Golf Course Rd. (EB)	427	328	505	425	910	1,030
Farrington Hwy.- West of Kapolei Golf Course Rd. (WB)	233	585	350	650	720	1,330
Two-Way	660	913	855	1,075	1,630	2,360
Farrington Hwy.- Between Kapolei Golf Course Rd. & Kualakai Pkwy. (EB)	423	381	528	473	963	1,258
Farrington Hwy.- Between Kapolei Golf Course Rd. & Kualakai Pkwy. (WB)	244	586	365	660	920	1,323
Two-Way	667	966	893	1,133	1,883	2,580
Farrington Hwy.- Between Kualakai Pkwy. & W. Old Ft. Weaver Rd. (EB)	648	309	748	388	1,138	1,018
Farrington Hwy.- Between Kualakai Pkwy. & W. Old Ft. Weaver Rd. (WB)	224	399	318	473	675	1,118
Two-Way	872	707	1,065	860	1,813	2,135
Farrington Hwy.- Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver Rd. (EB)	639	324	735	375	935	720
Farrington Hwy.- Between W. Old Ft. Weaver Rd. & E. Old Ft. Weaver Rd. (WB)	220	376	265	430	520	715
Two-Way	859	700	1,000	805	1,455	1,435
Farrington Hwy.- East of E. Old Ft. Weaver Rd. (EB)	712	369	815	430	1,020	800
Farrington Hwy.- East of E. Old Ft. Weaver Rd. (WB)	263	559	325	655	580	940
Two-Way	975	928	1,140	1,085	1,600	1,740

Appendix E

Traffic Impact Analysis Report

Farrington Highway Improvements Study

Version 4

May 18, 2020

City and County of Honolulu
Department of Design and Construction
650 S. King Street
Honolulu, HI 96813

Farrington Highway Improvements Study

Project No:	460223
Document Title:	Farrington Highway Improvements Study
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1. Introduction

This report describes the existing (2018) and future (2028, 2035) traffic operations for the Farrington Highway corridor and the Interstate H-1 (H-1) interchange at Kualakai Parkway. The existing year condition assesses current traffic counts on a two-lane configuration on Farrington Highway between Old Fort Weaver Road and Kapolei Golf Course Road. The future scenarios include forecasted background traffic volumes based on historic growth and future development, which includes anticipated vehicle trips generated by phased, programmed land uses in and around Kapolei. Farrington Highway varies between the current two-lane configuration and a four-lane or six-lane configuration in the future year analyses. This report also documents multimodal conditions along Farrington Highway assuming various physical improvements to the roadway.

1.1 Project Description

The City and County of Honolulu Department of Design and Construction (DDC) is proposing improvements to an existing two-lane section of Farrington Highway between Old Fort Weaver Road and Kapolei Golf Course Road. The purpose of the project is to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation options for all users. This approximately three-mile section of the roadway is the final remaining piece of Farrington Highway between Kapolei and Waipahu that is currently unimproved, with no sidewalks, curbs, gutters, medians, turn lanes, or bike lanes. Considered a secondary route connecting Kapolei and Waipahu, this section of the highway creates a potential bottleneck between the two regions in which Farrington Highway currently has four lanes. The remaining undeveloped areas, particularly along Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road, are slated for developments by both public and private sectors.

1.2 Multimodal Approach

The City and County of Honolulu has adopted plans and policies that shape the transportation framework. The overall goals of these policies are to achieve an effective, sustainable, multimodal transportation system that is safe and convenient for all users of the roadway, including pedestrians, bicyclists, motorists, persons with disabilities, users and operators of public transit, seniors, children, and movers of commercial goods. The proposed improvements will be consistent with the surrounding area by expanding the existing roadway system that includes a multimodal approach of including sidewalks and bike lanes to help provide connectivity and support walking, biking and transit use.

1.3 Study Area

The project's traffic study area extends along Farrington Highway between Old Fort Weaver Road to the east and Fort Barrette Road to the west, in addition to two ramp terminal intersections on H-1 at Kualakai Parkway. A total of eight intersections and seven roadway segments within the defined study area are analyzed to help understand and interpret regional travel pattern shifts that may result from future developments and highway design modifications. Improvements to the Old Fort Weaver Road (West and East Loop) intersections are proposed with this project, and enhancements to other existing and future intersections along Farrington Highway are anticipated with the future developments. These intersections and their designs will be analyzed by the appropriate agencies when the access for the future developments are requested. The future traffic from the future developments has been included in this study, as discussed in Section 2 – Methodology. Figure 1 shows the study area.

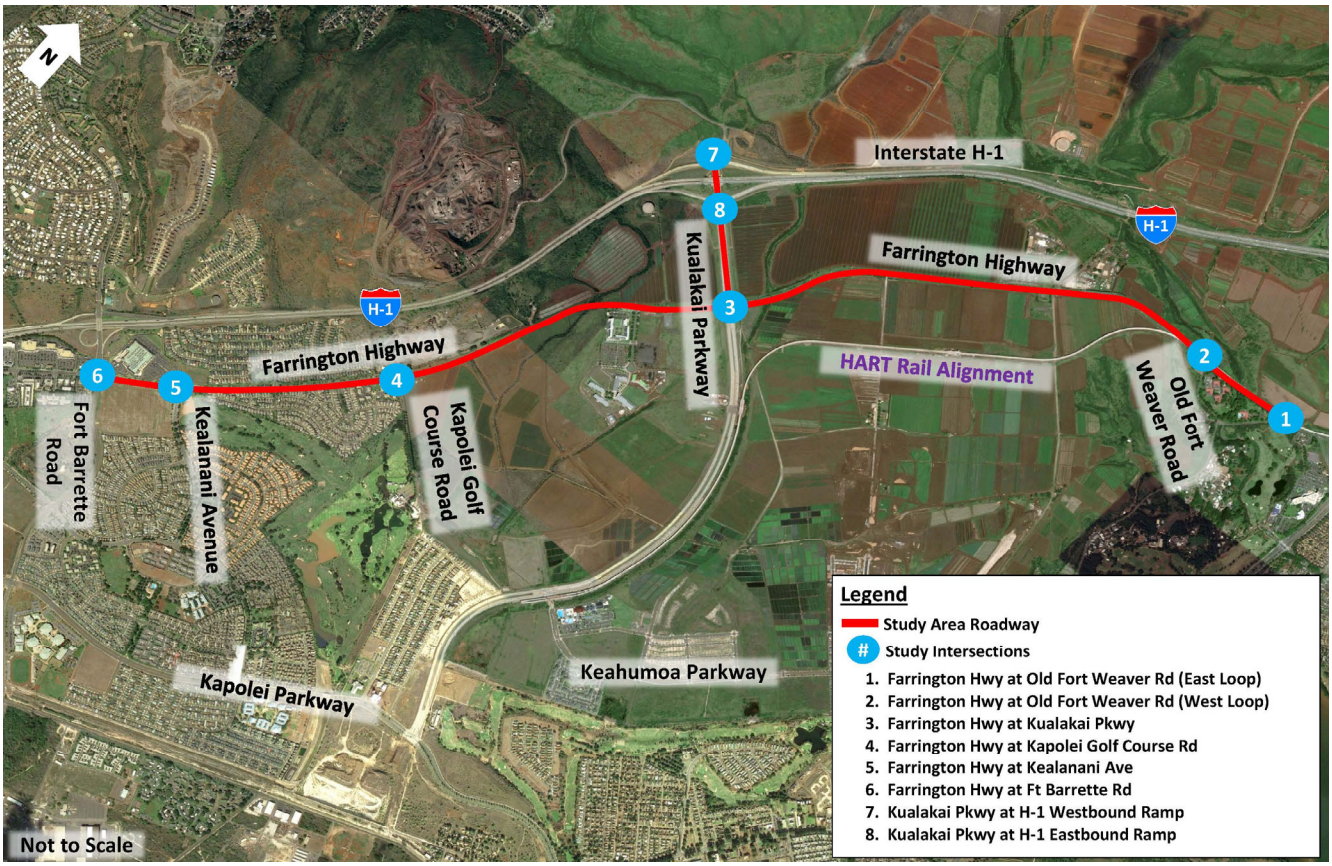


Figure 1 – Traffic Operations Study Area

2. Methodology

The multimodal traffic study comprises of the following major steps:

- Examines existing traffic operating conditions (2018);
- Forecasts travel demand for 2028 and for future phase year (2035);
- Analyzes traffic operating conditions for 2028 and for 2035;
- Summarizes anticipated conditions and identifies locations that could require physical improvement;
- Conducts a multimodal assessment for transit, bicycles, pedestrian and autos.

2.1 Analysis Scenarios

The traffic analysis was conducted for the AM and PM peak hours for the existing year (2018), year 2028, and future phase year (2035). The 2028 analysis includes a baseline “No Build” condition and a “Build” condition assessment of traffic. Both conditions assess background traffic growth and vehicle trips generated by various planned developments. The “No Build” scenario assumes no capacity improvements have been made to Farrington Highway. The “Build” scenario includes the project’s lane widening improvements to Farrington Highway. Mitigation measures are also analyzed at the intersection of Farrington Highway and Kualakai Parkway to identify potential options to alleviate congestion at project opening.

The future phase year (2035) “No Build” analysis assumes that the proposed project configuration, with four lanes on Farrington Highway throughout the study area, is in place. This scenario also assumes that channelization improvements along Kualakai Parkway (as recommended in the Oahu Regional Transportation Plan (ORTP) for regional connectivity) and intersection accesses along Farrington Highway (to support the neighboring Hoopili developments) are in place. Traffic volumes analyzed in the 2035 “No Build” scenario include background traffic growth and the additional vehicle trips generated by planned developments that are expected to be completed between 2028 and 2035. The future phase year “Build” scenario assumes that Farrington Highway is widened to a six-lane roadway between Kapolei Golf Course Road and Old Fort Weaver Road to accommodate planned land use developments. Mitigation measures for the future phase year are identified along the highway corridor and specifically at the intersection of Farrington Highway and Kualakai Parkway to improve operations and reduce vehicle delay in 2035.

The bullets below summarize the different scenarios that were analyzed.

- **Existing 2018** – A snapshot of existing 2018 traffic operations that provides a point of reference to compare with future scenarios. Existing traffic volumes and lane geometry were used in the analysis.

- **Year 2028 No Build** – This scenario includes background traffic growth, and vehicle trips generated by planned development projects that are scheduled to be completed by year 2028 in the region. No improvements to Farrington Highway are assumed between Old Fort Weaver Road and Kapolei Golf Course Road (remains one-lane in each direction).

- **Year 2028 Build** – This scenario includes background traffic growth plus vehicle trips generated by planned development projects that are scheduled to be completed by year 2028 in the region. This scenario assumes that Farrington Highway has been improved to four-lanes between Old Fort Weaver Road and Kapolei Golf Course Road.

- **Year 2035 No Build** – This scenario includes background traffic growth and vehicle trips generated by planned development projects that are scheduled to be completed by the year 2035. Farrington Highway is four-lanes between Old Fort Weaver Road and Kapolei Golf Course Road.

- **Year 2035 Build** – This scenario includes background traffic growth plus vehicle trips generated by planned development projects that are scheduled to be completed by the year 2035. Farrington Highway has been improved to six-lanes between Old Fort Weaver Road and Kapolei Golf Course Road.

2.2 Intersection Analysis

Intersection turning movement count data at locations on Farrington Highway were collected in May 2018, while public schools were in session, to ensure that current travel patterns are reflected in the analysis. Traffic counts were collected on typical weekdays (Tuesdays, Wednesdays, and Thursdays) between 6:30 AM and 8:30 AM, and between 3:30 PM and 5:30 PM. Turning movement data includes heavy vehicle, bicycle, and pedestrian volumes.

Traffic count data at the ramp terminal intersections on H-1 at Kualakai Parkway were provided by the Hawaii Department of Transportation (HDOT). This count data was collected on typical weekdays in August 2017. Turning movement data is included in Appendix A.

Synchro software, version 10, was used for the intersection analysis. The most recent version of the Highway Capacity Manual (HCM) analysis techniques were used to calculate intersection measures of effectiveness. Measures of effectiveness (MOE) reported for each intersection include the following:

- Average Vehicle Delay (seconds)
- Level-of-Service (LOS)

For signalized intersections, the overall LOS and average delay is reported. Signal timing data from the field was used. Additional signal timing data, including existing cycle length, time of day operations, signal phasing and signal splits were provided by the City and County of Honolulu. At unsignalized intersections, the LOS on the worst operating stop-controlled approach is reported. Table 1 outlines the assumptions that were implemented in the Synchro software program for intersection analysis.

Table 1. Synchro Intersection Operations Parameters/Assumptions

Arterial Intersection Parameter	Analysis Scenarios	
	Existing (2018)	2028 and Future (2035) No Build and Build
Peak Hour Factor (PHF)	From traffic count	- 0.85 for minor street approaches - 0.95 for major street approaches If traffic count has higher PHFs than default PHFs, then continue using the existing PHFs
Conflicting Bikes and Pedestrian per Hour	From traffic count, if not provided, assume 10-50 peds/bikes per approach (depending on the surrounding land use)	From Existing
Area Type	Default	From Existing
Ideal Saturation Flow Rate per Lane (for all movements)	1800	From Existing
Lane Width	From As-builts or field visit, otherwise 10 feet	From Existing (No Build), 11 feet (Build)
Percent Heavy Vehicles	From traffic count, otherwise 5%	From Existing
Percent Grade	From As-builts, otherwise 0%	From Existing
Intersection signal phasing and coordination	From field visit and signal timing plans	Optimize phase and cycle length, phase sequence and offset (if signals are coordinated)
Intersection signal timing optimization limits	N/A, only performed in future year analysis	60 to 150 seconds depending on the number of phases
Minimum Green time	From signal timing plans	For existing signals, same as existing. If additional signal warranted, the City's standard minimum time (dependent on the road width) will be used if no pedestrian time is required
Yellow and all-red time	From signal timing plans	For existing signals, same as existing. If additional signal warranted, (Y) = 4 seconds and (R) = 1 second
Right Turn on Red	From field visit	From existing conditions, if additional signal, then "allow" when adequate sight distance can be provided
Vehicle Queues	Synchro 95th Percentile, reported in feet	Same as Existing

Intersection operations can generally be described by six level of service grades which categorize operating conditions based on the average vehicle delay time in seconds. LOS classifications are given a letter designation from LOS A to LOS F. LOS A generally represents ideal operating conditions from the traveler's perspective with little to no delay and where movements are not influenced by other vehicles on the roadway. LOS F typically represents poor operating conditions, including high delays and extreme congestion. Table 2 shows the LOS categories in reference to average delay time criteria for both stop-controlled and signalized intersections, and their general traffic flow/operational characteristics.

Within the City and County of Honolulu, LOS D is generally considered the acceptable level of mobility. LOS D is also considered the acceptable level of mobility on state facilities. Traffic that operates at LOS E or LOS F is considered to be less than desirable, and should be re-examined for potential improvements to maintain acceptable operations.

Table 2. Level of Service Criteria for Intersections (Intersection Control Delay)

Level of Service	Intersection Control Delay (seconds/vehicle)		Traffic Flow Characteristics
	Signalized	Stop-Controlled	
A	0-10	0-10	*Few or no traffic delays* – Most vehicles arrive during the green phase and do not stop at all.
B	>10-20	>10-15	*Short traffic delays* – More vehicles stop, causing higher delay.
C	>20-35	>15-25	*Average traffic delays* – Vehicle stopping is significant, but many still pass through the intersection without stopping.
D	>35-55	>25-35	*Long traffic delays* – Many vehicles stop, and the influence of congestion becomes more noticeable.
E	>55-80	>35-50	*Very long traffic delays* – Very few vehicles pass through without stopping.
F	>80	>50	*Extreme traffic delays* – Considered unacceptable to most drivers.

Source: Highway Capacity Manual 2010.

2.3 Segment Analysis

Peak hour segment volumes were derived from the intersection turning movement volumes, and validated with field-collected tube counts on Farrington Highway. Tube counts were collected over multiple 24-hour periods in May 2018 at three locations; between Kealanani Avenue and Papaialulu Avenue, approximately 1,200 feet west of Kualakai Parkway, and approximately 2,000 feet east of Kualakai Parkway. Tube counts on Farrington Highway include vehicle classifications and directional distribution. This data is included in Appendix A. Tube count data were not collected on Kualakai Parkway.

Corridor segments on Farrington Highway and on Kualakai Parkway were evaluated for the peak hour using methodologies described in the most recent version of the HCM for multilane highways. Assumptions for all highway parameters and inputs are summarized in Table 3.

Table 3. Multilane Highway Operations Parameters/Assumptions

Highway Parameter	Analysis Scenarios	
	Existing (2018)	2028 and Future (2035) No Build and Build
Peak hour factor (PHF)	0.90	0.95
Terrain	Assume "Level"	From Existing
Trucks and Buses	From Existing or 5% if not available	From Existing
RVs	Assume 0 percent	From Existing
Driver population adjustment	0.98	From Existing
Base Free Flow Speed	40 mph	From Existing
Lane Capacity	1,500 vehicles per hour	From Existing
Lane Width	From As-Builts, otherwise 11 feet	From Existing

Segment operations by direction can be described by volume to capacity (V/C) ratio and by LOS. Similar to intersection operations, LOS A generally represents ideal operating conditions from the traveler's perspective while LOS F represents high delays and congestion. Table 4 shows the LOS and V/C categories for segment operations and their general traffic flow/operational characteristics.

Table 4. Level of Service Criteria for Roadways (Segment V/C Ratio)

Level of Service	Roadway Segment V/C Ratio	Traffic Flow Characteristics
A	0 – 0.26	*Few or no traffic delays* – Individual users are virtually unaffected by the presence of other vehicles.
B	>0.26 – 0.43	*Short traffic delays* – Traffic flow is stable, but the presence of other users begins to be noticeable.
C	>0.43 – 0.62	*Average traffic delays* – Traffic flow is stable, but other traffic begins to significantly affect individual users.
D	>0.62 – 0.82	*Long traffic delays* – Traffic flow is dense but stable. Other users restrict individual driver maneuverability.
E	>0.82 – 1.00	*Very long traffic delays* – Operations are at or near capacity levels and unstable. Freedom to maneuver is difficult.
F	>1.00	*Extreme traffic delays* – Operates are at breakdown where demand exceeds capacity. Delays and queuing may cause severe congestion.

Source: Highway Capacity Manual 2010.

3. Existing Conditions (Year 2018)

Roadway operations were evaluated for the existing year (2018) to identify existing traffic conditions and deficiencies to use as a basis for comparing future year conditions. The following sections describe the existing roadway conditions, traffic volumes, and intersection and segment operations.

3.1 Existing Roadway System

Study area roadways include state facilities (H-1, Makakilo Drive, Fort Barrette Road, Kualakai Parkway, and Farrington Highway) and county facilities (Farrington Highway, Kealanani Avenue, Kapolei Golf Course Road, and Old Fort Weaver Road). Brief descriptions of each roadway are provided below.

3.1.1 State of Hawaii Facilities

Interstate H-1, also known as the Queen Lilioukalani Freeway, is classified as an Urban Principal Arterial (Interstate) by the Hawaii Department of Transportation and runs generally in an east-west direction. It provides access between Honolulu and southwest Oahu. H-1 in the study area is a six-lane divided limited access freeway with paved shoulders and no pedestrian or bicycle facilities. The speed limit is posted at 60 miles per hour (mph) in the study area.

Makakilo Drive (State Route 901) is classified as an Urban Principal Arterial (Other) by the Hawaii Department of Transportation in the study area (makai of H-1) and runs generally in a north-south direction. It provides access to H-1 from the Kapolei neighborhood and is generally a four-lane divided roadway with sidewalks and no paved shoulders or bicycle facilities. The posted speed limit is 35 mph.

Fort Barrette Road (State Route 901) is classified as an Urban Principal Arterial (Other) by the Hawaii Department of Transportation in the study area and runs generally in a north-south direction. It provides access between H-1 and Kapolei and Kalaeloa. Fort Barrette Road is generally a two-lane undivided roadway with sidewalks and no paved shoulders or bicycle facilities. The posted speed limit is 40 mph.

Kualakai Parkway (State Route 8930) is classified as an Urban Principal Arterial (Other) by the Hawaii Department of Transportation in the study area and runs generally in a north-south direction. It provides access between H-1 and the Kapolei area. Kualakai Parkway is a six-lane divided roadway with paved shoulders and no bicycle facilities. Sidewalks are present on both sides of the roadway south of Farrington Highway. The posted speed limit is 35 mph.

Farrington Highway (State Route 7110) is a state facility classified as an Urban Principal Arterial (Other) by the Hawaii Department of Transportation east of Fort Weaver Road and runs generally in an east-west direction. It provides access from Kapolei to Pearl City. Farrington Highway is a four-lane divided roadway with paved shoulders and no bicycle facilities west of Kapolei Golf Course Road to the west study limit (Fort Barrette Road). There are sidewalks on both sides of the roadway and the speed limit is 35 mph. East of Old Fort Weaver Road, it is a two-lane undivided roadway with little to no shoulder and no non-motorized facilities. Between Kapolei Golf Course Road and Old Fort Weaver Road, Farrington Highway is a county facility, except for the intersection of Kualakai Parkway and Farrington Highway.

3.1.2 County of Honolulu Facilities

Farrington Highway is a county facility classified as an Urban Minor Arterial between Kapolei Golf Course Road and Old Fort Weaver Road (except for the intersection of Kualakai Parkway and Farrington Highway). It generally runs in an east-west direction. Within the study area, Farrington Highway is a two-lane undivided roadway without paved shoulders or pedestrian and bicycle facilities. The posted speed limit is 35 mph.

Kealanani Avenue is classified as an Urban Major Collector and runs generally in a north-south direction. It provides access from Farrington Highway to residential land uses in the Kapolei area. Kealanani Avenue is a four-lane divided roadway with sidewalks and paved shoulders, and is designated as a bike route south of Farrington Highway. The posted speed limit is 30 mph. This road is currently being

transferred to City and County of Honolulu jurisdiction from the Hawaii Housing Finance and Development Corporation.

Kapolei Golf Course Road is a four-lane divided roadway with a sidewalk on the west side of the road. It extends approximately 400 feet in the makai direction from Farrington Highway and tapers to a two-lane road before entering private property (Kapolei Golf Club).

Old Fort Weaver Road is classified as an Urban Minor Collector. It provides access to residential land uses via an east loop intersection and a west loop intersection with Farrington Highway. Old Fort Weaver Road at both loop intersections is a two-lane undivided roadway without paved shoulders or pedestrian and bicycle facilities. The posted speed limit is 25 mph.

3.2 Existing Transit Service

A description of transit routes serving the study area is provided below. Transit service is provided by the City and County of Honolulu's TheBus.

Route 40 provides regular service between downtown Honolulu and Makaha. This route travels on Farrington Highway in the study area.

Route 41 provides regular service between the Ewa Beach and Kapolei Transit Centers. This route travels on Farrington Highway and Kealanani Avenue in the study area.

Route 44 provides regular service between Waipahu and Ewa Beach. This route travels on Farrington Highway and Old Fort Weaver Road in the study area.

Route 94 provides peak hour service between downtown Honolulu and Kapolei. This route travels on Fort Barrette Road in the study area.

Route 99 provides peak hour service between the Wahiawa and Kapolei Transit Centers. This route travels on Farrington Highway in the study area.

Route 102 provides peak hour service between downtown Honolulu and Kapolei. This route travels on Farrington Highway, Kealanani Avenue, and Fort Barrette Road in the study area.

Route 411 provides late night service to the Villages of Kapolei. This route travels on Farrington Highway, Kealanani Avenue, and Fort Barrette Road in the study area.

Route 415 provides peak hour service between Kalaeloa and the Kapolei Transit Center. This route travels on Fort Barrette Road in the study area.

Route C – CountryExpress! provides express service between downtown Honolulu and Makaha. This route travels on Fort Barrette Road in the study area.

3.3 Existing Traffic Volumes

Existing turning movements were collected over a 2-hour period in both the AM and PM peak periods at the study intersections. In addition to the turning movement counts, three tube machine counts were collected along Farrington Highway for 24-hours per day over a 7-day period. The tube counts were used to assess overall weekly travel patterns and peaking characteristics of the existing traffic along Farrington Highway. The tube counts were collected at the following locations:

- Between Old Fort Weaver Road and Kualakai Parkway
- Between Kualakai Parkway and Kapolei Golf Course Road
- Between Kapolei Golf Course Road and Fort Barrette Road

Based on traffic count data, the average daily traffic carried by Farrington Highway is approximately 10,000 vehicles west of Kualakai Parkway and approximately 9,000 vehicles per day east of Kualakai Parkway. The daily truck percentage is about 3% to 5% and ranges from 2% to 8% during peak hour periods. Truck traffic could possibly be generated by nearby construction sites and the quarry that is located on Farrington Highway, about 0.25 miles northeast of Kapolei Golf Course Road. The weekday morning and afternoon peak hours of traffic were determined to occur between 7:00 AM and 8:00 AM and between 4:15 PM and 5:15 PM, respectively. The traffic count data is provided in Appendix A.

3.4 Existing Traffic Operations

The following sections describe traffic operations for both intersections and segments for year 2018 existing conditions.

3.4.1 Intersection Operations

Under the 2018 existing conditions during both AM and PM peak hours, operations at most study intersections operate at LOS ‘D’ or better. The intersection of Farrington Highway and Fort Barrette Road operates at LOS ‘E’ during the PM peak hour due to long delays on the southbound movements as vehicles travel from H-1 to the Kapolei neighborhoods.

Table 5 shows the existing intersection analysis results for the AM and PM peak hours. Figure 2 displays the existing lane channelization at each of the study intersections. Detailed Synchro output reports are included in Appendix B. Delays and LOS by individual turning movement are included in Appendix C.

Enhancements to other existing and future intersections along Farrington Highway are anticipated with the future developments. These intersections and their designs will be analyzed by the appropriate agencies when the access for the future developments are requested.

Table 5. Existing 2018, AM and PM Intersection Operations Results

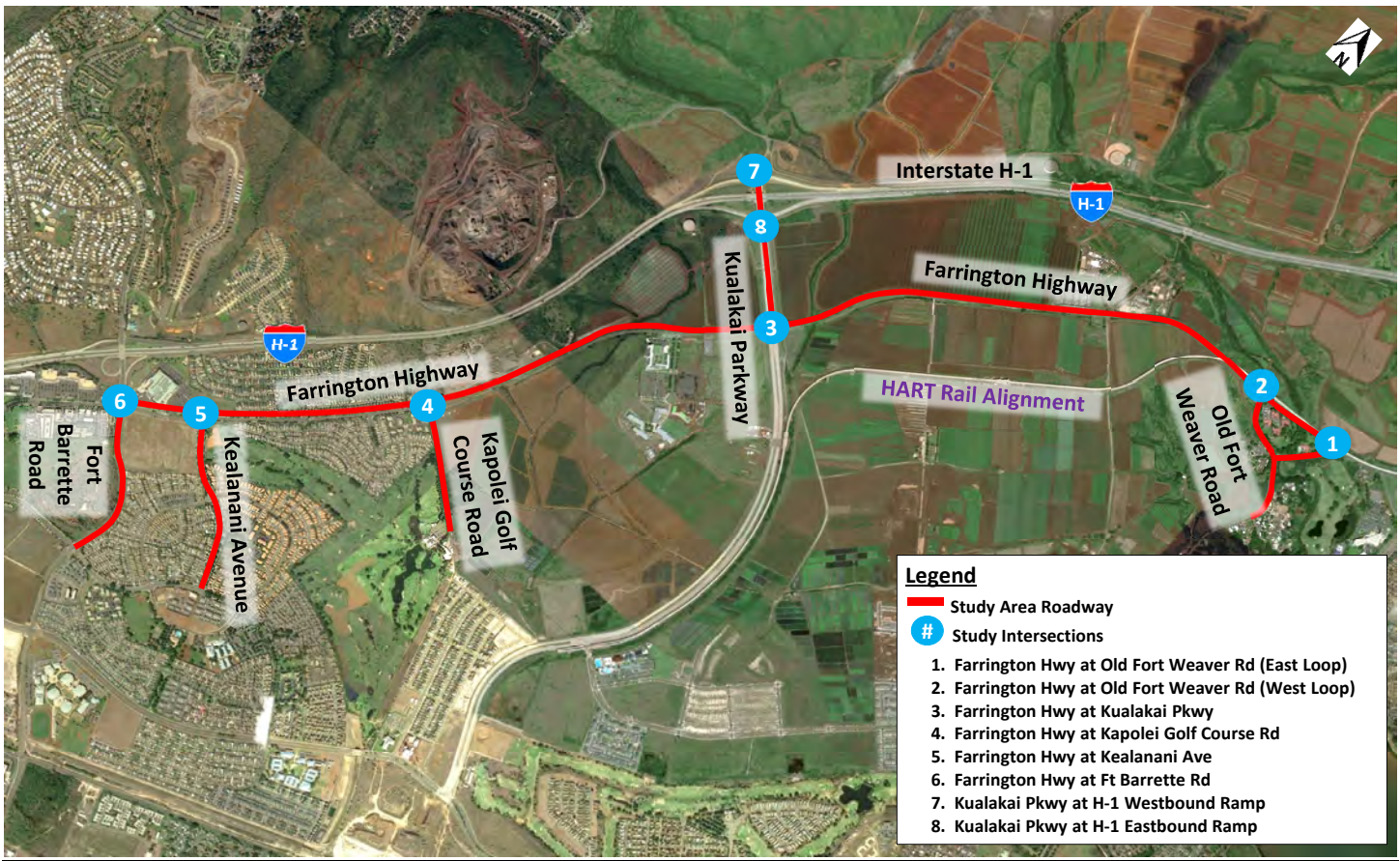
Peak Hour	Int ID	Intersection	Control Type	Delay (seconds)	Level of Service
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	20.6	C
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	23.3	C
	3	Farrington Highway and Kualakai Parkway	Signal	24.5	C
	4	Farrington Highway and Kapolei Golf Course Road	Stop	13.4	B
	5	Farrington Highway and Kealanani Avenue	Signal	20.3	C
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	45.6	D
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	17.3	B
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	5.1	A

Table 5. Existing 2018, AM and PM Intersection Operations Results

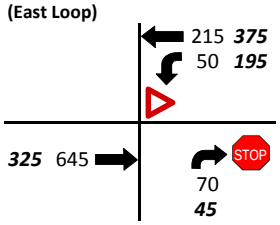
Peak Hour	Int ID	Intersection	Control Type	Delay (seconds)	Level of Service
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	11.6	B
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	16.6	C
	3	Farrington Highway and Kualakai Parkway	Signal	27.2	C
	4	Farrington Highway and Kapolei Golf Course Road	Stop	13.3	B
	5	Farrington Highway and Kealanani Avenue	Signal	24.2	C
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	60.0	E
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	26.0	C
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	4.4	A

Shaded cells indicate intersections that operate at 'LOS E' or worse.

Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

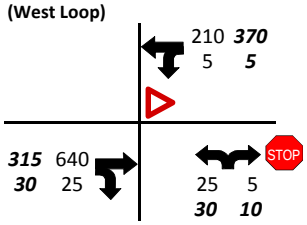


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



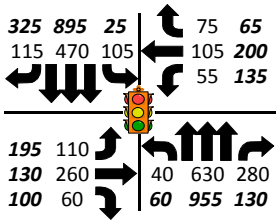
	Delay (s)	LOS
Existing AM	20.6	C
Existing PM	11.6	B

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



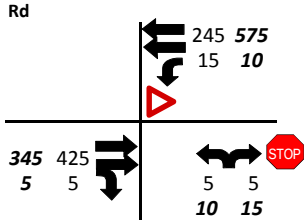
	Delay (s)	LOS
Existing AM	23.3	C
Existing PM	16.6	C

3 Farrington Hwy/Kualakai Pkwy



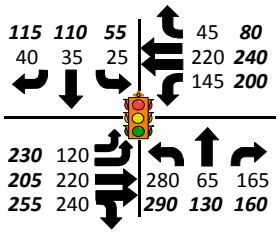
	Delay (s)	LOS
Existing AM	24.5	C
Existing PM	27.2	C

4 Farrington Hwy/Kapolei Golf Course Rd



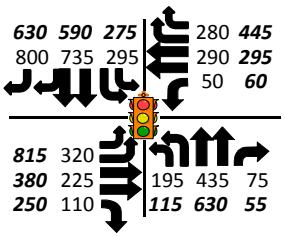
	Delay (s)	LOS
Existing AM	13.4	B
Existing PM	13.3	B

5 Farrington Hwy/Kealanani Ave



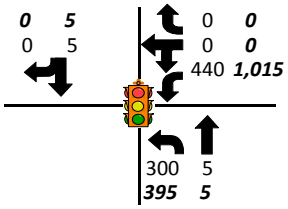
	Delay (s)	LOS
Existing AM	20.3	C
Existing PM	24.2	C

6 Farrington Hwy/Ft Barrette Rd



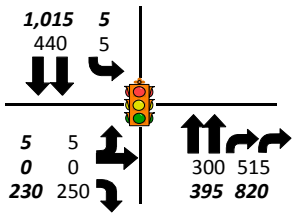
	Delay (s)	LOS
Existing AM	45.6	D
Existing PM	60.0	E

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
Existing AM	17.3	B
Existing PM	26.0	C

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
Existing AM	5.1	A
Existing PM	4.4	A

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- Turning Movement Direction
- 100 AM Peak-Hour Volume
- ***100*** PM Peak-Hour Volume
- LOS Level of Service

Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 2
Existing (2018) AM and PM Peak Hour Intersection Volumes and Operations Results

Farrington Highway Improvements Study

3.4.2 Segment Operations

In existing conditions, during both the AM and PM peak hours, all roadway segments operate at LOS 'C' or better, indicating that midblock traffic volumes are lower than the roadway capacity. Along Farrington Highway, the existing roadway has two lanes in each direction between Fort Barrette Road and Kapolei Golf Course Road and one lane in each direction from Kapolei Golf Course Road to Old Fort Weaver Road.

Along Kualakai Parkway, the existing roadway has three lanes in each direction between Farrington Highway and the H-1 interchange. South of Farrington Highway for approximately 1,000 feet, Kualakai Parkway continues as three lanes in each direction before transitioning to two lanes in each direction at the future UH West Oahu access intersection. Table 6 shows the existing roadway segment analysis results. Peak hour segment volumes are included in Appendix C.

Table 6. Existing 2018, AM and PM Segment Operations Results

Roadway Segment	Travel Direction	Number of Lanes	Level of Service	
			AM Peak	PM Peak
Farrington Highway				
Between Ft Barrette Ave and Kealanani Ave	Eastbound	2	A	A
	Westbound	2	A	A
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	A	A
	Westbound	2	A	A
Between Kapolei Golf Course Road and Kualakai Parkway	Eastbound	1	B	B
	Westbound	1	A	B
Between Kualakai Parkway and Fort Weaver Road (West Loop)	Eastbound	1	C	A
	Westbound	1	A	B
Between Fort Weaver Road West Loop and East Loop	Eastbound	1	B	A
	Westbound	1	A	A
Kualakai Parkway				
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	A	B
	Southbound	3	A	B
South of Farrington Hwy (For approximately 1000 feet)	Northbound	3	A	A
	Southbound	3	A	A

Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.

4. Forecast Methodology

Future traffic demand forecasts were developed using the Oahu Regional Transportation Plan (ORTP) travel demand model. Forecasts are based on future proposed, planned land use developments within the study area and adjacent to the Farrington Highway corridor.

4.1 Future Land Use

It is expected that over the next 35 years, populations and developments immediately adjacent to the two-lane section of Farrington Highway between Old Fort Weaver Road and Kapolei Golf Course Road will increase significantly as part of an overall growth plan for Leeward Oahu. As part of various State Land

Use District Amendments that reclassified land from agricultural use to urban use, commercial and residential projects such as the University of Hawaii West Oahu, Department of Hawaiian Home Lands (DHHL) developments, and community of Hoopili were planned within undeveloped areas adjacent to Farrington Highway that were previously reserved for agriculture use.

Figure 3 shows the location of nearby future planned developments. The footprint of the planned community of Hoopili shown in this figure is consistent with the planned development as documented in the most recent version of the Hoopili Traffic Impact Analysis Report dated April 28, 2013 and revised May 30, 2014.

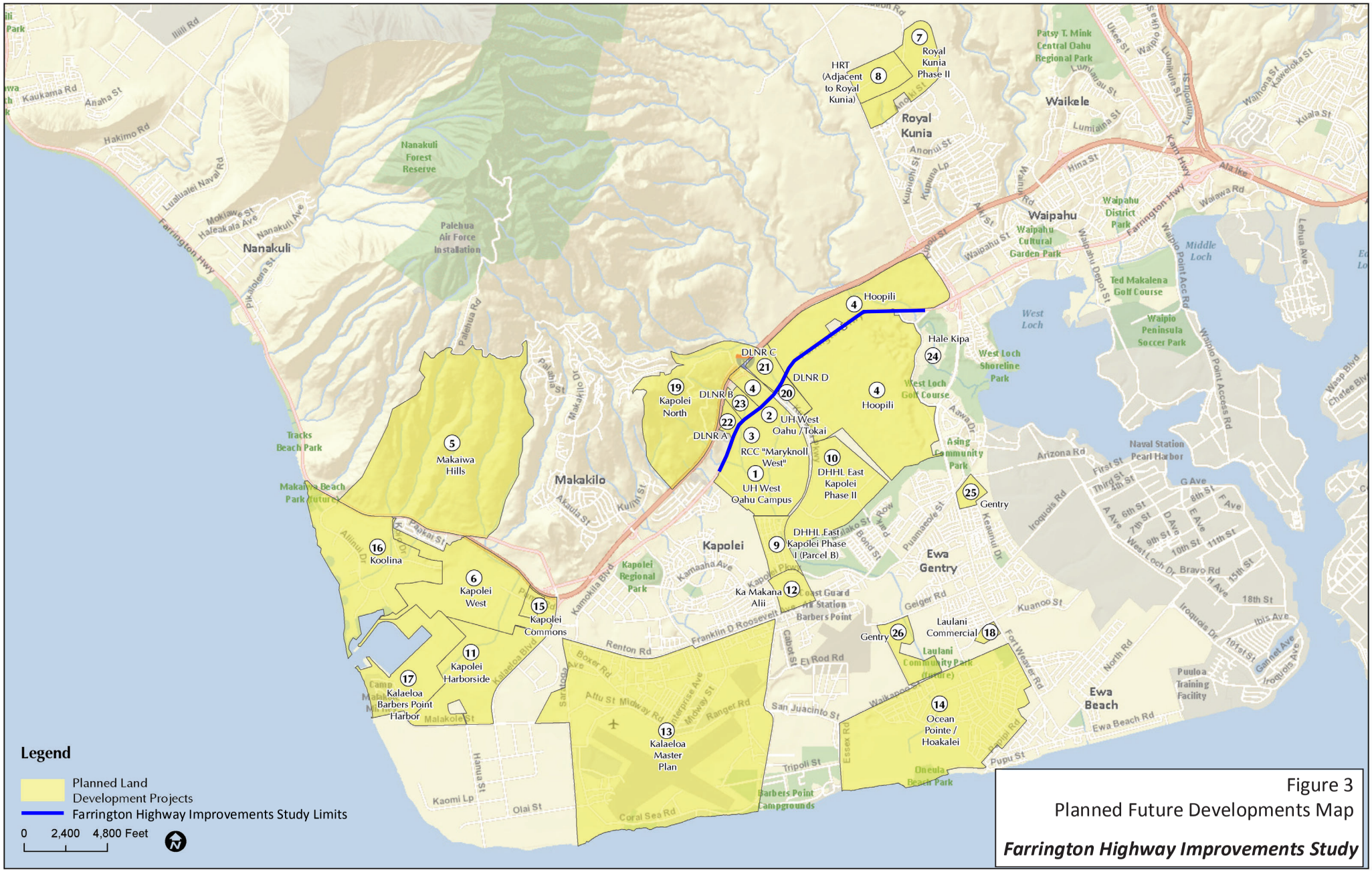


Figure 3
Planned Future Developments Map

Farrington Highway Improvements Study

4.2 Traffic Volume Forecasting

Two main steps were used to estimate the future year traffic volumes used in the AM and PM peak hour analysis. The first step was to establish the future year background traffic volumes. The second step was to calculate the incremental trips that are expected to occur when the phased, planned developments are completed in 2028 and in 2035, and to add those trips to the background traffic volumes.

Step 1: Develop Background Traffic Volumes

The sub-steps below provide a detailed description of the methods used to calculate the background traffic volumes for the various analysis years.

a) Calculate annual growth rates along Farrington Highway and the key north-south roadways. Model data from the 2007 and 2035 ORTP travel demand models were compared for roadways within the study area. Based on anticipated increases in traffic volumes between these two years, the straight line annual growth rates were calculated to be approximately 1.3 percent on Farrington Highway, Fort Barrette Road, and Fort Weaver Road, and approximately 3.6 percent on Kualakai Parkway. The 2035 ORTP model included a portion of planned, completed developments along the Farrington Highway corridor and adjacent areas, therefore it was assumed to reasonably represent the changes in traffic volumes between the current existing year analysis (2018) and 2028.

b) Apply annual growth rates to existing AM and PM peak hour volumes. The calculated annual growth rate of 1.3 percent was applied to the existing turning movement volumes at all intersection movements, except for those at the intersection of Farrington Highway and Kualakai Parkway, where a 3.6 percent annual growth rate was applied to the existing volumes. Growth rates were applied over 10 years to estimate year 2028 background volumes. Traffic volume adjustments were made manually to balance vehicle trips between closely spaced intersections.

c) Apply an additional 0.5 percent annual growth rate for analysis years beyond 2028. The 0.5 annual growth rate accounts for any additional growth in background traffic that is expected to occur outside of the Farrington Highway study influence area beyond the year 2028. The 0.5 percent annual growth rate is lower than the 2007 to 2035 model-calculated growth rates because much of the study area is already likely to be built-out by 2028.

Step 2: Estimate Volumes Generated by Planned Development

While the background traffic forecasts represent growth due to developments outside of the study area, this step accounts for vehicle trips associated with the planned developments closer to and within the Farrington Highway sub-area. These vehicle trips were not accounted for in the background traffic volume development, and therefore must be added to the analysis. These additional trips were generated as a result of developments being built-out to their planned development size in 2028 and the future phase year. The sub-steps below provide a description of the method used to estimate vehicle trips generated by planned developments.

a) Identify future development properties. Based on the location of future developments shown in Figure 3, it was assumed that the developments west of Kalaeloa Boulevard would not be likely to contribute a significant number of vehicle trips to the study area. Developments that currently do not have any available information regarding type or quantity of land uses, or build out completion years, are also not assumed to contribute a significant amount of vehicle trips to the study area. For these reasons, a trip generation exercise was not performed for certain future developments on Figure 3. Developments where trip generation was performed are noted in Table 7.

For all other nearby developments where trip generation was performed, it was assumed that not all of the trips generated as a result of build out would be expected to use Farrington Highway. Table 7 provides a summary of the planned developments and the percentage of trips generated that would use Farrington Highway per development. Detailed trip generation calculations for each of the planned developments are included in Appendix D.

b) Identify expected land uses and build out completion dates. Land use data for the major developments in the sub-area were gathered and provided by Group 70. The majority of planned developments include a mix of residential (single family and multi-family, with varying levels of density), commercial/retail, office, and industrial uses. For the Year 2028 conditions, approximately 60 percent of the planned developments are assumed to be complete.

For the Hoopili development specifically, approximately 30 percent of the planned build out is assumed to be complete by the year 2028. This estimate was extrapolated based on data presented in a memorandum dated August 3rd, 2018 by Austin Tsutsumi and Associates (see Appendix E) that summarizes the number of dwelling units and commercial square footage, by phase, assumed to be complete by 2024. For the Year 2035 conditions, all phases of the Hoopili development are assumed to be complete.

c) Estimate the number of vehicle trips generated by developments. To calculate future vehicle trips associated with developments, Institute of Transportation Engineers (ITE) Trip generation rates (based on ITE Trip Generation 8th Edition) were applied to the specific land use categories. Inbound and outbound vehicle trips were generated for the AM and PM peak hours.

d) Distribute vehicle trips to study roadway network. Development trips were distributed to study area intersections based on characteristics of the developments, proximity of highway routing access options, and travel patterns observed in the 2035 ORTP model. Trip distribution and assignment data used in the traffic analysis are provided in Appendix D.

Table 7. Planned Developments, Percentage of Trips Routed via Farrington Highway

Map ID	Planned Development (See Figure 3)	Trip Generation Performed	Percent of Development Trips Routed To/From Study Area Intersections
1, 2 & 3	UH West Oahu	Yes	75%
4	Hoopili	Yes	70%
5	Makaiwa Hills	No	0%*
6	Kapolei West	No	0%*
7	Royal Kunia Phase II	Yes	10%
8	HRT (adjacent to Royal Kunia)	No	0%*
9	DHHL East Kapolei Phase I (Kanehili)	Yes	60%
10	DHHL East Kapolei Phase II (Kauluokahai)	Yes	60%
11	Kapolei Harborside	No	0%*
12	Ka Makana Alii	Yes	60%
13	Kalaeloa Master Plan	Yes	20%
14	Ocean Pointe/Hoakalei	No	0%*
15	Kapolei Commons	No	0%*
16	Ko Olina	No	0%*
17	Kalaeloa Barbers Point Harbor	No	0%*

Table 7. Planned Developments, Percentage of Trips Routed via Farrington Highway

Map ID	Planned Development (See Figure 3)	Trip Generation Performed	Percent of Development Trips Routed To/From Study Area Intersections
18	Laulani Commercial	No	0%*
19	Kapolei North	Yes	10%
20	DLNR D	Yes	100%
21	DLNR C	Yes	100%
22 & 23	DLNR A and B	Yes	100%
24	Hale Kipa	No	0%*
25 & 26	Gentry Residential/Industrial	No	0%*

* The number of trips generated from these developments is assumed to be minimal and are therefore accounted for in the additional 0.5%

Table 8 summarizes the percent of the development assumed to be complete by 2028 and by 2035, and the vehicle trips generated by peak hour. Trip distribution and assignment data used in the traffic analysis are provided in Appendix D.

Table 8. Planned Developments, Percent Complete and Trips Generated

Map ID	Planned Development (See Figure 3)	2028 Build			2035 Build		
		Percent Complete	AM Trips	PM Trips	Percent Complete	AM Trips	PM Trips
1, 2 & 3	UH West Oahu	60%	935	1945	75-80%	1040	2070
4	Hoopili	30%	1800	2400	100%	5520	7365
7	Royal Kunia Phase II	60%	65	75	75-80%	75	90
9	DHHL East Kapolei Phase I (Kanehili)	100%	45	125	100%	45	125
10	DHHL East Kapolei Phase II (Kauluokahai)	100%	695	790	100%	695	790
12	Ka Makana Alii	100%	430	1235	100%	430	1235
13	Kalaeloa Master Plan	60%	770	895	75-80%	935	1085
19	Kapolei North	60%	45	65	75-80%	60	80
20	DLNR D	60%	260	435	75-80%	315	525
21	DLNR C	60%	445	900	75-80%	540	1095
22 & 23	DLNR A and B	60%	585	790	75-80%	710	955

Land use data for the major developments were gathered and provided by Group 70. (June 2019)

5. Year 2028 Conditions

This section describes traffic conditions in the study area for 2028. The 2028 No Build scenario assumes a modest 0.5 percent annual background growth in traffic for developments that are already completed, as well as vehicle trips from nearby planned developments that are expected to be complete by 2028. The existing Farrington Highway lane configuration is assumed.

The 2028 Build scenario includes background traffic plus vehicle trips from anticipated land use and proposed developments, with a four-lane Farrington Highway cross-section between Kapolei Golf Course Road and Old Fort Weaver Road. Land use assumptions and trip generation information is described in Section 4 – Forecast Methodology.

This section assesses how the Farrington Highway corridor and intersections would function with and without widening of Farrington Highway, and serves as a basis to identify future deficiencies and potential mitigation.

5.1 No Build Operations

Under the 2028 No Build scenario, the lane configuration on Farrington Highway remains the same as existing conditions. Between Kapolei Golf Course Road and Old Fort Weaver Road, the roadway is a two-lane, undivided highway with limited shoulders and without non-motorized facilities. With background traffic increases and planned development trips, five of the study intersections are expected to operate at LOS ‘D’ or better during the AM peak hour. During the PM peak hour, four of the eight study intersections are expected to operate at LOS ‘D’ or better. The intersections of Farrington Highway at Fort Barrette Road and at Old Fort Weaver Road (west loop) are expected to operate at LOS ‘E’ or ‘F’ in both peak hours. During the PM peak hour, the signalized intersection at the H-1 westbound on- and off-ramp at Kualakai Parkway would operate at LOS ‘F’ due to high traffic volumes making the left-turn from H-1 towards Kapolei.

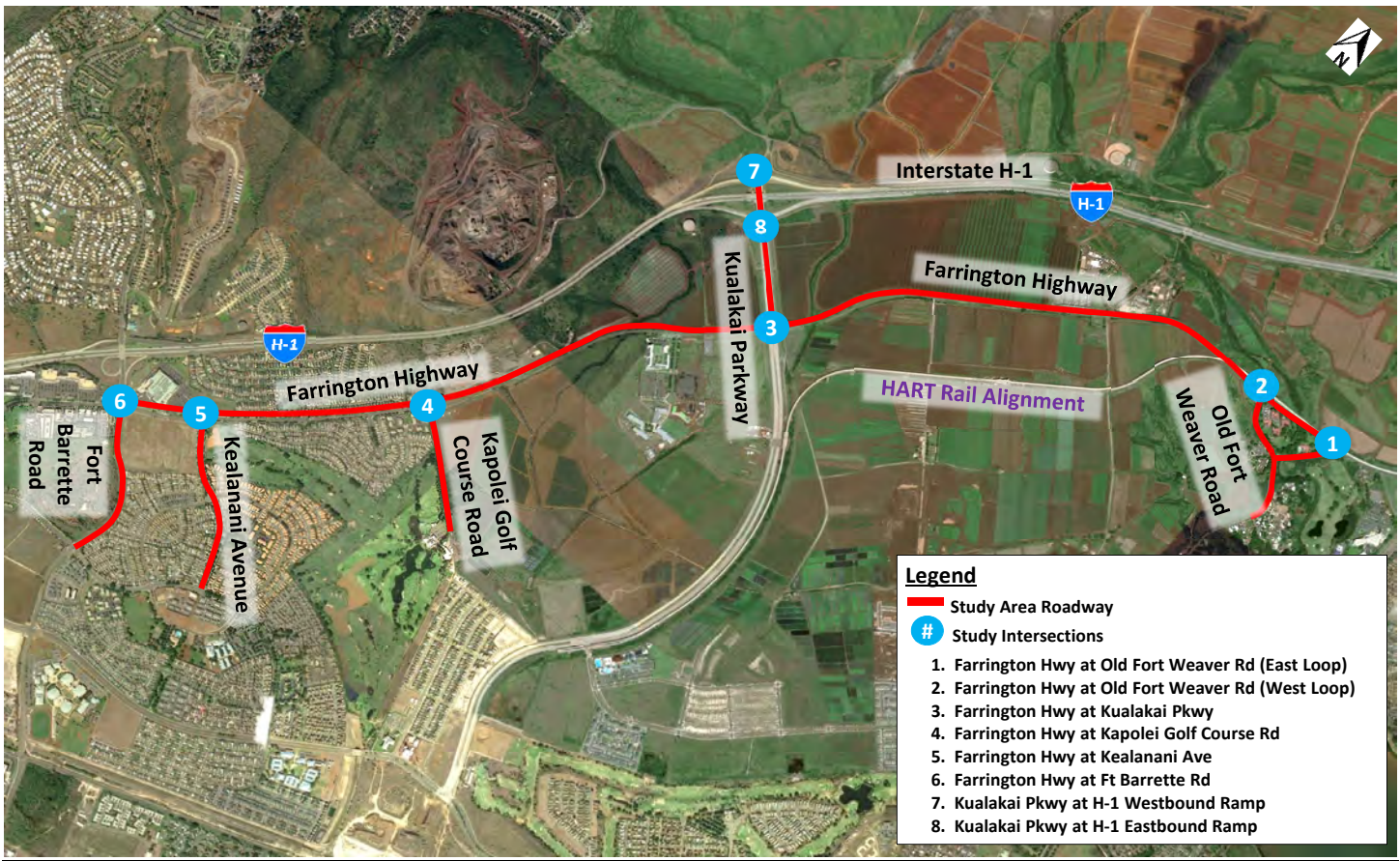
Many of the planned developments are located along Farrington Highway or can be accessed by Kualakai Parkway, therefore the majority of vehicles heading to or coming from H-1 will need to pass through the intersection of Farrington Highway at Kualakai Parkway. This intersection is expected to operate at LOS ‘F’ with high delay times and congestion during the AM and PM peak. Table 9 and Figure 4 provide a summary of the 2028 No Build intersection operations results for the AM and PM peak hours. See Appendix F for detailed Synchro output reports.

Table 9. No Build 2028, AM and PM Intersection Operations Results

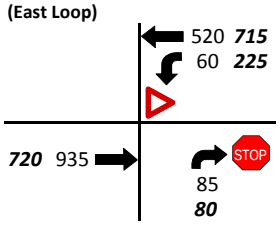
Peak Hour	Int ID	Intersection	Control Type	Delay (seconds)	Level of Service
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	24.1	C
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	48.3	E
	3	Farrington Highway and Kualakai Parkway	Signal	114.6	F
	4	Farrington Highway and Kapolei Golf Course Road	Stop	21.6	C
	5	Farrington Highway and Kealanani Avenue	Signal	34.0	C
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	64.3	E
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	45.1	D
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	31.7	C
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	18.1	C
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	47.2	E
	3	Farrington Highway and Kualakai Parkway	Signal	212.6	F
	4	Farrington Highway and Kapolei Golf Course Road	Stop	25.9	D
	5	Farrington Highway and Kealanani Avenue	Signal	50.5	D
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	83.1	F
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	185.1	F
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	22.7	C

Shaded cells indicate intersections that operate at 'LOS E' or worse.

Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

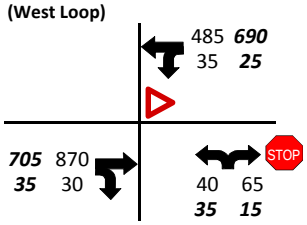


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



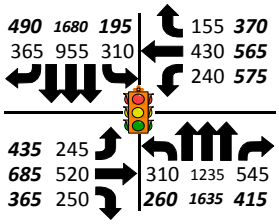
	Delay (s)	LOS
No Build AM	24.1	C
No Build PM	18.1	C

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



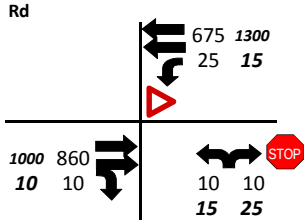
	Delay (s)	LOS
No Build AM	48.3	E
No Build PM	47.2	E

3 Farrington Hwy/Kualakai Pkwy



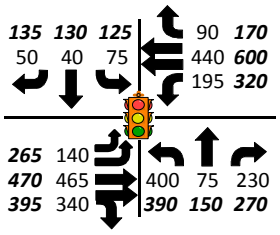
	Delay (s)	LOS
No Build AM	114.6	F
No Build PM	212.6	F

4 Farrington Hwy/Kapolei Golf Course Rd



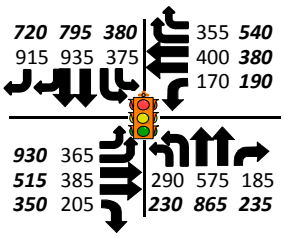
	Delay (s)	LOS
No Build AM	21.6	C
No Build PM	25.9	D

5 Farrington Hwy/Kealanani Ave



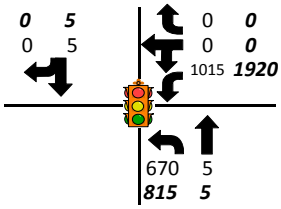
	Delay (s)	LOS
No Build AM	34.0	C
No Build PM	50.5	D

6 Farrington Hwy/Ft Barrette Rd



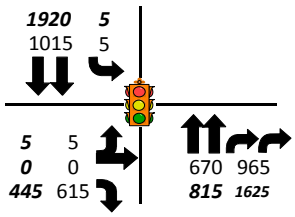
	Delay (s)	LOS
No Build AM	64.3	E
No Build PM	83.1	F

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build AM	45.1	D
No Build PM	185.1	F

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build AM	31.7	C
No Build PM	22.7	C

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- Turning Movement Direction
- 100 AM Peak-Hour Volume
- ***100*** PM Peak-Hour Volume
- LOS Level of Service

Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 4
Year (2028) No Build AM/PM Peak Hour Intersection Volumes and Operations Results

Farrington Highway Improvements Study

No lane geometry improvements are anticipated on Farrington Highway in the 2028 No Build scenario. With background growth and development trips, most study segments during the AM and PM peak hour would operate at LOS 'D' or better. During the PM peak hour, the segment between Kapolei Golf Course Road and Kualakai Parkway would operate at LOS 'E' in both directions. Table 10 provides a summary of the 2028 No Build segment analysis results. Peak hour segment volumes are included in Appendix C.

Table 10. No Build 2028, AM and PM Segment Operations Results

Roadway Segment	Travel Direction	Number of Lanes	Level of Service	
			AM Peak	PM Peak
Farrington Highway				
Between Ft Barrette Ave and Kealanani Ave	Eastbound	2	B	B
	Westbound	2	B	B
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	B	B
	Westbound	2	A	B
Between Kapolei Golf Course Road and Kualakai Parkway	Eastbound	1	D	E
	Westbound	1	C	E
Between Kualakai Parkway and Fort Weaver Road (West Loop)	Eastbound	1	D	D
	Westbound	1	C	D
Between Fort Weaver Road West Loop and East Loop	Eastbound	1	D	C
	Westbound	1	B	C
Kualakai Parkway				
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	B	C
	Southbound	3	B	C
South of Farrington Hwy (For approximately 1000 feet)	Northbound	3	C	C
	Southbound	3	B	C

Shaded cells indicate segments that operate at 'LOS E' or worse.
Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.

5.2 Build Operations with Developments (Intersections)

To provide additional roadway capacity and to accommodate the trips from anticipated developments, Farrington Highway east of Kapolei Golf Course Road is projected to be widened to a four-lane, divided roadway with dedicated turn lanes at select cross-streets in the 2028 Build scenario. Intersection control at the study intersections are expected to remain as they are under existing conditions.

Enhancements to Farrington Highway are expected to improve mobility between Kapolei and Waipahu as this section completes a continuous, four-lane roadway with shoulders and curb and gutter between the two communities.

With increased roadway capacity, operations at some study intersections would improve compared to the No Build scenario. Operations at Farrington Highway and Old Fort Weaver Road (west loop) would improve from LOS 'E' to 'D' during the AM and PM peak hours. The intersection of Farrington Highway and Kualakai Parkway would remain at LOS 'F' (same as No Build) but the average delay would improve by over 25 seconds per vehicle in the AM peak hour, and by nearly 70 seconds per vehicle in the PM peak hour. With roadway widening, the pedestrian phases at the intersection of Farrington Highway and Kualakai Parkway would be longer than in the No Build scenario. These longer crossing times are necessary to accommodate the longer crossing distance as well as the anticipated increase pedestrian

activity throughout the day. Synchro output reports for the 2028 No Build and Build scenarios are included in Appendix F. Synchro queue tables are included in Appendix C.

To further investigate intersection operations, a VISSIM microsimulation analysis was conducted. VISSIM (version 10.00-16) was used to analyze potential vehicle queuing impacts as a result of future development. The VISSIM analysis network includes the three study intersections along Kualakai Parkway, including the H-1 interchange ramp terminals and the intersection with Farrington Highway. Simulation scenarios were modeled for the PM peak hour only because the PM peak hour analysis volumes are higher than the AM peak hour volumes, and would therefore provide a more conservative analysis that describes the worst of the two peaks.

Although additional capacity is provided on Farrington Highway in the 2028 Build scenario, there is substantial growth in vehicular and pedestrian demand generated by the planned developments. Notable vehicle queues include:

- Eastbound through movement queues on Farrington Highway approaching Kualakai Parkway could extend back beyond the UH West Oahu driveway, and westbound queues may affect access to the Hoopili development.
- At the H-1 interchange westbound ramp terminal, congestion and queues are expected on the northbound left-turn and westbound left-turn movements. The northbound left-turn queue from Kualakai Parkway to westbound H-1, on average, is not expected to affect the eastbound ramp terminal, but occasional maximum queues may extend back past the eastbound ramp terminal.
- The westbound left-turn movement queue from the H-1 off-ramp to southbound Kualakai Parkway is expected to be long, with high vehicle delays. However, the westbound off-ramp queue would still be contained on the ramp and would not be expected to spill back onto the mainline.

Detailed information on the VISSIM microsimulation analysis is documented in a separate technical memorandum in Appendix G. This appendix includes a summary of the average and 95th percentile queue lengths for all movements, as reported from the VISSIM simulation, at intersections on Kualakai Parkway as well graphics of typical queuing during the PM peak hour.

5.2.1 Potential Mitigation

With highway widening, the intersection of Farrington Highway and Kualakai Parkway is expected to operate at LOS ‘F’ in the 2028 Build scenario with development trips. Mitigation measures are identified to increase capacity and improve vehicle efficiency. By implementing double left-turn lanes on all approaches of the intersection, more vehicles would be able to pass through the intersection on the same green phase. With more efficient service on the left-turn signal phases, capacity (or green time) can be reallocated to other movements to reduce delay.

In the AM peak hour, the overall average intersection delay would improve from 87 seconds per vehicle (LOS ‘F’) to 49 seconds per vehicle (LOS ‘D’) with mitigation. Nearly all of the individual turning movements (as shown in Appendix C) would improve by at least one LOS grade, and all movements would experience a reduction in vehicle delay from the reallocation of green time as a result of implementing double left-turn lanes. See Appendix C for individual turning movement delay. In the PM peak hour, the overall average intersection delay would improve from 144 seconds per vehicle (LOS ‘F’) to 79 seconds per vehicle (LOS ‘E’) with mitigation. Although many of the individual movements would remain at LOS ‘F’ with the additional turn lanes, all movements would benefit from the increased capacity as shown by the reduction in vehicle delay in Appendix C. Detailed Synchro output reports for the mitigated condition are included in Appendix F.

Table 11 compares intersection operations between the 2028 No Build and Build scenarios, and shows the improved vehicle delay and LOS at the intersection of Farrington Highway and Kualakai Parkway with

added left-turn capacity mitigation. Lane capacity mitigation is not proposed at the remaining study intersections. The project is not expected to worsen operations at the intersection of Farrington Highway at Fort Barrette Road, or the H-1 westbound ramp terminal on Kualakai Parkway. Both of these locations are expected to operate at LOS E or worse in the future No Build scenario, even without the project, as a result of regional background traffic growth and trips generated by area land use developments.

Table 11. No Build and Build 2028 Intersection Operations Results

Peak Hour	Int ID	Intersection	Control Type	2028 No Build (2-lanes to Golf Course Road)		2028 Build (4-lanes to Golf Course Road)		2028 Build Mitigated (4-lanes to Golf Course Road, double left-turns at Kualakai Pkwy)	
				Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	24.1	C	14.3	B	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	48.3	E	29.7	D	-	-
	3	Farrington Highway and Kualakai Parkway	Signal	114.6	F	87.0	F	***48.8***	***D***
	4	Farrington Highway and Kapolei Golf Course Road	Stop	21.6	C	21.6	C	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	34.0	C	34.0	C	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	64.3	E	64.3	E	-	-
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	45.1	D	45.1	D	-	-
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	31.7	C	31.7	C	-	-
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Stop	18.1	C	12.6	B	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Stop	47.2	E	30.0	D	-	-
	3	Farrington Highway and Kualakai Parkway	Signal	212.6	F	144.4	F	***78.6***	***E***
	4	Farrington Highway and Kapolei Golf Course Road	Stop	25.9	D	25.9	D	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	50.5	D	50.5	D	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	83.1	F	83.1	F	-	-
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	185.1	F	185.1	F	-	-
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	22.7	C	22.7	C	-	-

Shaded cells indicate unmitigated intersections that operate at 'LOS E' or worse. Bold italicized text indicates delay improvements with potential mitigation.

Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

Figures 5 and 6 display the intersection turning movements at each of the study intersections for the No Build and Build scenarios with turn lane mitigation at Farrington Highway and Kualakai Parkway.

With mitigation, vehicle queue lengths reported from the VISSIM microsimulation would improve on nearly all of approaches of the Farrington Highway and Kualakai Parkway intersection. The additional left-turn lane capacity allows more vehicles to pass through the intersection in the same amount of time as the scenario without lane mitigation. Traffic signal timing has been optimized to provide improvements to the overall intersection level of service. In the PM peak hour, the overall intersection LOS would improve from LOS ‘F’ in the Build scenario to LOS ‘E’ and the average vehicle delay would be reduced by approximately 65 seconds. The optimized signal includes a reasonable level of prioritization of the southbound left-, through-, and right-turn movements to prevent queues from affecting the H-1 interchange.

More aggressive signal prioritization could be given to the southbound movements, but is not recommended as it would worsen the remaining approaches and would cause the overall intersection to operate at LOS ‘F’. Taking time from the eastbound and westbound approaches and giving that time to the southbound movements could improve the through- and right-turn movements to LOS ‘D’ but this would also increase the average vehicle delay on westbound Farrington Highway by over 100 seconds.

Adaptive signal control technology should be considered during the final design phase of traffic signal improvements at Farrington Highway and Kualakai Parkway, as well as at any new traffic signals along the Farrington Highway corridor within the study limits. Adaptive signal control would allow a coordinated system of traffic signals to optimize vehicle flow by actively adjusting phases to accommodate real-time traffic. This type of technology would reduce wait times at intersections and increase efficiency of traffic flow.

Appendix C presents the individual movement delays at the intersection of Farrington Highway and Kualakai Parkway with optimized signal timing (overall intersection LOS ‘E’) and more aggressive signal timing (overall intersection LOS ‘F’) for the southbound movements.

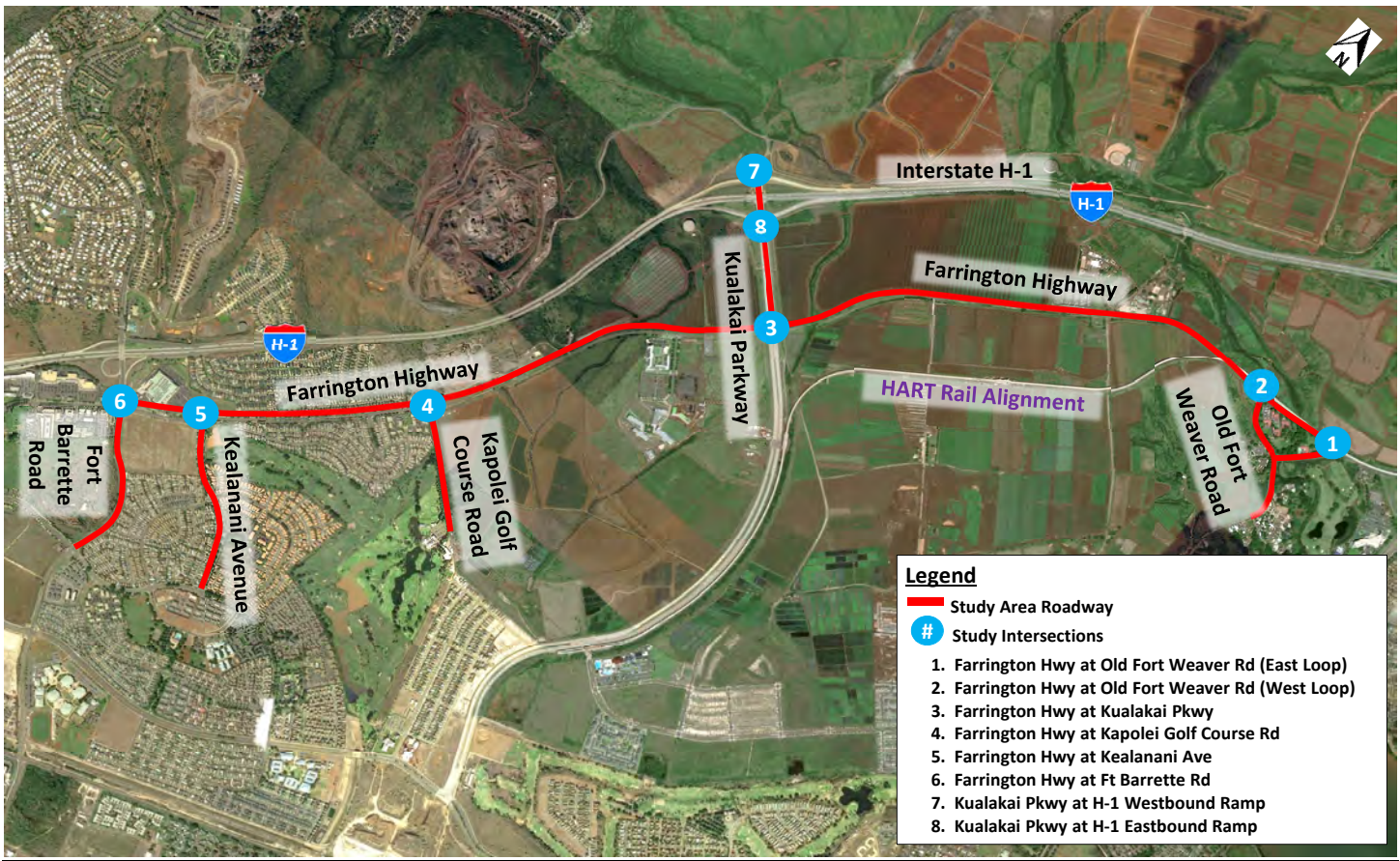
Even with improved timing and left-turn vehicle progression, the eastbound through movement queues on Farrington Highway approaching Kualakai Parkway in the PM peak hour may still occasionally extend back beyond the UH West Oahu driveway. Detailed information on the VISSIM microsimulation analysis is presented in Appendix G, including summaries of the average and 95th percentile queue lengths at intersections on Kualakai Parkway, and graphics of typical PM peak hour queuing.

Several grade separation concepts were considered at the intersection of Kualakai Parkway and Farrington Highway, including a compressed diamond configuration and various partial cloverleaf designs, to provide better level of service for vehicular traffic in order to meet the State Department of Transportation’s preferred LOS D operation. However, the grade separated intersection designs at Kualakai Parkway and Farrington Highway would require significant property acquisition to accommodate the configurations on-ramps and off-ramps.

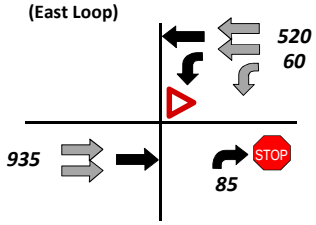
The ramps would also affect adjacent property owners and limit access to their properties as the ramp lengths would block driveway access to each property. In addition, the proximity of the new grade separated intersection to the H-1 Freeway would require difficult weaving patterns with vehicles merging onto Kualakai Parkway. Lastly, the grade separated intersection would be not be consistent with proposed East Kapolei Neighborhood TOD (transit-oriented development) Plan (Public Review Draft 2), which envisions the area as transit-oriented development sites that are compact and pedestrian friendly. Grade separation intersections are typically less pedestrian and bicycle friendly and is not aligned with the future vision of Farrington Highway as a multimodal corridor with robust non-motorized and transit access.

For these reasons, the grade separation intersection was eliminated from further consideration. Previously considered grade separation concepts at the intersection of Farrington Highway and Kualakai Parkway are shown in Appendix H.

While the proposed at-grade intersection design may not meet the State DOT's recommended LOS D for transportation facilities, it will provide additional capacity and mitigation that would not otherwise be provided under the 2028 No Build scenario.

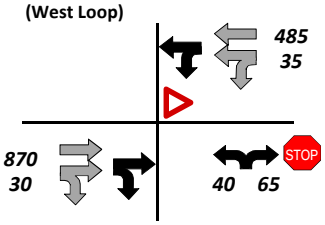


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



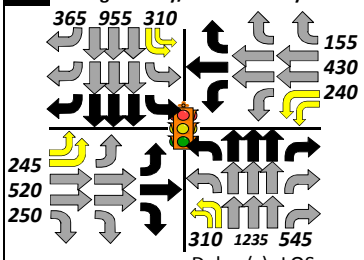
	Delay (s)	LOS
No Build	24.1	C
Build	14.3	B

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



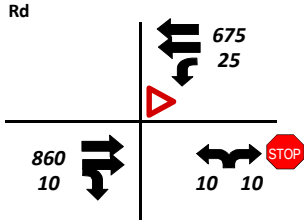
	Delay (s)	LOS
No Build	48.3	E
Build	29.7	D

3 Farrington Hwy/Kualakai Pkwy



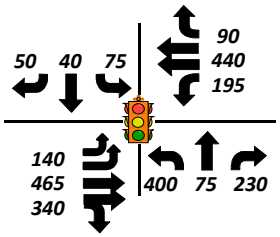
	Delay (s)	LOS
No Build	114.6	F
Build	87.0	F
Mitigated	48.8	D

4 Farrington Hwy/Kapolei Golf Course Rd



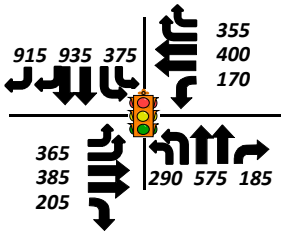
	Delay (s)	LOS
No Build	21.6	C
Build	21.6	C

5 Farrington Hwy/Kealanani Ave



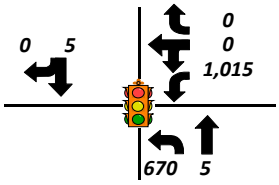
	Delay (s)	LOS
No Build	34.0	C
Build	34.0	C

6 Farrington Hwy/Ft Barrette Rd



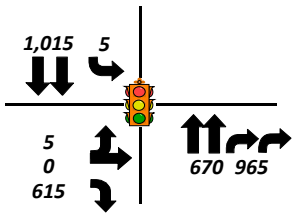
	Delay (s)	LOS
No Build	64.3	E
Build	64.3	E

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build	45.1	D
Build	45.1	D

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build	31.7	C
Build	31.7	C

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- LOS Level of Service

Lane Movement: No Build, Build, Mitigation

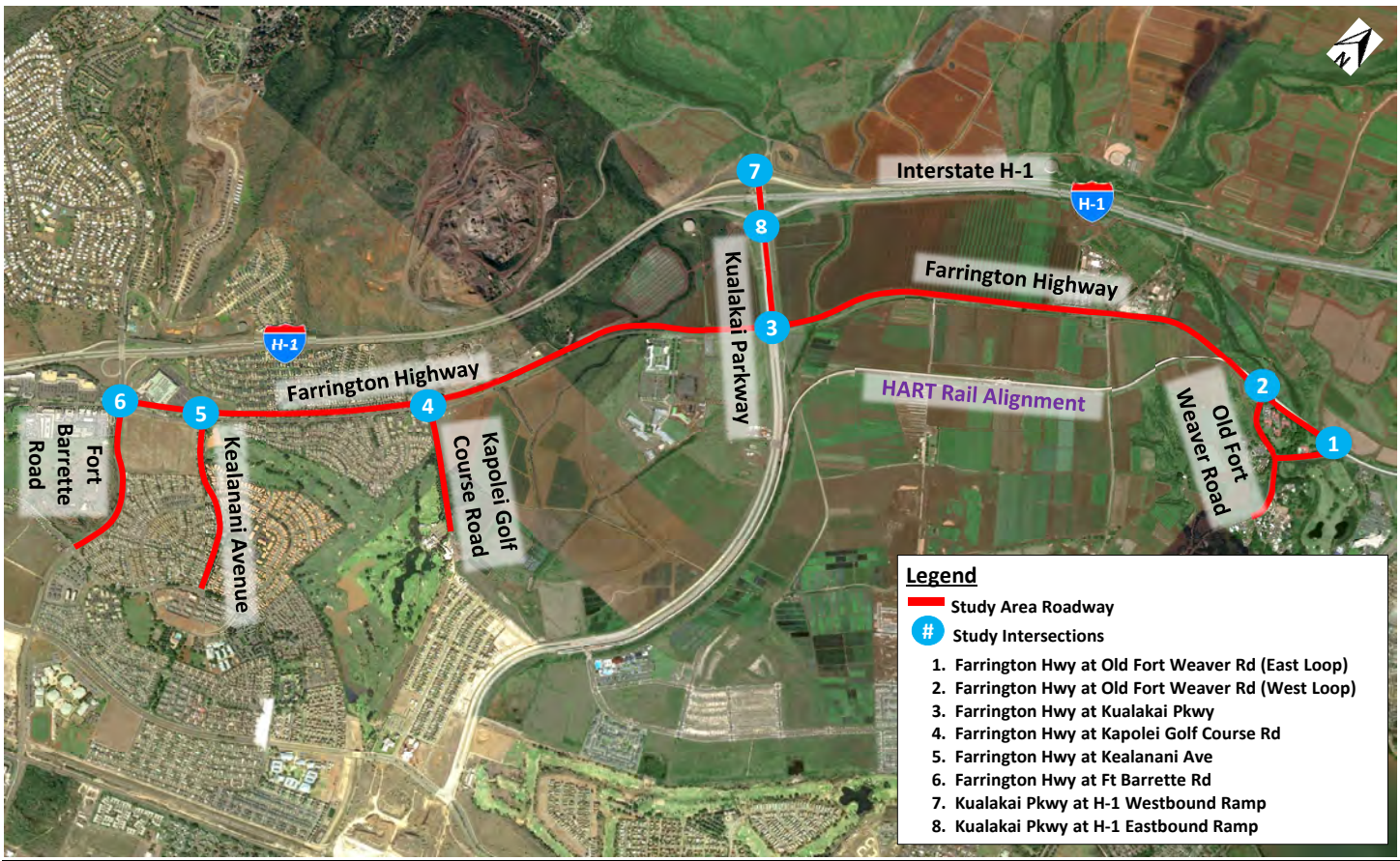
Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

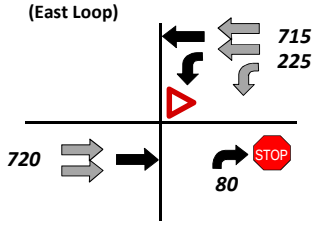
Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 5
Year (2028) AM Peak Hour
No Build, Build, and Build with Mitigation
Intersection Volumes and Operations Results

Farrington Highway Improvements Study

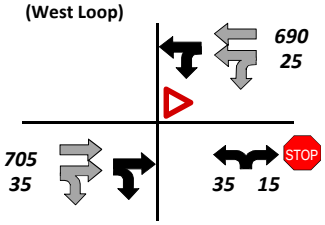


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



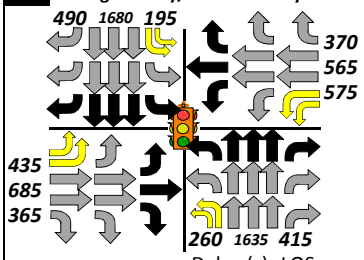
	Delay (s)	LOS
No Build	18.1	C
Build	12.6	B

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



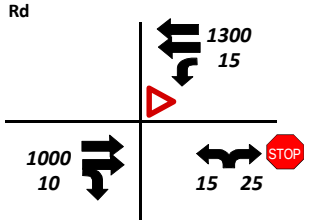
	Delay (s)	LOS
No Build	47.2	E
Build	30.0	D

3 Farrington Hwy/Kualakai Pkwy



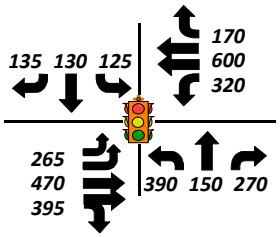
	Delay (s)	LOS
No Build	212.6	F
Build	144.4	F
Mitigated	78.6	E

4 Farrington Hwy/Kapolei Golf Course Rd



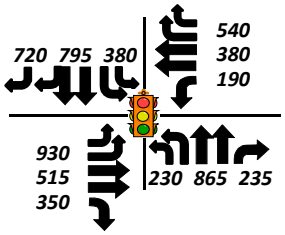
	Delay (s)	LOS
No Build	25.9	D
Build	25.9	D

5 Farrington Hwy/Kealanani Ave



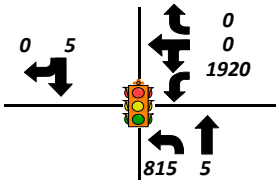
	Delay (s)	LOS
No Build	50.5	D
Build	50.5	D

6 Farrington Hwy/Ft Barrette Rd



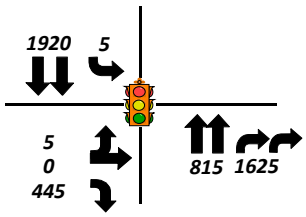
	Delay (s)	LOS
No Build	83.1	F
Build	83.1	F

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build	185.1	F
Build	185.1	F

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build	22.7	C
Build	22.7	C

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- LOS Level of Service
- Lane Movement: No Build, Build, Mitigation

Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 6
Year (2028) PM Peak Hour
No Build, Build, and Build with Mitigation
Intersection Volumes and Operations Results

Farrington Highway Improvements Study

5.3 Build Operations with Developments (Segments)

During the AM and PM peak hours, all study segments are expected to continue operating at LOS 'C' or better with development trips. Table 12 provides a summary of the segment operations results for the 2028 Build scenarios compared to the No Build results. Peak hour segment volumes are included in Appendix C.

Table 12. No Build and Build 2028 Segment Operations Results

Roadway Segment	Travel Direction	2028 No Build			2028 Build		
		Number of Lanes	AM LOS	PM LOS	Number of Lanes	AM LOS	PM LOS
Farrington Highway							
Between Ft Barrette Ave and Kealanani Ave	Eastbound	2	B	B	2	B	B
	Westbound	2	B	B	2	B	B
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	B	B	2	B	B
	Westbound	2	A	B	2	A	B
Between Kapolei Golf Course Road and Kualakai Parkway	Eastbound	1	D	E	2	B	B
	Westbound	1	C	E	2	B	C
Between Kualakai Parkway and Fort Weaver Road (West Loop)	Eastbound	1	D	D	2	B	B
	Westbound	1	C	D	2	A	B
Between Fort Weaver Road West Loop and East Loop	Eastbound	1	D	C	2	B	A
	Westbound	1	B	C	2	A	A
Kualakai Parkway							
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	B	C	3	B	C
	Southbound	3	B	C	3	B	C
South of Farrington Hwy (For approximately 1000 feet)	Northbound	3	C	C	3	C	C
	Southbound	3	B	C	3	B	C

Shaded cells indicate segments that operate at 'LOS E' or worse.
Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.

No mitigation is proposed for the Farrington Highway study segments because they are expected to operate at LOS 'C' or better with development trips in the 2028 Build scenario.

6. Future Phase (2035) Conditions

This section describes anticipated traffic conditions in the study area for the future phase year 2035. Year 2035 traffic volumes include background growth (assuming a 0.5 percent annual increase) for developments that are already completed. It also includes trips generated by new developments that are expected to be complete by 2035.

The No Build lane configuration includes two lanes in each direction between Kapolei Golf Course Road and Old Fort Weaver Road on Farrington Highway. This No Build scenario also assumes that intersection improvements have been made at both Old Fort Weaver Road intersections with Farrington Highway to support access to and from the Hoopili development. Per the Hoopili Traffic Impact Analysis Report (2014), both intersections (which are currently stop-controlled) are planned to have traffic signals in 2035.

Recommended regional connectivity projects documented in the ORTP (and analyzed and documented in the Hoopili Traffic Impact Analysis Report for the developments full buildout), are assumed to be in place in the No Build scenario. These improvements include an extension of Makakilo Drive to Kualakai Parkway north of the H-1 interchange, as well as turn lane additions at the westbound H-1 off-ramp terminal intersection at Kualakai Parkway.

The future phase Build scenario assumes the same traffic volumes as the No Build scenario, but includes three lanes in each direction of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road.

6.1 No Build Operations

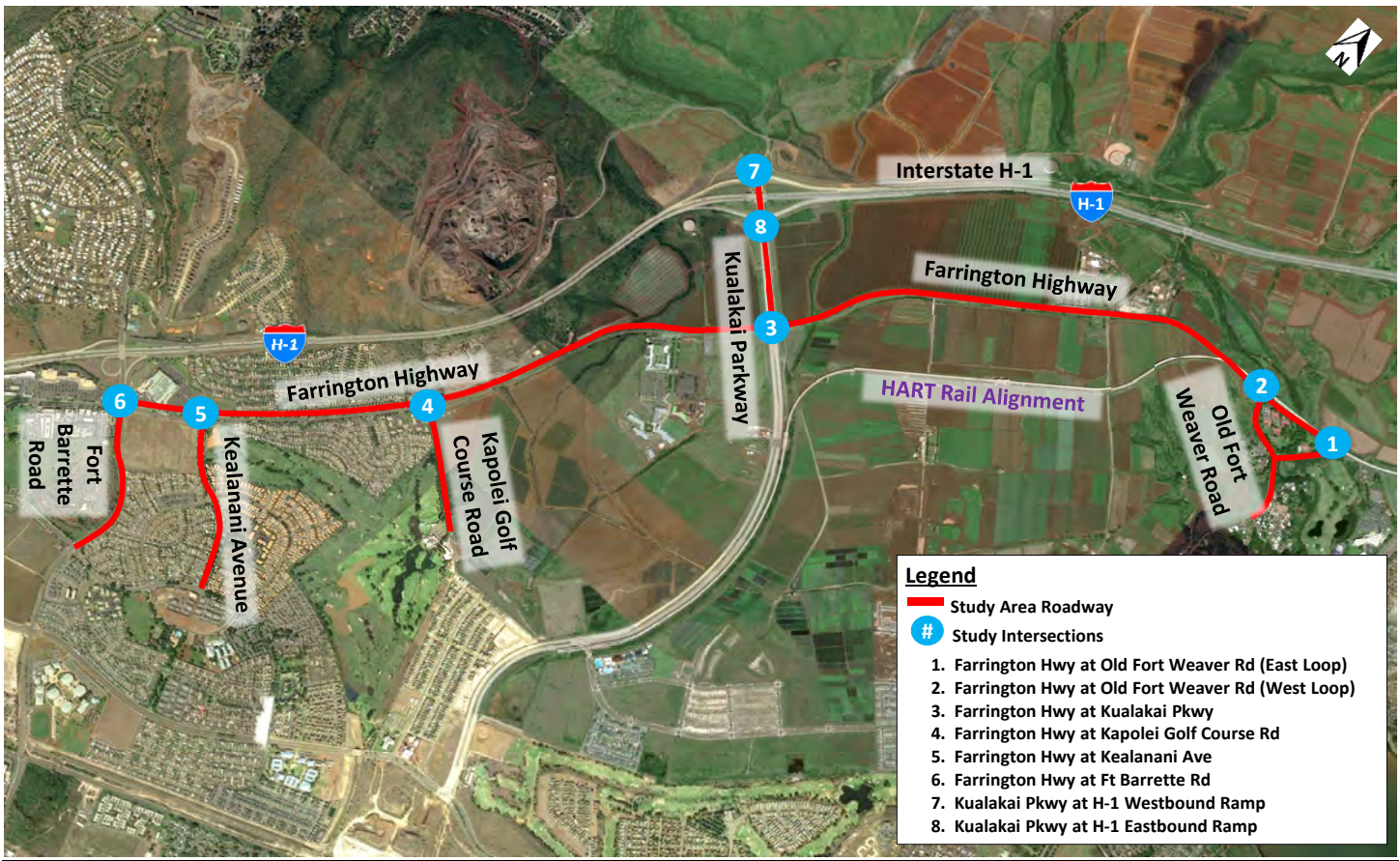
With Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road as a four-lane, divided roadway, two of the study intersections are expected to operate at LOS 'E' or worse during the AM peak hour. During the PM peak hour, nearly all of the intersections are expected to operate at LOS 'E' or worse. Table 13 and Figure 7 provide a summary of the 2035 No Build intersection operations results for the AM and PM peak hours. See Appendix I for detailed Synchro output reports.

Table 13. No Build 2035, AM and PM Intersection Operations Results

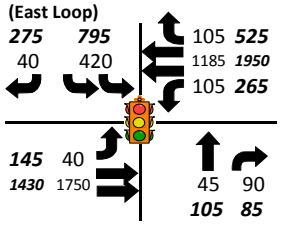
Peak Hour	Int ID	Intersection	Control Type	Delay (seconds)	Level of Service
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	35.7	D
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	5.6	A
	3	Farrington Highway and Kualakai Parkway	Signal	196.6	F
	4	Farrington Highway and Kapolei Golf Course Road	Stop	28.2	D
	5	Farrington Highway and Kealanani Avenue	Signal	40.2	D
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	53.4	D
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	73.5	E
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	11.0	B
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	88.1	F
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	7.3	A
	3	Farrington Highway and Kualakai Parkway	Signal	266.6	F
	4	Farrington Highway and Kapolei Golf Course Road	Stop	48.1	E
	5	Farrington Highway and Kealanani Avenue	Signal	69.8	E
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	93.8	F
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	78.7	E
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	6.9	A

Shaded cells indicate intersections that operate at 'LOS E' or worse.

Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

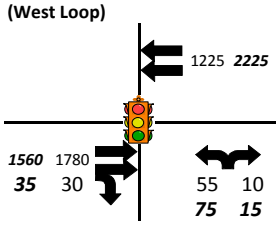


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



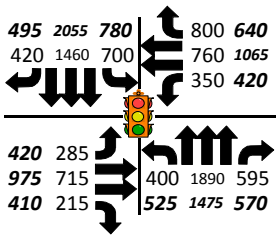
	Delay (s)	LOS
No Build AM	35.7	D
No Build PM	88.1	F

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



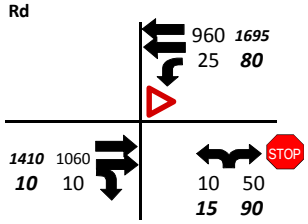
	Delay (s)	LOS
No Build AM	5.6	A
No Build PM	7.3	A

3 Farrington Hwy/Kualakai Pkwy



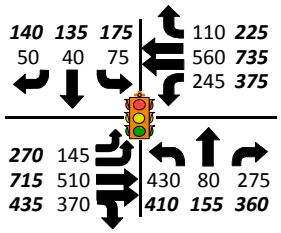
	Delay (s)	LOS
No Build AM	196.6	F
No Build PM	266.6	F

4 Farrington Hwy/Kapolei Golf Course Rd



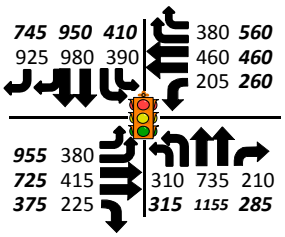
	Delay (s)	LOS
No Build AM	28.2	D
No Build PM	48.1	E

5 Farrington Hwy/Kealanani Ave



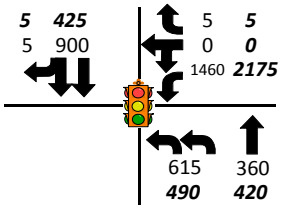
	Delay (s)	LOS
No Build AM	40.2	D
No Build PM	69.8	E

6 Farrington Hwy/Ft Barrette Rd



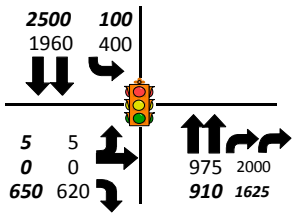
	Delay (s)	LOS
No Build AM	53.4	D
No Build PM	93.8	F

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build AM	73.5	E
No Build PM	78.7	E

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build AM	11.0	B
No Build PM	6.9	A

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- Turning Movement Direction
- 100 AM Peak-Hour Volume
- ***100*** PM Peak-Hour Volume
- LOS Level of Service

Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 7
Future Phase (2035) No Build AM/PM Peak Hour Intersection Volumes and Operations Results

Farrington Highway Improvements Study

6.2 Build Operations with Developments (Intersections)

The future phase widening of Farrington Highway to a six-lane, divided roadway with dedicated turn lanes at select cross-streets will provide some congestion relief for anticipated traffic in 2035, but the intersection of Farrington Highway at Kualakai Parkway is still expected to experience heavy congestion. It is expected to operate at LOS 'F' with approximately 160 seconds of delay per vehicle in the AM, and with roughly 220 seconds of average delay per vehicle in the PM peak hour.

With six lanes on Farrington Highway, operations at the Old Fort Weaver Road intersections would improve and the average vehicle delay would be reduced. At the east loop intersection, the PM peak hour LOS would improve from LOS 'F' in the No Build to an acceptable LOS 'D' with approximately 50 seconds of average delay per vehicle.

Intersection operations at study locations on Farrington Highway west of Kualakai Parkway would remain unchanged compared to the No Build condition. These intersections are unaffected by the future phase lane widening and would remain at their current cross sections with two lanes in each direction. See Appendix I for detailed Synchro output reports. Synchro queue tables are included in Appendix C

6.2.1 Potential Mitigation

Reasonable mitigation measures are identified at the intersection of Farrington Highway and Kualakai Parkway to further improve operations and reduce expected delay in the future phase Build scenario. With the proposed three lanes in each direction of Farrington Highway, the intersection is expected to operate at LOS 'F' with over 160 seconds of average vehicle delay during the peak hours.

Consistent with potential mitigation identified in the Hoopili Traffic Impact Analysis Report, increasing the turn lane capacity to double left-turn lanes on the eastbound, westbound, and northbound approaches would allow more vehicles to pass through the intersection on the same green phase. Increasing the southbound left-turn movement to triple lanes would further increase capacity and improve efficiency.

With the described turn lane mitigation, the overall average intersection delay in the AM peak hour would improve from approximately 160 seconds per vehicle to 68 seconds per vehicle, resulting in LOS 'E'. In the PM peak hour, average delay would improve from about 220 seconds per vehicle to 95 seconds per vehicle on average. Although the identified mitigation would not provide enough capacity to sufficiently reduce vehicle delays to an acceptable LOS, the intersection would benefit from the additional capacity and noticeable improvements to vehicle delay and queueing would likely be experienced. Adaptive signal control technology at this intersection and new signalized intersections along Farrington Highway within the study limits should be considered to optimize vehicle flow. This technology gathers data from real-time traffic and actively adjusts signal phases to accommodate flow most efficiently. Appendix C includes movement-specific delays at each intersection. Detailed Synchro output reports for the mitigated condition are included in Appendix I.

Mitigation measures such as grade separation of the intersection or widening Kualakai Parkway to more than three lanes in each direction were not further explored in this study. Although these types of mitigation measures could improve operations to acceptable LOS values, they are not aligned with the future vision of Farrington Highway as a multimodal corridor with robust non-motorized and transit access. Refer to the grade separation discussion in 5.2.1 Potential Mitigations under the Year 2028 Conditions Chapter.

Table 14 compares intersection operations between the future phase year 2035 No Build and Build scenarios, and shows the improved vehicle delay and LOS at the intersection of Farrington Highway and Kualakai Parkway with reasonable mitigation and capacity improvements. Lane capacity mitigation is not proposed at the remaining study intersections. The project is not expected to worsen operations at the

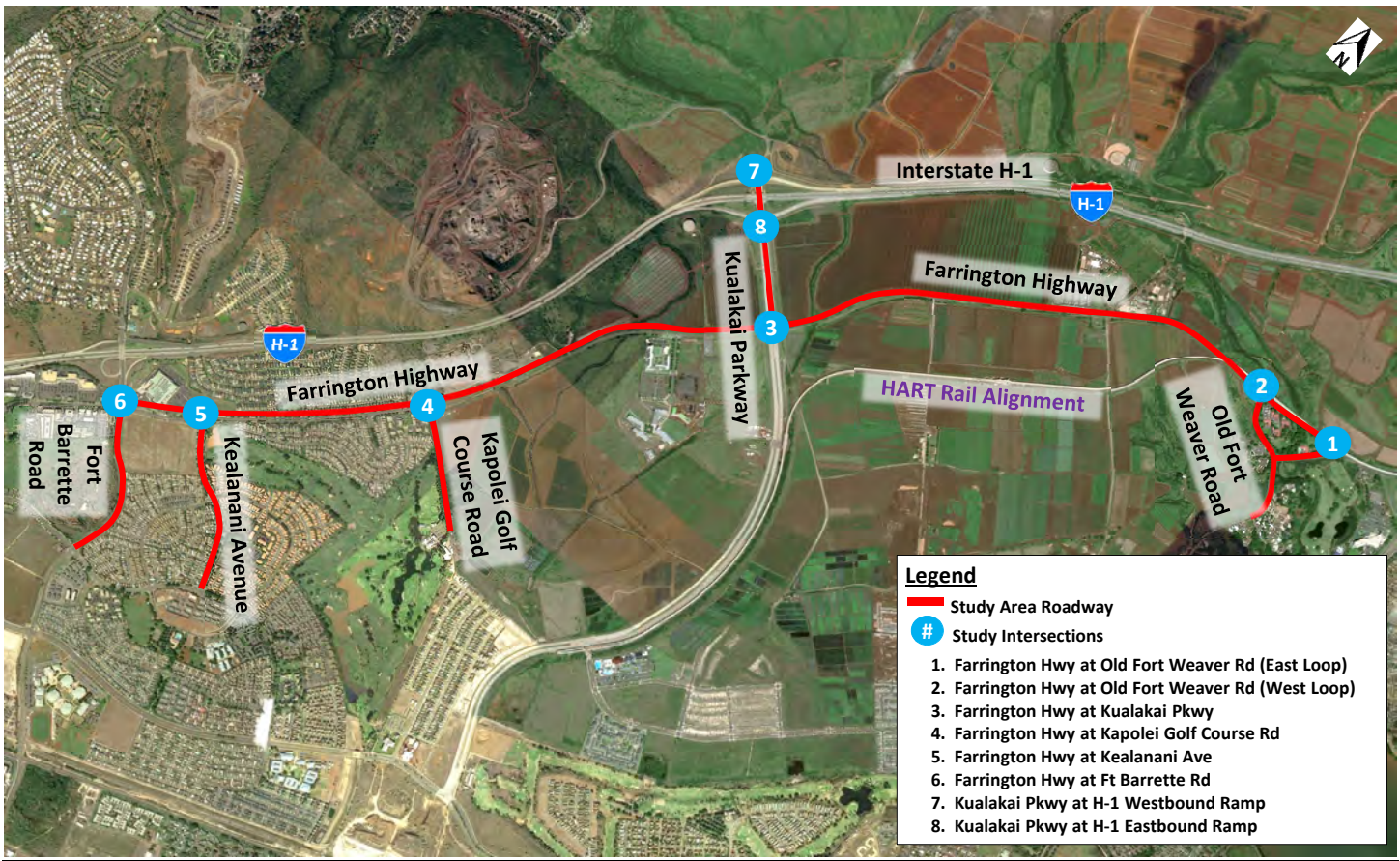
intersection of Farrington Highway at Fort Barrette Road, or the H-1 westbound ramp terminal on Kualakai Parkway. Figures 8 and 9 display the intersection turning movements at each of the study intersections for the No Build and Build scenarios. These figures also show the potential turn lane and capacity mitigation measures at the intersection of Farrington Highway and Kualakai Parkway.

Table 14. No Build and Build 2035 Intersection Operations Results

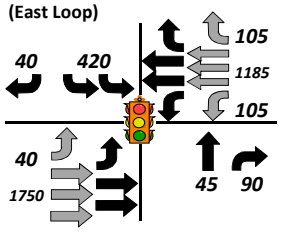
Peak Hour	Int ID	Intersection	Control Type	2035 No Build (4-lanes to Golf Course Road)		2035 Build (6-lanes to Golf Course Road)		2035 Build Mitigated (6-lanes to Golf Course Road, turn lane improvements at Kualakai Pkwy)	
				Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	35.7	D	22.5	C	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	5.6	A	4.5	A	-	-
	3	Farrington Highway and Kualakai Parkway	Signal	196.6	F	160.9	F	***67.8***	***E***
	4	Farrington Highway and Kapolei Golf Course Road	Stop	28.2	D	28.2	D	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	40.2	D	40.2	D	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	53.4	D	53.4	D	-	-
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	73.5	E	73.5	E	-	-
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	11.0	B	11.0	B	-	-
PM Peak	1	Farrington Highway and Old Fort Weaver Road (East Loop)	Signal	88.1	F	51.7	D	-	-
	2	Farrington Highway and Old Fort Weaver Road (West Loop)	Signal	7.3	A	4.4	A	-	-
	3	Farrington Highway and Kualakai Parkway	Signal	266.6	F	222.3	F	***94.5***	***F***
	4	Farrington Highway and Kapolei Golf Course Road	Stop	48.1	E	48.1	E	-	-
	5	Farrington Highway and Kealanani Avenue	Signal	69.8	E	69.8	E	-	-
	6	Farrington Highway and Makakilo Drive/Fort Barrette Road	Signal	93.8	F	93.8	F	-	-
	7	Kualakai Parkway and H-1 Westbound Ramps	Signal	78.7	E	78.7	E	-	-
	8	Kualakai Parkway and H-1 Eastbound Ramps	Signal	6.9	A	6.9	A	-	-

Shaded cells indicate unmitigated intersections that operate at 'LOS E' or worse. Bold italicized text indicates delay improvements with potential mitigation.

Results reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections). Results are consistent with Highway Capacity Manual 2010 methodology.

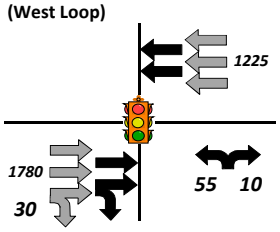


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



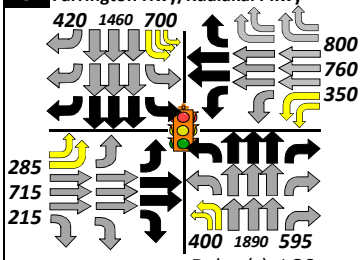
	Delay (s)	LOS
No Build	35.7	D
Build	22.5	C

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



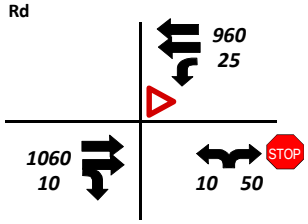
	Delay (s)	LOS
No Build	5.6	A
Build	4.5	A

3 Farrington Hwy/Kualakai Pkwy



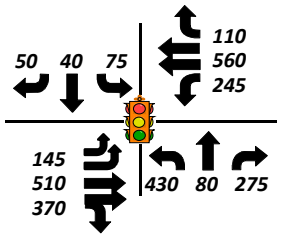
	Delay (s)	LOS
No Build	196.6	F
Build	160.9	F
Mitigated	67.8	E

4 Farrington Hwy/Kapolei Golf Course Rd



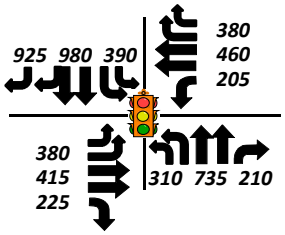
	Delay (s)	LOS
No Build	28.2	D
Build	28.2	D

5 Farrington Hwy/Kealanani Ave



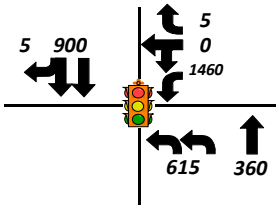
	Delay (s)	LOS
No Build	40.2	D
Build	40.2	D

6 Farrington Hwy/Ft Barrette Rd



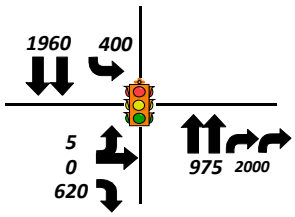
	Delay (s)	LOS
No Build	53.4	D
Build	53.4	D

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build	73.5	E
Build	73.5	E

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build	11.0	B
Build	11.0	B

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- LOS Level of Service

Lane Movement: No Build, Build, Mitigation

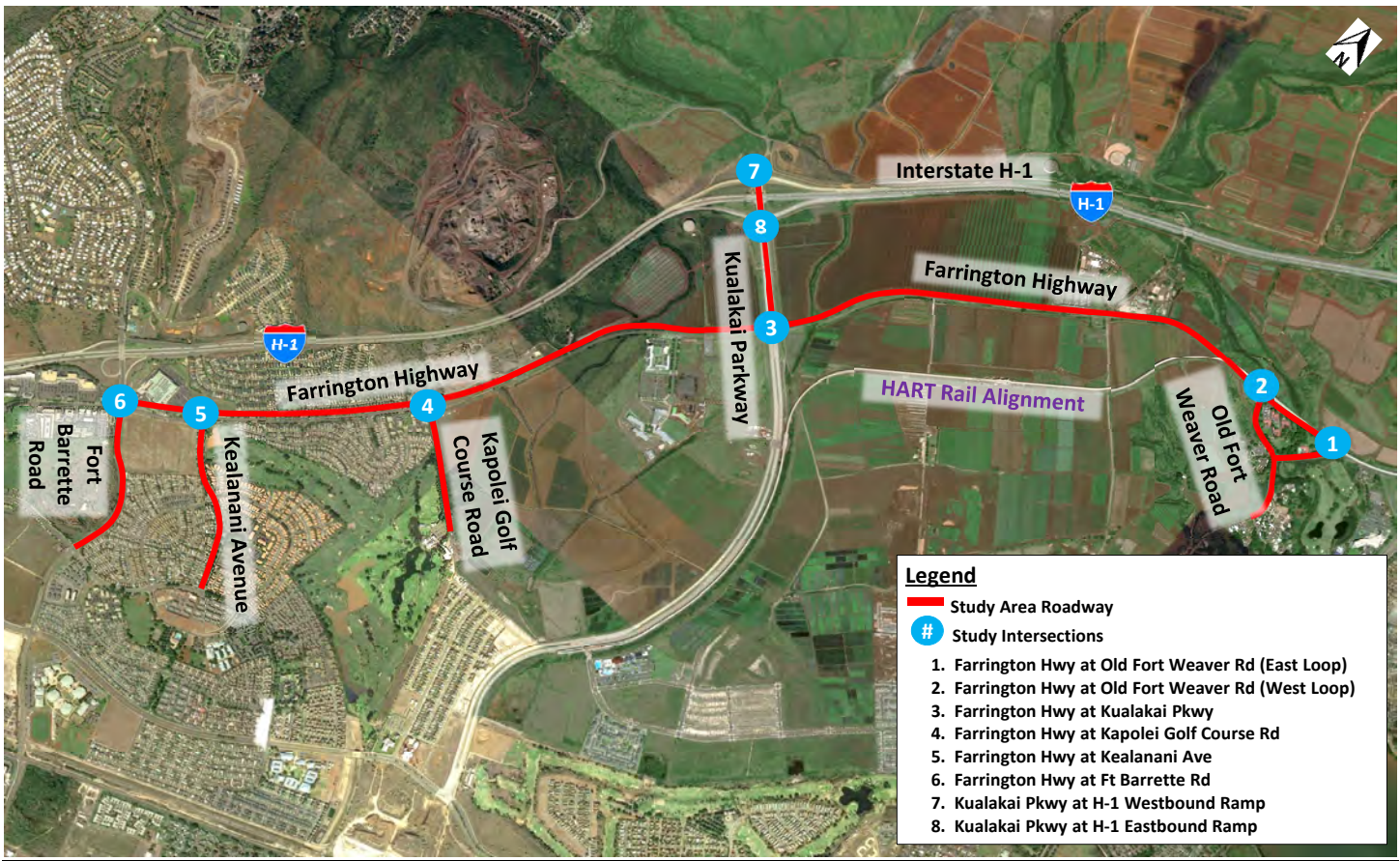
Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

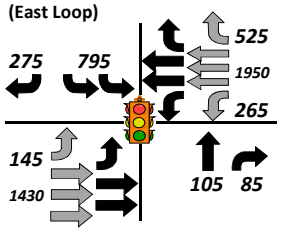
Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 8
Future Phase (2035) AM Peak Hour
No Build, Build, and Build with Mitigation
Intersection Volumes and Operations Results

Farrington Highway Improvements Study

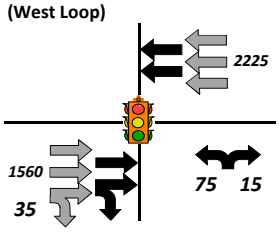


1 Farrington Hwy/Old Fort Weaver Rd (East Loop)



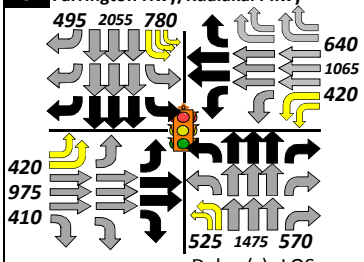
	Delay (s)	LOS
No Build	88.1	F
Build	51.7	D

2 Farrington Hwy/Old Fort Weaver Rd (West Loop)



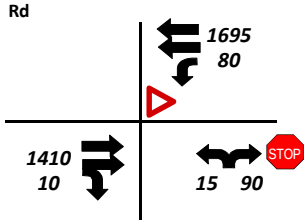
	Delay (s)	LOS
No Build	7.3	A
Build	4.4	A

3 Farrington Hwy/Kualakai Pkwy



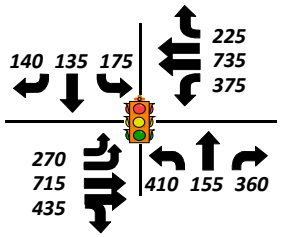
	Delay (s)	LOS
No Build	266.6	F
Build	222.3	F
Mitigated	94.5	F

4 Farrington Hwy/Kapolei Golf Course Rd



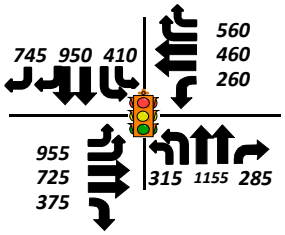
	Delay (s)	LOS
No Build	48.1	E
Build	48.1	E

5 Farrington Hwy/Kealanani Ave



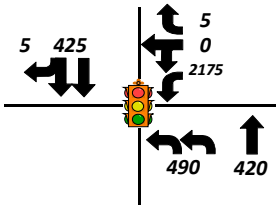
	Delay (s)	LOS
No Build	69.8	E
Build	69.8	E

6 Farrington Hwy/Ft Barrette Rd



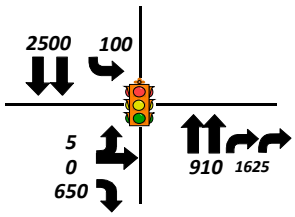
	Delay (s)	LOS
No Build	93.8	F
Build	93.8	F

7 Kualakai Pkwy/H-1 Westbound Ramp



	Delay (s)	LOS
No Build	78.7	E
Build	78.7	E

8 Kualakai Pkwy/H-1 Eastbound Ramp



	Delay (s)	LOS
No Build	6.9	A
Build	6.9	A

Legend

- 7 Study Intersection Number
- STOP Stop-Controlled Approach
- Yield-Controlled Approach
- Signalized Intersection
- LOS Level of Service

Lane Movement: No Build, Build, Mitigation

Notes

Results are based on HCM 2010 methodology. Signalized intersection results are based on an average of all approaches. Stop-control intersection delay results are shown for the worst minor street approach.

Left-turn, through, and right-turn volumes are shown by movement, not by approach lane channelization.

Figure 9
Future Phase (2035) PM Peak Hour
No Build, Build, and Build with Mitigation
Intersection Volumes and Operations Results

Farrington Highway Improvements Study

6.3 No Build and Build Operations with Developments (Segments)

With two lanes in each direction of Farrington Highway, all study segments are expected to operate at LOS 'D' or better with development trips in the No Build scenario. With the future phase Build cross section consisting of three lanes in each direction, segment operations would further improve. Table 15 provides a summary of the segment operations results for the future phase 2035 scenarios. Peak hour segment volumes are included in Appendix C.

Table 15. No Build and Build 2035 Segment Operations Results

Roadway Segment	Travel Direction	2035 No Build			2035 Build		
		Number of Lanes	AM LOS	PM LOS	Number of Lanes	AM LOS	PM LOS
Farrington Highway							
Between Ft Barrette Ave and Kealanani Ave	Eastbound	2	B	C	2	B	C
	Westbound	2	B	B	2	B	B
Between Kealanani Ave and Kapolei Golf Course Road	Eastbound	2	B	C	2	B	C
	Westbound	2	B	C	2	B	C
Between Kapolei Golf Course Road and Kualakai Parkway	Eastbound	2	B	C	3	A	B
	Westbound	2	B	D	3	B	B
Between Kualakai Parkway and Fort Weaver Road (West Loop)	Eastbound	2	D	D	3	B	C
	Westbound	2	C	D	3	B	C
Between Fort Weaver Road West Loop and East Loop	Eastbound	2	C	C	3	B	B
	Westbound	2	B	D	3	B	C
Kualakai Parkway							
Between H-1 Interchange Ramps and Farrington Hwy	Northbound	3	D	C	3	D	C
	Southbound	3	C	D	3	C	D
South of Farrington Hwy (For approximately 1000 feet)	Northbound	3	D	C	3	D	C
	Southbound	3	C	D	3	C	D

Results are consistent with Highway Capacity Manual 2010 methodology for multilane highways.

7. Multimodal Assessment

Based on the goals and objectives of long-range transportation plans and multimodal plans, the Farrington Highway Improvements Study considers all modes of transportation within the project corridor. A qualitative assessment of existing and 2028 Build scenario multimodal (transit, bicycle, pedestrian, and vehicle) conditions along Farrington Highway is presented in this section.

The level and quality of service of each mode is determined using a specific tool or methodology for each mode. This analysis results in a uniform multimodal score, scaled from one to four, with one being the best. The multimodal score is then used in a modal priority analysis to determine whether the modal accommodations meet the 'target' score for the specified street typologies. The 'target' score represents the ideal or goal for a particular mode on a specified street typology, which is based on City and County of Honolulu established priorities. Farrington Highway is given the street typology designation of a 'Boulevard and Parkway' where automobile traffic and transit services are prioritized over non-motorized modes. See Appendix J for a summary of the modal priority assessment.

The preliminary plans for highway improvements include nonmotorized facilities, landscaping, and additional travel lanes. Planned improvements would be constructed within a 140-foot wide right-of-way between Kapolei Golf Course Road and Old Fort Weaver Road. The improved cross section includes 8-foot sidewalks and 10-foot stormwater treatment planter strips on both sides of the highway. Striped 6-foot bicycle lanes, and two 12-foot travel lanes are provided in each direction of travel on Farrington Highway. Travel directions are separated by a 44-foot planted median. Figure 10 depicts the preliminary typical cross section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road.

For this study, the highway is divided into three separate segments based on where traffic volumes are anticipated to change along the corridor. The segments are described below and the anticipated roadway cross section design, along with preliminary roadway plan and profile information between Kapolei Golf Course Road and Old Fort Weaver Road, are included in Appendix K.

- Segment A extends from Kapolei Golf Course Road to Kualakai Parkway. This segment is approximately 0.96 miles long.
- Segment B extends from Kualakai Parkway to Old Fort Weaver Road (west intersection with Farrington Highway). This segment is approximately 1.6 miles long.
- Segment C extends from the Old Fort Weaver Road west intersection with Farrington Highway to the Old Fort Weaver Road east intersection with Farrington Highway. This segment is approximately 0.36 miles long.

7.1 Transit Assessment

The Transit Capacity and Quality of Service Manual (TCQSM) developed by the Transportation Research Board presents methodologies for assigning a score for quality of transit service on a corridor. The Transit Level of Service (Transit LOS) model found in the TCQSM evaluates transit operations, transit amenities, and pedestrian environment data to assign a score to a specific street segment.

The Transit LOS letter grade and score is assigned to ranges that represent relative transit operations/comfort on a scale of one through four, as shown in Table 16.

Table 16. Transit LOS Scoring System

Transit LOS Letter	Transit LOS Score	Transit Operations/ Comfort Scale
A	< 2.00	1
B	2.00 – 2.75	2
C	2.76 – 3.59	3
D	3.60 – 4.25	
E	4.26 – 5.00	4
F	> 5.00	

Source: Multimodal Transit LOS Computational Engine, City and County of Honolulu.

The existing (2018) and 2028 Build scenario transit environment was assessed for Segments A, B, and C along the study corridor between Kapolei Golf Course Road and Old Fort Weaver Road using the TCQSM methodology. Existing transit route frequency and headways were gathered from the City and County of Honolulu (thebus.org) and existing roadway features such as shelters, buffer widths, and sidewalks were gathered from online aerial mapping. Roadway Segments A and B currently operate at Transit LOS B, while Segment C operates at LOS A.

Source: Farrington Highway Improvements, Draft Environmental Assessment (Group 70)

Figure 10 – Preliminary Farrington Highway Typical Cross Section

In the future, the number of local transit routes is assumed to increase to support regional rail operations. Transit amenities at bus stop locations will be improved to include benches, shelters, and wider buffers between the roadway and the bus stop waiting area. Transit LOS with the 2028 Build scenario is expected to be LOS A in all three segments. Appendix J includes detailed information on the transit mode input assumptions and resulting LOS.

7.2 Bicycle Assessment

The Level of Traffic Stress (LTS) tool is used to evaluate bicycle comfort on Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. LTS uses metrics such as traffic volumes, vehicle speeds, type of bicycle infrastructure, and roadway design to evaluate bicycling conditions. This tool assesses personal level of comfort while bicycling. Bicyclists experience different levels of stress depending on the type of infrastructure present on the street, for example segregated facilities such as protected bike lanes and off-street paths provide a lower stress environment for all types of cyclists, compared to shared, on-street bike lanes without striping or lane markings/designation. The bicycle environment is assigned to one of the four levels of traffic stress shown in Table 17.

Table 17. Bicycle Level of Traffic Stress Scoring System

Bicycle Level of Traffic Stress Description	Bicycle LTS Scale
Lowest level of traffic stress. All types of cyclists feel comfortable at this level. Facility types include separated bike lanes and paths.	1
Second lowest level of traffic stress. Families and less experienced cyclists may feel less comfortable on these facilities. Facility types include buffered bike lanes.	2
Higher level of traffic stress. Fewer cyclists are comfortable on this roadway type. Facility examples include narrow bike lanes or a shoulder on a busy street.	3
Highest level of traffic stress. Only the most experienced cyclists are willing to use these roadways. Examples include busy four-lane roads with no bike lane.	4

Source: Bicycle Facility Selection Tool, City and County of Honolulu.

Farrington Highway within the project area currently does not have bicycle lanes or wide shoulders that can accommodate shared bicycle and vehicle traffic. The resulting existing bicycle LTS score of four indicates that the comfort for riders is generally low, and cyclists are likely to experience higher levels of stress.

In the 2028 Build scenario, 6-foot wide bicycle lanes are planned in both directions for the entire length of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road, as shown in the typical cross sections in Appendix K. Bicycle lanes will be adjacent to vehicle traffic. With striped bicycle lanes in the 2028 Build scenario, Segments A, B, and C are each expected to operate with a bicycle LTS score of two, representing good cycling conditions where experienced riders will feel comfortable using the facility. Less experienced riders or families with children may feel less comfortable using this type of facility. Appendix J includes the information on LTS tool assumptions and results.

7.3 Pedestrian Assessment

The quality and safety of the physical pedestrian environment is evaluated by the Pedestrian Environmental Quality Index (PEQI). This tool assesses the pedestrian environment in six different categories including intersection safety, traffic, street design, land use, the perception of safety, and

walkability. Measurable indicators across each of the six categories, such as width of sidewalks, number of driveway cuts, and frequency of street lighting and street furniture, contribute to the overall pedestrian quality. Input values are assigned a weight to generate a total score ranging between 0-100.

The score range, shown in Table 18, categorizes street segments and intersections based on the quality of the pedestrian environment, and correlates to a level of pedestrian comfort on a scale of one through four.

Table 18. PEQI Scoring System

PEQI Score	Description	Pedestrian Comfort Scale
100-81	Ideal pedestrian conditions exist	1
61-80	Reasonable pedestrian conditions exist	
41-60	Basic pedestrian conditions exist	2
21-40	Poor pedestrian conditions exist	3
0-20	Environment not suitable for pedestrians	4

Source: Pedestrian Environmental Quality Index Tool, City and County of Honolulu.

The existing PEQI score for Segments A, B, and C is 20, which corresponds to a pedestrian comfort scale of four. This suggests the existing roadway is unsuitable for pedestrians due to the lack of sidewalks or other pedestrian amenities.

Although there is little to no pedestrian activity today at the intersection of Farrington Highway and Kualakai Parkway, it received a PEQI score of 41 because it does have some amenities already in place (traffic signal, street lighting, etc.) to provide basic pedestrian conditions.

By the 2028 Build scenario, Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road is expected to have continuous, 8-foot sidewalks on both sides of the street. These sidewalks will be buffered from vehicle traffic by a 10-foot stormwater/landscaping planter strip and an on-street, striped 6-foot bicycle lane. Pedestrian comfort and safety will be supported with lighting on both sides of the street, street trees, and throughways without obstructions or impediments. With these enhancements, the PEQI score for Segments A, B, and C would increase to 64 and the pedestrian environment would be improved to a comfort scale of one.

The intersection of Farrington Highway and Kualakai Parkway would be enhanced with marked, visible crosswalks and pedestrian signal phases on all approaches. The pedestrian phases for the peak periods and off-peak periods would be designed with adequate walk times to account for the anticipated crossing distances across Farrington Highway and across Kualakai Parkway. With the expected increase in pedestrian activity throughout the day, the intersection would include pedestrian refuge islands on all legs, and accessible curb ramps on all corners of the intersection. These improvements increase the PEQI score to 78, suggesting that the intersection will provide ideal conditions for pedestrians. See Appendix J for the PEQI evaluation reports at the study intersection and each segment.

7.4 Auto Assessment

The multimodal assessment of Farrington Highway considers vehicle operations at intersections and along segments using different methodologies than described in the chapters above. Intersection operations are based on traffic volumes from the 2nd highest peak hour of traffic counts, not the peak hour volumes analyzed above.

Intersection delay and level of service results from the 2nd highest hour analysis are categorized as shown in Table 19, and each intersection is assigned an Auto LOS score ranging from one to four.

Table 19. Auto Level of Service Scoring System (Intersections)

Level of Service	Volume to Capacity (V/C) Ratio	Intersection Control Delay (sec/veh)		Vehicle Operations Scale
		Signal Control	Stop Controlled	
A	< 0.60	< 10	< 10	1
B	0.60 – 0.70	10 – 20	10 – 15	
C	0.70 – 0.80	20 – 35	15 – 25	
D	0.80 – 0.90	35 – 55	25 – 35	2
E	0.90 – 1.00	55 – 80	35 – 50	3
F	> 1.00	> 80	> 50	4

Source: Vehicle Evaluation Methodology, City and County of Honolulu.

In addition to the intersection calculations, roadway segment level of service is calculated based on the estimated daily traffic volumes, in both directions, expected to use each analysis segment of Farrington Highway. The estimated volume is compared against the standard HCM 2010 Generalized Daily Service Volumes for Urban Street Facilities for the appropriate lane configuration, and each segment is assigned an Auto LOS score. Table 20 shows the ranges of daily vehicle volumes and the associated scale ranging from a score of one to four.

Table 20. Auto Level of Service Scoring System (Segments)

Level of Service	Average Daily Vehicle Volume			Vehicle Operations Scale
	2-lane Road	4-lane Road	6-lane Road	
C or better	0 – 5,900	0 – 11,300	0 – 16,300	1
D	5,901 – 15,400	11,301 – 31,400	16,301 – 46,400	2
E	15,401 – 19,900	31,401 – 37,900	46,401 – 54,300	3
F	> 19,900	> 37,900	> 54,300	4

Source: Vehicle Evaluation Methodology, City and County of Honolulu.

The Auto LOS score for the existing Segments A, B, and C is controlled by the segment daily volumes, which are in the range of approximately 7,000 to 10,000 vehicles per day. This volume on a 2-lane road corresponds to an operations scale of two.

In the 2028 Build scenario, study area segment volumes are expected to increase to between approximately 14,000 and 26,000 vehicles per day in both directions. On a 4-lane roadway cross-section, these volumes would correspond to an operations scale of two for Segments A, B, and C. See Appendix J for the Auto LOS evaluation of each multimodal segment.

7.5 Multimodal Summary

A summary of the transit, bicycle, pedestrian, and auto evaluation scores for study area Segments A, B, and C, along with their target scores for the 'Boulevard and Parkway' street typology, are shown in Table 21.

Table 21. Multimodal Evaluation Score Summary

Study Segment	Transit Scale	Bicycle Scale	Pedestrian Scale	Auto Scale
Segment A – Kapolei Golf Course Road to Kualakai Parkway				
Existing 2018	2	4	4	2
Year 2028 Build	1	2	1	2
Target Score	**1**	**2**	**1**	**1**
Segment B – Kualakai Parkway to Old Fort Weaver Road (West)				
Existing 2018	2	4	4	2
Year 2028 Build	1	2	1	2
Target Score	**1**	**2**	**1**	**1**
Segment C – Old Fort Weaver Road (West) to Old Fort Weaver Road (East)				
Existing 2018	1	4	4	2
Year 2028 Build	1	2	1	2
Target Score	**1**	**2**	**1**	**1**

Based on the street type modal priorities, the planned design of Farrington Highway is expected to meet the target scores for pedestrian comfort and bicycle conditions. The planned design is expected to meet the target for transit conditions in terms of amenities provided and comfort or services focused on transit riders. Transit vehicle operations, in terms of travel time or delay, are expected to be influenced by general purpose vehicle operations along Farrington Highway. Transit coaches are likely to experience high delays and congestion at the study intersections projected to operate at LOS ‘E’ or ‘F’ in the future Build scenario.

The projected vehicle operations on Farrington Highway in 2028 are not expected to meet the target condition for a ‘Boulevard or Parkway.’ The planned design does not worsen the auto target score compared to the existing conditions. Because the auto target score is based solely on daily vehicular volumes, measures to reduce vehicle trip generation along the corridor are recommended. Improving nonmotorized access and mobility, and planning and developing land uses that are incorporated into the neighborhoods, could encourage drivers to make their trips via an alternative mode. Appendix J includes diagrams of each mode and how they would perform against the multimodal priority targets.

8. Recommendations

The proposed improvements for this stretch of Farrington Highway should incorporate a multimodal approach and consider all potential transportation users in the planning and design of the facility. The proposed improvements meet the target score for pedestrian comfort and for bicycle conditions. In addition, the planned design is expected to meet the target for transit conditions in terms of amenities provided and comfort or services focused on transit riders. However, transit vehicle operations, in terms of travel time or delay, are expected to be influenced by general purpose vehicle operations along Farrington Highway. The transit coaches will experience the same delays and congestion as autos at the study intersections projected to operate at LOS ‘E’ or ‘F’ in the 2028 and future phase (2035) Build scenarios.

With consideration of a context sensitive approach, consistency with the proposed East Kapolei Neighborhood TOD Plan, and the future vision of Farrington Highway as a multimodal corridor with robust non-motorized and transit access, further lane capacity and grade separation options at the Farrington Highway and Kualakai Parkway intersection were not further pursued.

Based on 2028 traffic operations, the Build Mitigated scenario is recommended. Mitigation in the form of double left-turn lanes is recommended at the intersection of Farrington Highway and Kualakai Parkway. The additional turn lane capacity would improve overall intersection vehicle delay compared to the No Build scenario. Signal prioritization for the movements along Kualakai Parkway would also allow more efficient north-south vehicle progression, and adaptive signal control technology should be considered. In the AM peak hour, this intersection would improve from LOS ‘F’ in the No Build scenario (with over 110 seconds of average delay) to LOS ‘D’ with mitigation (less than 50 seconds of average vehicle delay). In the PM peak hour, additional turn lane capacity would improve the overall LOS from ‘F’ in the No Build scenario (with over 210 seconds of average delay) to LOS ‘E’ with mitigation (approximately 80 seconds of average delay).

The recommended, proposed improvements will meet the purpose of the project to enhance sub-regional roadway connectivity and mobility, increase capacity for future transportation demands from adjoining developments, and accommodate multimodal transportation options for all users.

Appendix A

Traffic Count Data

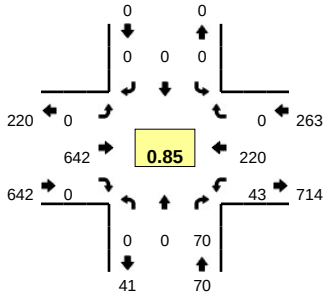
Type of peak hour being reported: Intersection Peak

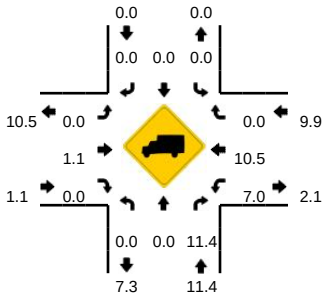
Method for determining peak hour: Total Entering Volume

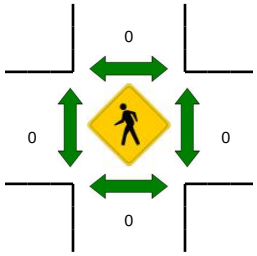
LOCATION: 1 - Old Fort Weaver Rd (East) -- Farrington Hwy
CITY/STATE: Ewa Beach, HI

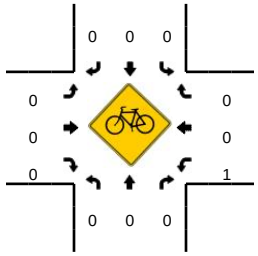
QC JOB #: 14681204
DATE: Tue, May 08 2018

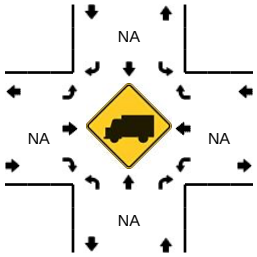
Peak-Hour: 6:30 AM -- 7:30 AM
Peak 15-Min: 6:35 AM -- 6:50 AM

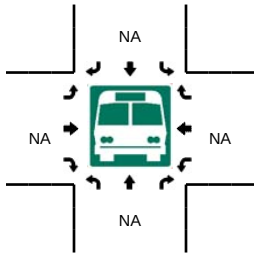












5-Min Count Period Beginning At	1 - Old Fort Weaver Rd (East) (Northbound)				1 - Old Fort Weaver Rd (East) (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	0	0	4	0	0	0	0	0	0	78	0	0	2	13	0	1	98	
6:35 AM	0	0	2	0	0	0	0	0	0	62	0	0	2	21	0	0	87	
6:40 AM	0	0	3	0	0	0	0	0	0	68	0	0	3	22	0	0	96	
6:45 AM	0	0	9	0	0	0	0	0	0	77	0	0	4	15	0	0	105	
6:50 AM	0	0	12	0	0	0	0	0	0	36	0	0	2	11	0	0	61	
6:55 AM	0	0	6	0	0	0	0	0	0	57	0	0	2	18	0	0	83	
7:00 AM	0	0	5	0	0	0	0	0	0	55	0	0	4	21	0	0	85	
7:05 AM	0	0	9	0	0	0	0	0	0	47	0	0	1	18	0	0	75	
7:10 AM	0	0	4	0	0	0	0	0	0	44	0	0	6	22	0	0	76	
7:15 AM	0	0	5	0	0	0	0	0	0	35	0	0	3	19	0	0	62	
7:20 AM	0	0	7	0	0	0	0	0	0	42	0	0	8	23	0	0	80	
7:25 AM	0	0	4	0	0	0	0	0	0	41	0	0	4	17	0	1	67	975
7:30 AM	0	0	6	0	0	0	0	0	0	32	0	0	4	17	0	1	60	937
7:35 AM	0	0	4	0	0	0	0	0	0	38	0	0	3	13	0	0	58	908
7:40 AM	0	0	2	0	0	0	0	0	0	32	0	0	5	20	0	1	60	872
7:45 AM	0	0	1	0	0	0	0	0	0	33	0	0	7	21	0	0	62	829
7:50 AM	0	0	3	0	0	0	0	0	0	35	0	0	7	13	0	0	58	826
7:55 AM	0	0	4	0	0	0	0	0	0	35	0	0	2	16	0	0	57	800
8:00 AM	0	0	4	0	0	0	0	0	0	26	0	0	4	10	0	0	44	759
8:05 AM	0	0	2	0	0	0	0	0	0	28	0	0	9	16	0	0	55	739
8:10 AM	0	0	1	0	0	0	0	0	0	26	0	0	2	13	0	1	43	706
8:15 AM	0	0	3	0	0	0	0	0	0	32	0	0	5	15	0	0	55	699
8:20 AM	0	0	1	0	0	0	0	0	0	15	0	0	3	17	0	0	36	655
8:25 AM	0	0	2	0	0	0	0	0	0	16	0	0	4	10	0	0	32	620

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	56	0	0	0	0	0	0	828	0	0	36	232	0	0	1152
Heavy Trucks	0	0	4		0	0	0		0	12	0		4	32	0		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		1	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

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CITY/STATE: Ewa Beach, HI

QC JOB #: 14681205
DATE: Tue, May 08 2018

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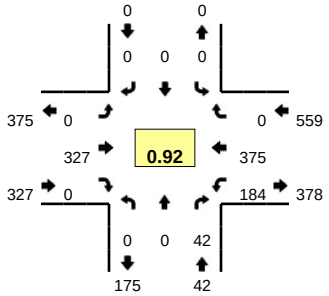
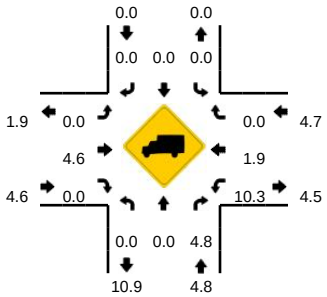
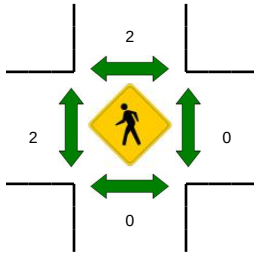
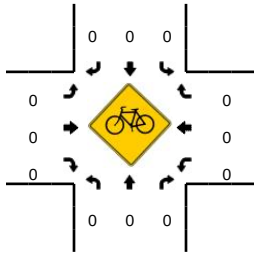
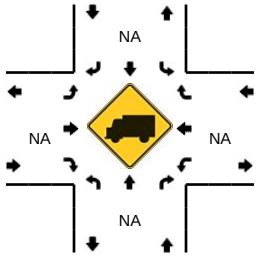
Peak 15-Min: 3:35 PM -- 3:50 PM

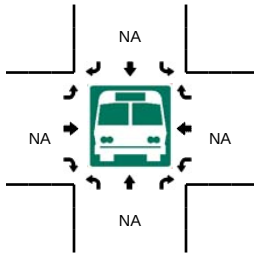












5-Min Count Period Beginning At	1 - Old Fort Weaver Rd (East) (Northbound)				1 - Old Fort Weaver Rd (East) (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	0	0	2	0	0	0	0	0	0	21	1	0	9	27	0	1	61	
3:35 PM	0	0	1	0	0	0	0	0	0	51	0	0	19	25	0	0	96	
3:40 PM	0	0	6	0	0	0	0	0	0	29	0	0	15	36	0	0	86	
3:45 PM	0	0	2	0	0	0	0	0	0	24	0	0	17	27	0	1	71	
3:50 PM	0	0	3	0	0	0	0	0	0	25	0	0	12	35	0	1	76	
3:55 PM	0	0	3	0	0	0	0	0	0	24	0	0	8	32	0	1	68	
4:00 PM	0	0	5	0	0	0	0	0	0	22	0	0	10	30	0	1	68	
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4:20 PM	0	0	3	0	0	0	0	0	0	19	0	0	13	29	0	0	64	
4:25 PM	0	0	1	0	0	0	0	0	0	27	0	0	19	33	0	1	81	901
4:30 PM	0	0	4	0	0	0	0	0	0	36	0	0	18	29	0	1	88	928
4:35 PM	0	0	1	0	0	0	0	0	0	12	0	0	4	20	0	2	39	871
4:40 PM	0	0	6	0	0	0	0	0	0	22	0	0	16	38	0	0	82	867
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5:05 PM	0	0	6	0	0	0	0	0	0	15	0	0	13	21	0	1	56	814
5:10 PM	0	0	3	0	0	0	0	0	0	30	0	0	12	30	0	1	76	813
5:15 PM	0	0	4	0	0	0	0	0	0	16	0	0	21	29	0	0	70	803
5:20 PM	0	0	4	0	0	0	0	0	0	11	0	0	13	18	0	0	46	785
5:25 PM	0	0	4	0	0	0	0	0	0	19	0	0	15	17	0	0	55	759

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	36	0	0	0	0	0	0	416	0	0	204	352	0	4	1012
Heavy Trucks	0	0	0		0	0	0		0	12	0		32	4	0		48
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: 2 - Old Fort Weaver Rd (West) -- Farrington Hwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681206
DATE: Tue, May 08 2018

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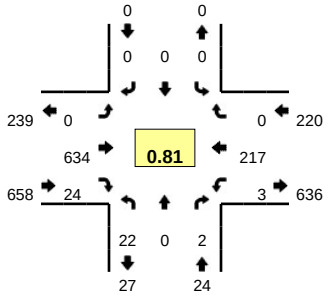
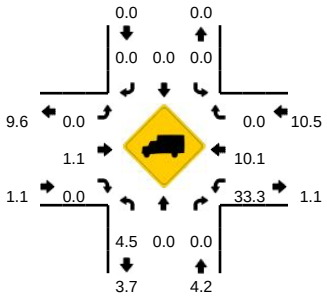
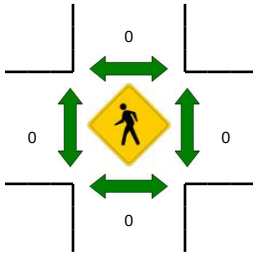
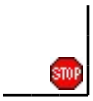
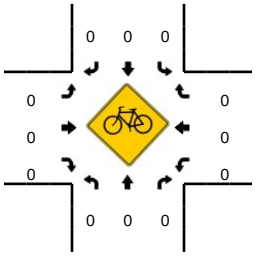
Peak 15-Min: 6:30 AM -- 6:45 AM

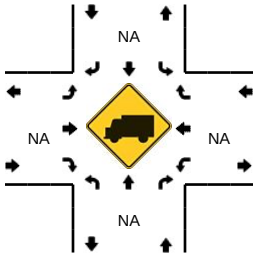


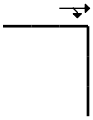


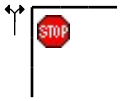


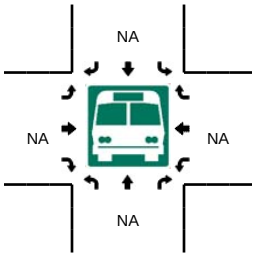












5-Min Count Period Beginning At	2 - Old Fort Weaver Rd (West) (Northbound)				2 - Old Fort Weaver Rd (West) (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	5	0	0	0	0	0	0	0	0	77	2	0	0	12	0	0	96	
6:35 AM	0	0	0	0	0	0	0	0	0	61	0	0	0	23	0	0	84	
6:40 AM	3	0	0	0	0	0	0	0	0	72	1	0	0	21	0	0	97	
6:45 AM	3	0	0	0	0	0	0	0	0	72	4	0	1	14	0	0	94	
6:50 AM	0	0	0	0	0	0	0	0	0	37	1	0	0	11	0	0	49	
6:55 AM	1	0	1	0	0	0	0	0	0	59	1	0	0	18	0	0	80	
7:00 AM	1	0	1	0	0	0	0	0	0	50	1	0	0	19	0	0	72	
7:05 AM	1	0	0	0	0	0	0	0	0	46	2	0	1	20	0	0	70	
7:10 AM	0	0	0	0	0	0	0	0	0	42	2	0	0	22	0	0	66	
7:15 AM	3	0	0	0	0	0	0	0	0	38	4	0	0	20	0	0	65	
7:20 AM	3	0	0	0	0	0	0	0	0	42	3	0	1	21	0	0	70	
7:25 AM	2	0	0	0	0	0	0	0	0	38	3	0	0	16	0	0	59	902
7:30 AM	0	0	0	0	0	0	0	0	0	31	0	0	0	15	0	0	46	852
7:35 AM	5	0	0	0	0	0	0	0	0	40	4	0	0	15	0	0	64	832
7:40 AM	1	0	0	0	0	0	0	0	0	31	2	0	1	19	0	0	54	789
7:45 AM	3	0	0	0	0	0	0	0	0	34	2	0	2	14	0	0	55	750
7:50 AM	2	0	0	0	0	0	0	0	0	39	1	0	0	18	0	0	60	761
7:55 AM	3	0	1	0	0	0	0	0	0	32	3	0	0	17	0	0	56	737
8:00 AM	0	0	0	0	0	0	0	0	0	24	5	0	2	6	0	0	37	702
8:05 AM	0	0	1	0	0	0	0	0	0	24	3	0	0	17	0	0	45	677
8:10 AM	1	0	0	0	0	0	0	0	0	33	3	0	0	12	0	0	49	660
8:15 AM	0	0	0	0	0	0	0	0	0	32	0	0	0	16	0	0	48	643
8:20 AM	0	0	0	0	0	0	0	0	0	9	0	0	0	15	0	0	24	597
8:25 AM	0	0	1	0	0	0	0	0	0	15	1	0	0	11	0	0	28	566

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	32	0	0	0	0	0	0	0	0	840	12	0	0	224	0	0	1108
Heavy Trucks	0	0	0		0	0	0		0	16	0		0	28	0		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

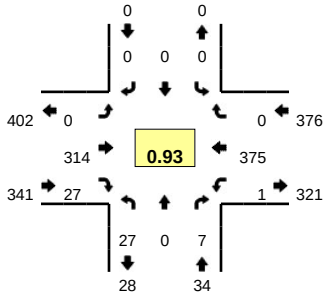
Type of peak hour being reported: Intersection Peak

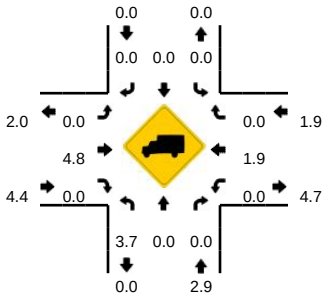
Method for determining peak hour: Total Entering Volume

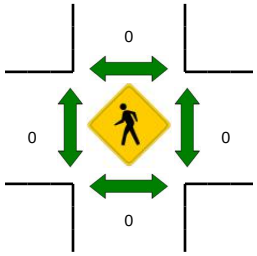
LOCATION: 2 - Old Fort Weaver Rd (West) -- Farrington Hwy
CITY/STATE: Ewa Beach, HI

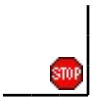
QC JOB #: 14681207
DATE: Tue, May 08 2018

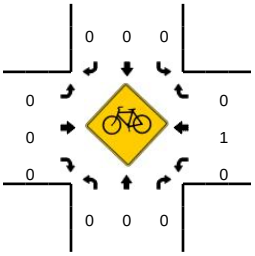
Peak-Hour: 3:35 PM -- 4:35 PM
Peak 15-Min: 3:35 PM -- 3:50 PM

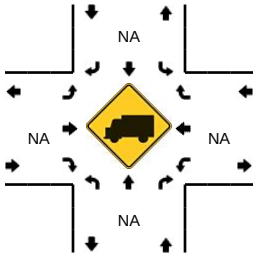


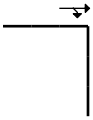


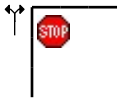


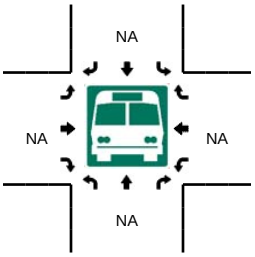












5-Min Count Period Beginning At	2 - Old Fort Weaver Rd (West) (Northbound)				2 - Old Fort Weaver Rd (West) (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	4	0	0	0	0	0	0	0	0	27	3	0	0	25	0	0	59	
3:35 PM	1	0	0	0	0	0	0	0	0	45	2	0	0	27	0	0	75	
3:40 PM	0	0	0	0	0	0	0	0	0	35	3	0	0	38	0	0	76	
3:45 PM	0	0	0	0	0	0	0	0	0	22	2	0	0	26	0	0	50	
3:50 PM	1	0	0	0	0	0	0	0	0	23	2	0	0	32	0	0	58	
3:55 PM	1	0	0	0	0	0	0	0	0	24	1	0	0	35	0	0	61	
4:00 PM	6	0	0	0	0	0	0	0	0	20	0	0	0	30	0	0	56	
4:05 PM	5	0	2	0	0	0	0	0	0	28	2	0	0	30	0	0	67	
4:10 PM	2	0	0	0	0	0	0	0	0	15	3	0	0	34	0	0	54	
4:15 PM	3	0	0	0	0	0	0	0	0	31	5	0	0	32	0	0	71	
4:20 PM	1	0	0	0	0	0	0	0	0	18	1	0	1	28	0	0	49	
4:25 PM	6	0	4	0	0	0	0	0	0	24	1	0	0	35	0	0	70	746
4:30 PM	1	0	1	0	0	0	0	0	0	29	5	0	0	28	0	0	64	751
4:35 PM	5	0	0	0	0	0	0	0	0	13	1	0	0	21	0	0	40	716
4:40 PM	1	0	1	0	0	0	0	0	0	20	3	0	0	40	0	0	65	705
4:45 PM	4	0	0	0	0	0	0	0	0	24	2	0	0	20	0	0	50	705
4:50 PM	0	0	1	0	0	0	0	0	0	27	2	0	0	31	0	0	61	708
4:55 PM	1	0	0	0	0	0	0	0	0	18	4	0	0	26	0	0	49	696
5:00 PM	3	0	0	0	0	0	0	0	0	17	1	0	0	25	0	0	46	686
5:05 PM	3	0	3	0	0	0	0	0	0	14	1	0	0	25	0	0	46	665
5:10 PM	5	0	1	0	0	0	0	0	0	27	6	0	0	30	0	0	69	680
5:15 PM	2	0	0	0	0	0	0	0	0	14	4	0	0	23	0	0	43	652
5:20 PM	4	0	0	0	0	0	0	0	0	12	2	0	0	22	0	0	40	643
5:25 PM	4	0	0	0	0	0	0	0	0	17	3	0	0	19	0	0	43	616

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	0	0	0	0	0	0	0	0	408	28	0	0	364	0	0	804
Heavy Trucks	0	0	0		0	0	0		0	12	0		0	4	0		16
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	1	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

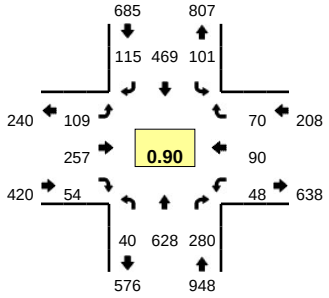
Type of peak hour being reported: Intersection Peak

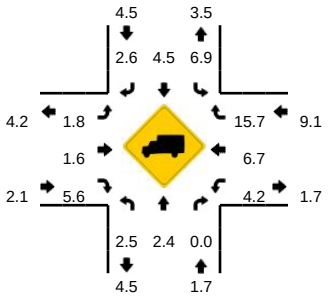
Method for determining peak hour: Total Entering Volume

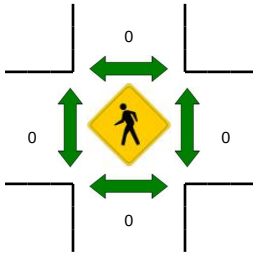
LOCATION: 3 - Kualakai Pkwy -- Farrington Hwy
CITY/STATE: Kapolei, HI

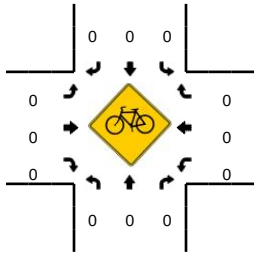
QC JOB #: 14681208
DATE: Tue, May 08 2018

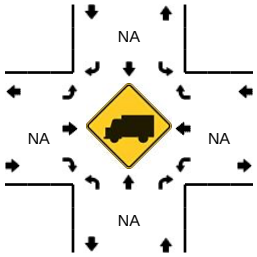
Peak-Hour: 6:30 AM -- 7:30 AM
Peak 15-Min: 6:30 AM -- 6:45 AM

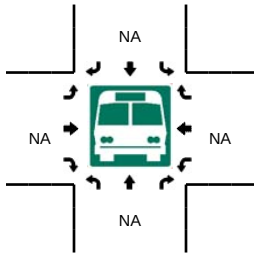












5-Min Count Period Beginning At	3 - Kualakai Pkwy (Northbound)				3 - Kualakai Pkwy (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	5	48	29	1	18	49	5	0	5	24	6	0	2	3	2	0	197	
6:35 AM	2	51	23	1	7	48	10	0	7	29	1	0	5	4	6	0	194	
6:40 AM	2	59	37	1	11	39	14	0	16	31	4	0	9	5	11	0	239	
6:45 AM	3	50	19	0	7	28	13	0	6	31	5	0	1	5	10	0	178	
6:50 AM	2	47	21	0	7	41	6	0	15	16	2	0	2	3	6	0	168	
6:55 AM	2	65	37	0	8	40	4	0	4	20	4	0	1	7	3	0	195	
7:00 AM	0	34	25	0	3	23	6	0	15	25	8	0	5	7	7	0	158	
7:05 AM	6	62	23	0	8	40	8	0	12	13	3	0	6	11	7	0	199	
7:10 AM	2	48	15	0	8	31	9	0	6	17	3	0	1	14	2	0	156	
7:15 AM	5	60	22	1	10	49	12	0	7	19	4	0	4	8	5	0	206	
7:20 AM	2	42	14	0	6	28	14	0	7	17	7	0	7	18	8	0	170	
7:25 AM	4	62	15	1	8	53	14	0	9	15	7	0	5	5	3	0	201	2261
7:30 AM	4	36	15	0	9	29	11	0	17	20	6	0	6	6	5	0	164	2228
7:35 AM	6	57	11	0	1	55	18	0	15	23	3	0	3	11	3	0	206	2240
7:40 AM	5	59	15	1	3	43	14	0	5	20	3	0	7	9	4	0	188	2189
7:45 AM	3	52	20	0	4	26	14	0	12	18	7	0	11	13	3	0	183	2194
7:50 AM	10	68	19	0	3	38	21	0	12	12	0	0	9	6	4	0	202	2228
7:55 AM	7	62	15	0	2	35	20	0	10	20	8	0	7	4	3	0	193	2226
8:00 AM	7	56	6	0	4	21	10	0	18	10	8	0	8	5	1	0	154	2222
8:05 AM	6	55	19	0	5	42	14	1	12	14	4	0	5	3	1	0	181	2204
8:10 AM	4	33	11	0	2	11	13	1	21	23	3	0	6	8	1	0	137	2185
8:15 AM	6	55	5	0	3	36	8	0	13	14	5	0	5	3	2	0	155	2134
8:20 AM	4	40	4	0	1	30	14	0	10	9	4	0	3	9	1	0	129	2093
8:25 AM	1	28	5	0	2	21	15	0	18	14	5	0	10	7	1	0	127	2019

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	36	632	356	12	144	544	116	0	112	336	44	0	64	48	76	0	2520
Heavy Trucks	4	16	0		8	16	0		4	4	4		0	0	12		68
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

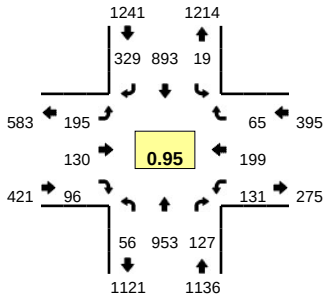
Type of peak hour being reported: Intersection Peak

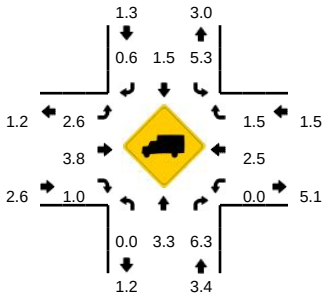
Method for determining peak hour: Total Entering Volume

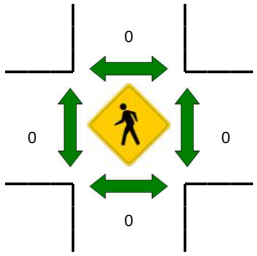
LOCATION: 3 - Kualakai Pkwy -- Farrington Hwy
CITY/STATE: Kapolei, HI

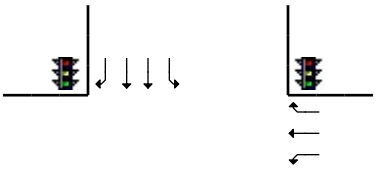
QC JOB #: 14681209
DATE: Tue, May 08 2018

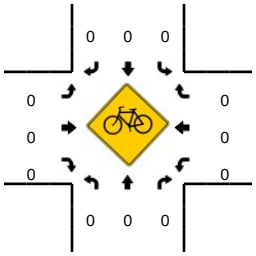
Peak-Hour: 3:55 PM -- 4:55 PM
Peak 15-Min: 4:35 PM -- 4:50 PM

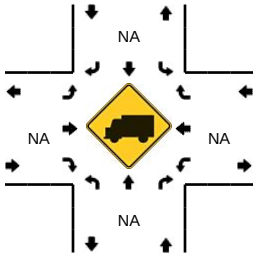


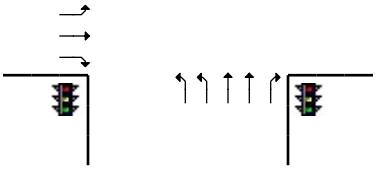


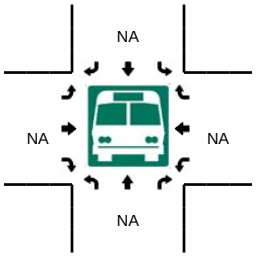












5-Min Count Period Beginning At	3 - Kualakai Pkwy (Northbound)				3 - Kualakai Pkwy (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	0	44	17	1	2	60	28	0	9	23	7	0	13	20	4	0	228	
3:35 PM	9	65	15	1	2	54	20	0	23	18	5	0	5	13	7	0	237	
3:40 PM	4	94	9	0	0	81	11	0	25	9	7	0	15	23	9	0	287	
3:45 PM	1	88	11	0	4	82	33	0	12	12	11	0	12	10	9	0	285	
3:50 PM	6	79	16	1	2	52	27	0	14	4	5	0	6	17	6	0	235	
3:55 PM	6	88	14	0	1	76	33	0	16	14	8	0	11	19	8	0	294	
4:00 PM	2	70	9	0	1	45	30	0	13	8	5	0	11	14	12	0	220	
4:05 PM	5	89	14	0	1	62	28	0	10	9	8	0	13	18	6	0	263	
4:10 PM	5	75	12	0	1	76	19	0	15	15	8	0	9	23	7	0	265	
4:15 PM	4	82	11	0	0	84	24	0	15	6	8	0	10	15	3	0	262	
4:20 PM	3	75	12	0	4	69	33	0	17	9	10	0	7	20	4	0	263	
4:25 PM	5	72	10	0	2	91	35	0	15	14	11	0	10	17	5	0	287	3126
4:30 PM	7	83	6	0	1	57	19	0	21	10	9	0	14	13	3	0	243	3141
4:35 PM	4	74	9	0	1	85	34	0	13	14	8	0	13	17	4	0	276	3180
4:40 PM	4	72	6	0	3	67	29	0	27	9	7	0	13	11	10	0	258	3151
4:45 PM	6	90	17	1	1	104	22	1	15	11	7	0	13	15	1	0	304	3170
4:50 PM	4	83	7	0	2	77	23	0	18	11	7	0	7	17	2	0	258	3193
4:55 PM	0	90	8	0	3	84	21	0	8	3	11	0	14	18	3	0	263	3162
5:00 PM	2	65	5	0	3	62	23	0	12	10	9	0	5	15	1	0	212	3154
5:05 PM	8	71	9	0	2	82	23	0	11	15	8	1	9	17	3	0	259	3150
5:10 PM	5	102	8	0	1	66	29	0	17	14	11	0	6	15	6	0	280	3165
5:15 PM	4	88	4	1	0	95	25	0	15	10	10	0	5	19	8	0	284	3187
5:20 PM	7	80	4	1	2	81	21	0	18	4	13	0	10	18	2	0	261	3185
5:25 PM	8	65	11	0	5	61	15	2	18	8	7	0	13	12	3	0	228	3126

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	56	944	128	4	20	1024	340	4	220	136	88	0	156	172	60	0	3352
Heavy Trucks	0	20	12		0	4	0		4	8	0		0	0	0		48
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

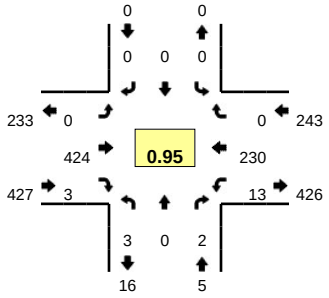
Type of peak hour being reported: Intersection Peak

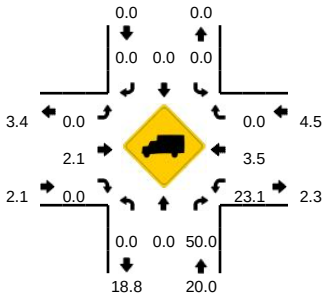
Method for determining peak hour: Total Entering Volume

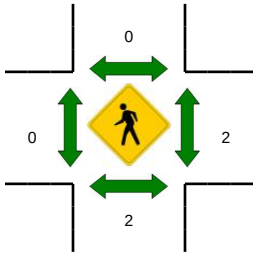
LOCATION: 4 - Kapolei Golf Course Rd -- Farrington Hwy
CITY/STATE: Kapolei, HI

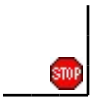
QC JOB #: 14681210
DATE: Tue, May 08 2018

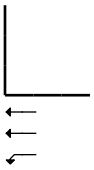
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:20 AM -- 7:35 AM

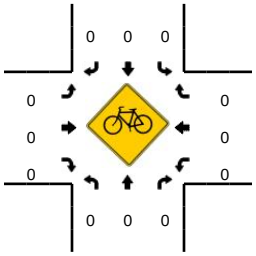


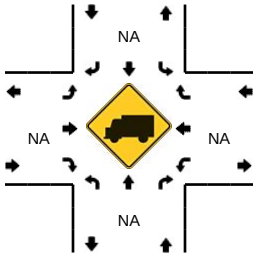


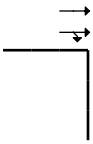


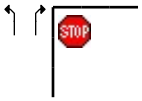


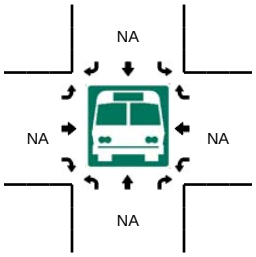












5-Min Count Period Beginning At	4 - Kapolei Golf Course Rd (Northbound)				4 - Kapolei Golf Course Rd (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	0	0	0	1	0	0	0	0	0	45	0	0	0	17	0	0	63	
6:35 AM	0	0	0	0	0	0	0	0	0	44	0	0	1	9	0	0	54	
6:40 AM	0	0	0	0	0	0	0	0	0	37	0	0	0	9	0	0	46	
6:45 AM	0	0	0	0	0	0	0	0	0	39	1	0	2	10	0	0	52	
6:50 AM	0	0	0	0	0	0	0	0	0	34	0	0	0	8	0	0	42	
6:55 AM	0	0	0	0	0	0	0	0	0	30	1	0	0	9	0	0	40	
7:00 AM	0	0	1	0	0	0	0	0	0	44	1	0	1	7	0	0	54	
7:05 AM	0	0	0	0	0	0	0	0	0	30	0	0	1	9	0	0	40	
7:10 AM	0	0	0	0	0	0	0	0	0	23	0	0	2	22	0	0	47	
7:15 AM	1	0	0	0	0	0	0	0	0	27	0	0	2	20	0	0	50	
7:20 AM	0	0	0	0	0	0	0	0	0	38	0	0	2	25	0	0	65	
7:25 AM	0	0	0	0	0	0	0	0	0	34	0	0	0	20	0	0	54	607
7:30 AM	0	0	1	0	0	0	0	0	0	44	1	0	0	12	0	0	58	602
7:35 AM	0	0	0	0	0	0	0	0	0	40	0	0	3	22	0	0	65	613
7:40 AM	0	0	0	0	0	0	0	0	0	25	0	0	0	19	0	0	44	611
7:45 AM	0	0	1	0	0	0	0	0	0	41	1	0	1	23	0	0	67	626
7:50 AM	0	0	0	0	0	0	0	0	0	26	0	0	0	18	0	0	44	628
7:55 AM	0	0	0	0	0	0	0	0	0	35	0	0	1	17	0	0	53	641
8:00 AM	1	0	0	0	0	0	0	0	0	43	0	0	2	22	0	0	68	655
8:05 AM	1	0	0	0	0	0	0	0	0	36	1	0	1	16	0	0	55	670
8:10 AM	0	0	0	0	0	0	0	0	0	35	0	0	1	16	0	0	52	675
8:15 AM	0	0	0	0	0	0	0	0	0	28	0	0	2	11	0	0	41	666
8:20 AM	0	0	1	0	0	0	0	0	0	26	0	0	0	23	0	0	50	651
8:25 AM	1	0	2	0	0	0	0	0	0	31	0	0	0	12	0	0	46	643

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	4	0	0	0	0	0	0	464	4	0	8	228	0	0	708
Heavy Trucks	0	0	4		0	0	0		0	8	0		0	16	0		28
Pedestrians		8				0				0				8			16
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

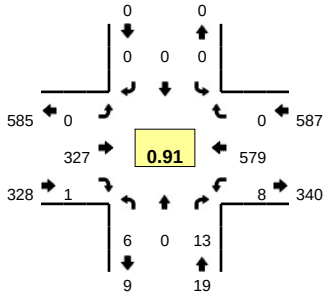
Type of peak hour being reported: Intersection Peak

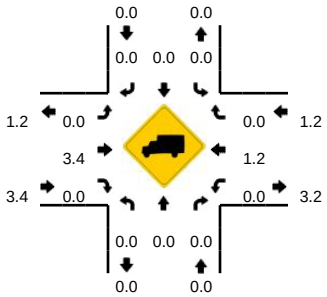
Method for determining peak hour: Total Entering Volume

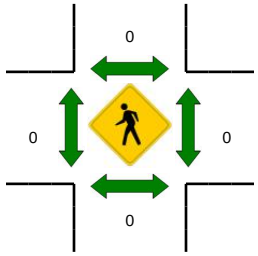
LOCATION: 4 - Kapolei Golf Course Rd -- Farrington Hwy
CITY/STATE: Kapolei, HI

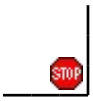
QC JOB #: 14681211
DATE: Tue, May 08 2018

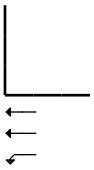
Peak-Hour: 3:50 PM -- 4:50 PM
Peak 15-Min: 4:15 PM -- 4:30 PM

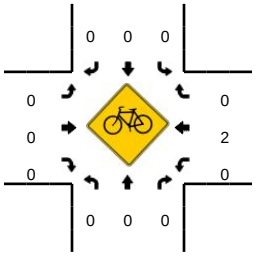


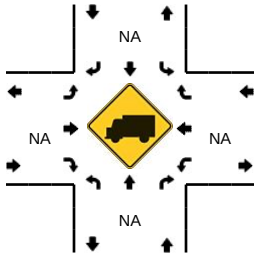


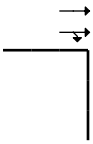


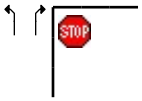


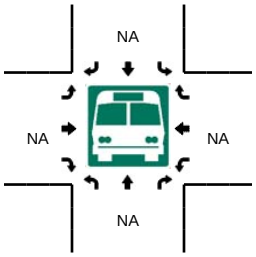












5-Min Count Period Beginning At	4 - Kapolei Golf Course Rd (Northbound)				4 - Kapolei Golf Course Rd (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	0	0	0	0	0	0	0	0	0	29	0	0	0	52	0	0	81	
3:35 PM	1	0	1	0	0	0	0	0	0	32	1	0	0	30	0	0	65	
3:40 PM	1	0	3	0	0	0	0	0	0	23	0	0	0	41	0	0	68	
3:45 PM	1	0	0	0	0	0	0	0	0	23	0	0	0	48	0	0	72	
3:50 PM	0	0	1	0	0	0	0	0	0	28	0	0	1	38	0	0	68	
3:55 PM	3	0	1	0	0	0	0	0	0	19	0	0	1	53	0	0	77	
4:00 PM	0	0	1	0	0	0	0	0	0	20	0	0	0	62	0	0	83	
4:05 PM	1	0	0	0	0	0	0	0	0	34	0	0	1	46	0	0	82	
4:10 PM	0	0	0	0	0	0	0	0	0	21	0	0	0	44	0	0	65	
4:15 PM	0	0	1	0	0	0	0	0	0	31	0	0	1	40	0	0	73	
4:20 PM	0	0	0	0	0	0	0	0	0	38	0	0	0	58	0	0	96	
4:25 PM	0	0	2	0	0	0	0	0	0	31	0	0	0	55	0	0	88	918
4:30 PM	0	0	2	0	0	0	0	0	0	29	1	0	1	36	0	0	69	906
4:35 PM	2	0	4	0	0	0	0	0	0	20	0	0	1	48	0	0	75	916
4:40 PM	0	0	1	0	0	0	0	0	0	23	0	0	2	47	0	0	73	921
4:45 PM	0	0	0	0	0	0	0	0	0	33	0	0	0	52	0	0	85	934
4:50 PM	0	0	0	0	0	0	0	0	0	22	1	0	1	37	0	0	61	927
4:55 PM	4	0	0	0	0	0	0	0	0	22	0	0	1	39	0	0	66	916
5:00 PM	0	0	0	0	0	0	0	0	0	26	1	0	1	36	0	0	64	897
5:05 PM	0	0	2	0	0	0	0	0	0	33	0	0	0	45	0	0	80	895
5:10 PM	2	0	0	0	0	0	0	0	0	41	0	0	0	42	0	0	85	915
5:15 PM	1	0	2	0	0	0	0	0	0	19	1	0	1	48	0	0	72	914
5:20 PM	0	0	1	0	0	0	0	0	0	27	0	0	1	44	0	0	73	891
5:25 PM	2	0	5	0	0	0	0	0	0	21	1	0	1	35	0	0	65	868

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	12	0	0	0	0	0	0	400	0	0	4	612	0	0	1028
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	12	0		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

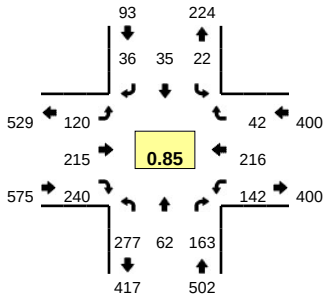
Type of peak hour being reported: Intersection Peak

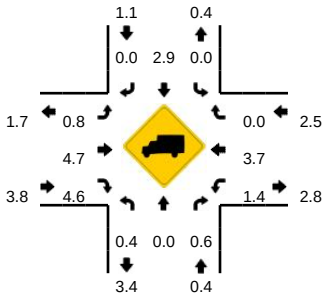
Method for determining peak hour: Total Entering Volume

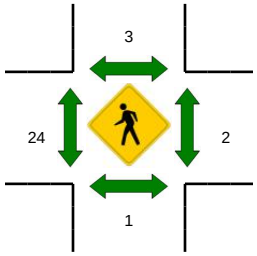
LOCATION: 5 - Kealanani Ave -- Farrington Hwy
CITY/STATE: Kapolei, HI

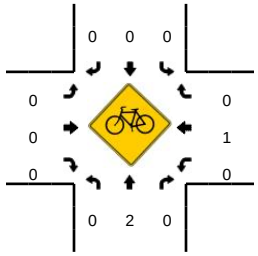
QC JOB #: 14681212
DATE: Tue, May 08 2018

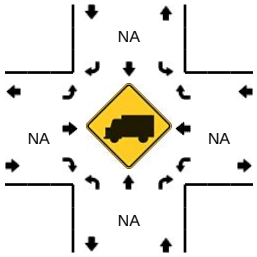
Peak-Hour: 7:10 AM -- 8:10 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

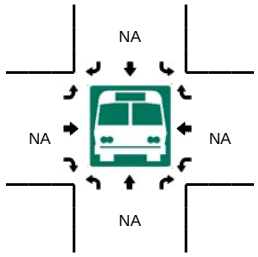












5-Min Count Period Beginning At	5 - Kealanani Ave (Northbound)				5 - Kealanani Ave (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	22	1	13	0	1	2	2	0	4	12	12	0	8	7	4	0	88	
6:35 AM	19	3	14	0	2	0	2	0	7	15	10	0	1	9	2	0	84	
6:40 AM	15	2	13	1	2	0	2	0	6	10	7	0	2	9	3	0	72	
6:45 AM	13	3	12	0	6	4	2	0	10	9	3	0	5	6	2	0	75	
6:50 AM	11	2	15	0	1	2	3	0	11	11	8	0	2	8	1	0	75	
6:55 AM	22	5	8	0	0	2	2	0	11	11	11	0	12	9	1	0	94	
7:00 AM	14	7	15	0	0	2	8	0	8	22	14	0	3	9	1	0	103	
7:05 AM	17	3	12	0	1	3	1	0	14	9	6	0	12	21	1	0	100	
7:10 AM	22	3	12	0	1	5	2	0	8	10	16	0	10	21	3	0	113	
7:15 AM	19	3	8	0	2	4	7	0	7	8	16	0	22	13	5	0	114	
7:20 AM	27	7	6	0	1	1	1	0	5	17	21	0	15	21	1	0	123	
7:25 AM	21	3	10	0	1	2	2	0	9	14	15	0	17	27	2	0	123	1164
7:30 AM	27	5	12	0	2	1	4	0	7	28	27	0	14	24	3	0	154	1230
7:35 AM	15	3	14	0	1	2	4	0	15	22	19	0	13	20	2	0	130	1276
7:40 AM	17	4	12	0	1	3	1	0	12	15	18	0	20	11	3	0	117	1321
7:45 AM	26	4	24	0	3	0	5	0	10	22	43	0	9	18	5	0	169	1415
7:50 AM	34	14	14	0	1	5	4	0	14	17	18	0	6	15	7	0	149	1489
7:55 AM	25	7	24	0	5	6	2	0	13	17	18	0	6	13	6	0	142	1537
8:00 AM	22	6	13	0	3	2	1	0	11	19	14	0	8	15	3	0	117	1551
8:05 AM	22	3	14	0	1	4	3	0	9	26	15	0	2	18	2	0	119	1570
8:10 AM	15	3	6	0	1	4	5	0	8	15	16	0	5	13	0	0	91	1548
8:15 AM	23	5	6	0	3	2	2	0	8	10	10	0	4	11	0	0	84	1518
8:20 AM	28	2	9	0	2	5	3	0	10	11	12	0	8	13	2	0	105	1500
8:25 AM	11	6	10	0	1	6	4	0	15	11	8	0	9	15	6	0	102	1479

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	340	100	248	0	36	44	44	0	148	224	316	0	84	184	72	0	1840
Heavy Trucks	4	0	4		0	0	0		0	12	4		0	4	0		28
Pedestrians		0				4				20				4			28
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

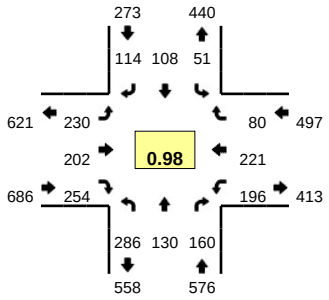
Type of peak hour being reported: Intersection Peak

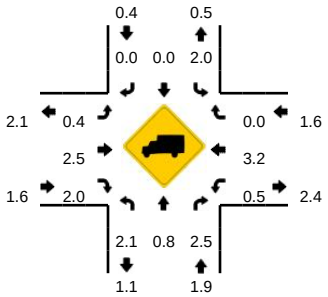
Method for determining peak hour: Total Entering Volume

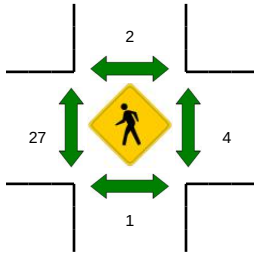
LOCATION: 5 - Kealanani Ave -- Farrington Hwy
CITY/STATE: Kapolei, HI

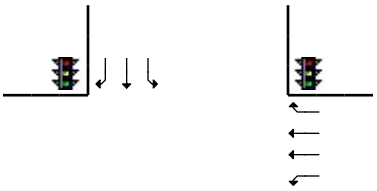
QC JOB #: 14681213
DATE: Tue, May 08 2018

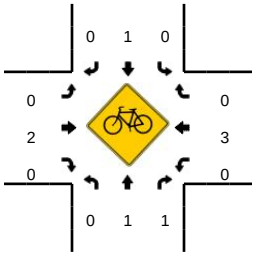
Peak-Hour: 4:25 PM -- 5:25 PM
Peak 15-Min: 5:10 PM -- 5:25 PM

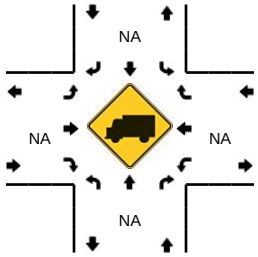


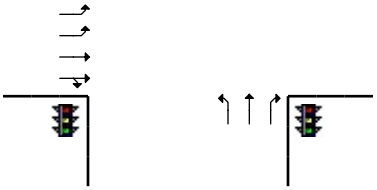


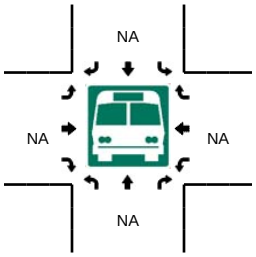












5-Min Count Period Beginning At	5 - Kealanani Ave (Northbound)				5 - Kealanani Ave (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	11	5	16	0	3	4	6	0	18	20	17	0	13	10	11	0	134	
3:35 PM	15	4	14	0	6	8	8	0	15	18	16	0	9	15	5	0	133	
3:40 PM	28	8	7	0	6	9	10	0	23	11	15	0	13	18	9	0	157	
3:45 PM	13	6	7	0	0	6	12	0	8	16	14	0	16	32	7	0	137	
3:50 PM	21	3	8	0	5	11	4	0	17	17	17	0	13	8	5	0	129	
3:55 PM	15	11	9	0	3	2	10	0	26	14	22	0	21	26	6	0	165	
4:00 PM	24	5	14	0	0	8	10	0	20	14	19	0	13	20	11	0	158	
4:05 PM	18	2	13	0	2	5	6	0	20	22	26	0	19	20	9	0	162	
4:10 PM	33	14	10	0	4	18	10	0	10	13	8	0	16	11	11	0	158	
4:15 PM	24	8	11	0	4	3	5	0	17	28	18	0	14	28	7	0	167	
4:20 PM	21	8	13	0	6	6	4	0	21	21	30	0	8	23	0	0	161	
4:25 PM	20	15	20	0	5	11	7	0	23	14	25	0	18	17	11	0	186	1847
4:30 PM	20	9	3	0	5	7	16	0	24	17	14	0	21	24	7	0	167	1880
4:35 PM	24	12	11	0	5	9	9	0	16	12	20	0	8	17	10	0	153	1900
4:40 PM	23	11	7	0	3	8	12	0	26	15	21	0	30	18	6	0	180	1923
4:45 PM	27	7	15	0	3	3	6	0	19	17	24	0	16	18	0	0	155	1941
4:50 PM	26	11	16	0	2	14	10	0	17	16	17	0	11	21	8	0	169	1981
4:55 PM	17	7	12	0	3	12	11	0	17	24	24	0	21	11	8	0	167	1983
5:00 PM	28	11	20	0	7	6	4	0	29	13	22	0	14	12	5	0	171	1996
5:05 PM	16	9	19	0	4	10	6	0	15	21	25	0	12	23	4	0	164	1998
5:10 PM	24	16	14	0	4	5	13	0	18	24	14	0	17	26	7	0	182	2022
5:15 PM	36	10	10	0	9	11	10	0	9	13	18	0	12	16	7	0	161	2016
5:20 PM	25	12	13	0	1	12	10	0	17	16	30	0	16	18	7	0	177	2032
5:25 PM	21	11	15	0	2	17	12	0	35	12	22	0	16	9	6	0	178	2024

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	340	152	148	0	56	112	132	0	176	212	248	0	180	240	84	0	2080
Heavy Trucks	8	0	0		0	0	0		4	8	8		4	8	0		40
Pedestrians		4				4				52				4			64
Bicycles	0	0	1		0	0	0		0	0	0		0	2	0		3
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:36 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

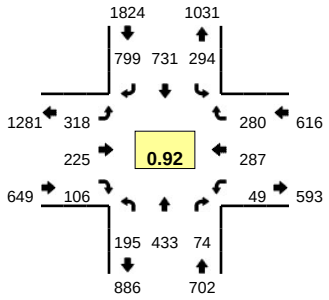
Type of peak hour being reported: Intersection Peak

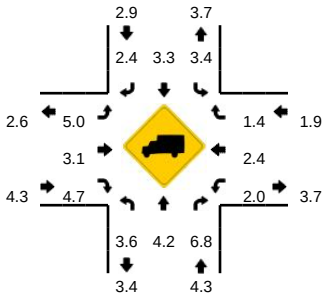
Method for determining peak hour: Total Entering Volume

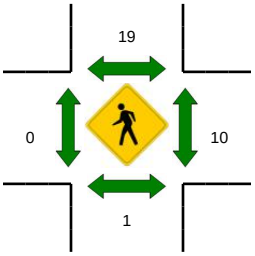
LOCATION: 6 - Makakilo Dr -- Farrington Hwy
CITY/STATE: Kapolei, HI

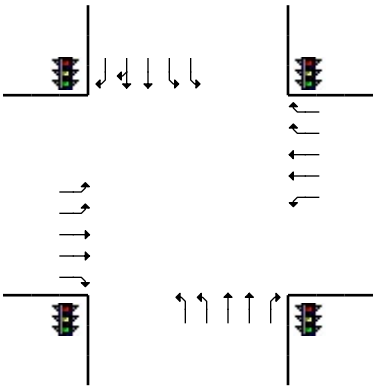
QC JOB #: 14681214
DATE: Tue, May 08 2018

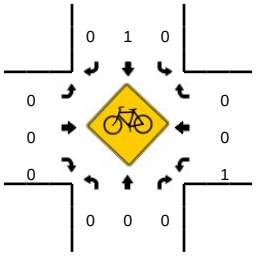
Peak-Hour: 7:10 AM -- 8:10 AM
Peak 15-Min: 7:40 AM -- 7:55 AM

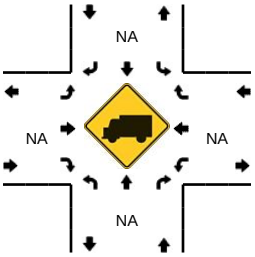


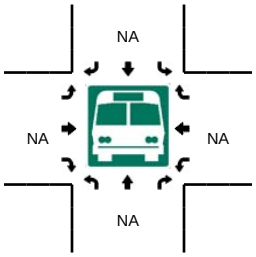












5-Min Count Period Beginning At	6 - Makakilo Dr (Northbound)				6 - Makakilo Dr (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	6	28	3	0	15	23	40	0	24	15	12	0	7	10	20	0	203	
6:35 AM	11	21	5	0	18	39	60	0	9	6	13	0	0	15	14	0	211	
6:40 AM	7	17	4	0	9	34	41	0	22	15	14	0	6	19	15	0	203	
6:45 AM	13	20	1	0	18	38	47	0	16	8	10	0	2	7	16	0	196	
6:50 AM	6	22	2	0	5	46	55	0	26	14	12	0	2	8	12	0	210	
6:55 AM	5	19	4	0	29	35	43	0	17	11	7	0	1	17	17	0	205	
7:00 AM	7	53	3	0	21	73	59	0	25	15	6	0	5	8	21	0	296	
7:05 AM	6	20	3	0	8	32	56	0	21	3	5	0	2	27	21	0	204	
7:10 AM	12	34	3	0	21	74	72	0	20	14	13	0	5	21	14	0	303	
7:15 AM	9	30	3	0	17	56	41	0	24	15	5	0	5	31	27	0	263	
7:20 AM	16	20	3	0	31	54	54	0	17	15	13	0	4	23	24	0	274	
7:25 AM	11	32	6	0	30	91	84	0	19	7	9	0	7	22	20	0	338	2906
7:30 AM	13	44	5	0	32	76	67	0	24	16	7	0	7	26	20	0	337	3040
7:35 AM	9	33	10	0	18	63	69	0	34	25	7	0	5	30	16	0	319	3148
7:40 AM	27	29	6	0	37	49	76	0	15	19	8	0	1	24	21	0	312	3257
7:45 AM	17	59	8	0	32	91	79	0	17	16	12	0	4	23	23	0	381	3442
7:50 AM	16	37	8	0	22	41	73	0	47	25	8	0	6	30	29	0	342	3574
7:55 AM	38	52	8	0	26	39	51	0	19	21	8	0	2	14	15	0	293	3662
8:00 AM	9	43	7	0	10	67	71	0	48	26	6	0	2	13	43	0	345	3711
8:05 AM	18	20	7	0	18	30	62	0	34	26	10	0	1	30	28	0	284	3791
8:10 AM	11	48	3	0	14	57	48	0	43	18	13	0	4	14	22	0	295	3783
8:15 AM	18	16	4	0	15	17	58	0	12	10	9	0	1	28	20	0	208	3728
8:20 AM	7	47	2	0	6	53	62	0	43	25	6	0	1	19	21	0	292	3746
8:25 AM	14	18	1	0	12	21	30	0	30	19	13	0	1	24	21	0	204	3612

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	240	500	88	0	364	724	912	0	316	240	112	0	44	308	292	0	4140
Heavy Trucks	4	16	4		12	20	36		36	0	16		0	16	8		168
Pedestrians		0				24				0				12			36
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

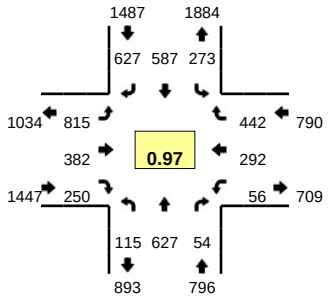
Type of peak hour being reported: Intersection Peak

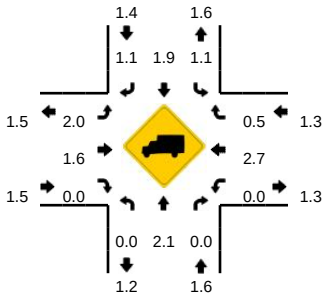
Method for determining peak hour: Total Entering Volume

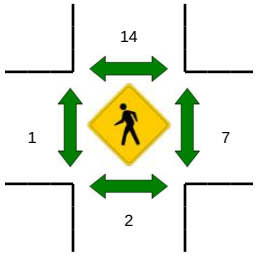
LOCATION: 6 - Makakilo Dr -- Farrington Hwy
CITY/STATE: Kapolei, HI

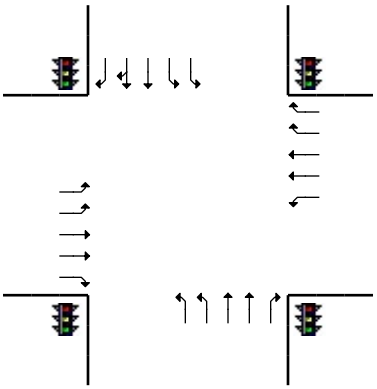
QC JOB #: 14681215
DATE: Tue, May 08 2018

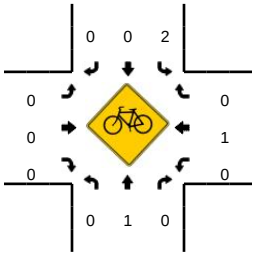
Peak-Hour: 4:15 PM -- 5:15 PM
Peak 15-Min: 4:55 PM -- 5:10 PM

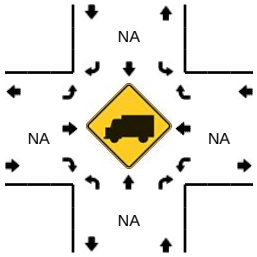


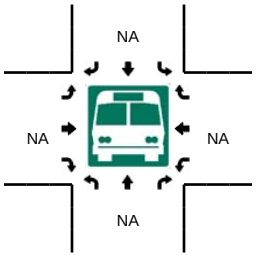












5-Min Count Period Beginning At	6 - Makakilo Dr (Northbound)				6 - Makakilo Dr (Southbound)				Farrington Hwy (Eastbound)				Farrington Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	7	44	6	0	13	43	50	0	59	25	20	0	2	15	12	0	296	
3:35 PM	12	38	4	0	17	42	62	0	61	34	13	0	4	33	24	0	344	
3:40 PM	12	45	4	0	30	53	47	0	50	21	27	0	4	27	33	0	353	
3:45 PM	5	69	3	0	17	49	49	0	55	15	18	0	6	23	30	0	339	
3:50 PM	13	42	7	0	16	39	52	0	78	36	20	0	16	26	18	0	363	
3:55 PM	12	46	3	0	21	38	45	0	63	27	17	0	4	30	45	0	351	
4:00 PM	15	39	5	0	41	48	41	0	51	29	17	0	2	39	34	0	361	
4:05 PM	5	73	3	0	17	70	48	0	61	22	30	0	4	12	25	0	370	
4:10 PM	9	53	3	0	8	32	47	0	83	36	16	0	6	23	25	0	341	
4:15 PM	7	40	3	0	23	47	44	0	69	34	22	0	4	42	56	0	391	
4:20 PM	16	50	9	0	40	50	51	0	50	33	17	0	8	29	33	0	386	
4:25 PM	6	81	2	0	18	68	48	0	53	28	21	0	9	17	33	0	384	4279
4:30 PM	10	44	4	0	10	41	49	0	91	48	17	0	6	25	36	0	381	4364
4:35 PM	12	38	7	0	14	43	37	0	63	23	22	0	2	43	48	0	352	4372
4:40 PM	15	53	3	0	38	61	57	0	57	29	17	0	7	18	43	0	398	4417
4:45 PM	5	68	7	0	12	50	57	0	74	29	28	0	4	14	24	0	372	4450
4:50 PM	7	39	3	0	15	28	54	0	77	32	23	0	5	20	41	0	344	4431
4:55 PM	9	45	1	0	23	50	64	0	68	42	25	0	5	31	39	0	402	4482
5:00 PM	11	55	8	0	41	54	63	0	51	24	13	0	5	16	28	0	369	4490
5:05 PM	7	77	4	0	25	64	52	0	66	30	19	0	0	21	30	0	395	4515
5:10 PM	10	37	3	0	14	31	51	0	96	30	26	0	1	16	31	0	346	4520
5:15 PM	8	45	4	0	22	41	44	0	62	25	20	0	5	46	47	0	369	4498
5:20 PM	14	40	7	0	33	56	58	0	48	29	12	0	5	29	25	0	356	4468
5:25 PM	4	77	5	0	24	59	53	0	57	27	18	0	6	23	27	0	380	4464

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	108	708	52	0	356	672	716	0	740	384	228	0	40	272	388	0	4664
Heavy Trucks	0	8	0		8	20	4		4	0	0		0	0	4		48
Pedestrians		0				24				0				8			32
Bicycles	0	0	0		2	0	0		0	0	0		0	1	0		3
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2018 4:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/15/2017															
12:00-12:15	5	0	5	06:00-06:15	56	0	56	12:00-12:15	33	0	33	06:00-06:15	27	0	27
12:15-12:30	3	0	3	06:15-06:30	49	0	49	12:15-12:30	70	0	70	06:15-06:30	38	0	38
12:30-12:45	7	0	7	06:30-06:45	55	0	55	12:30-12:45	48	0	48	06:30-06:45	27	0	27
12:45-01:00	3	0	3	06:45-07:00	66	0	66	12:45-01:00	48	0	48	06:45-07:00	32	0	32
01:00-01:15	3	0	3	07:00-07:15	66	0	66	01:00-01:15	56	0	56	07:00-07:15	26	0	26
01:15-01:30	1	0	1	07:15-07:30	75	0	75	01:15-01:30	72	0	72	07:15-07:30	48	0	48
01:30-01:45	0	0	0	07:30-07:45	53	0	53	01:30-01:45	49	0	49	07:30-07:45	33	0	33
01:45-02:00	1	0	1	07:45-08:00	78	0	78	01:45-02:00	68	0	68	07:45-08:00	32	0	32
02:00-02:15	2	0	2	08:00-08:15	80	0	80	02:00-02:15	53	0	53	08:00-08:15	22	0	22
02:15-02:30	4	0	4	08:15-08:30	67	0	67	02:15-02:30	52	0	52	08:15-08:30	18	0	18
02:30-02:45	1	0	1	08:30-08:45	73	0	73	02:30-02:45	47	0	47	08:30-08:45	17	0	17
02:45-03:00	0	0	0	08:45-09:00	84	0	84	02:45-03:00	45	0	45	08:45-09:00	15	0	15
03:00-03:15	0	0	0	09:00-09:15	55	0	55	03:00-03:15	55	0	55	09:00-09:15	12	0	12
03:15-03:30	2	0	2	09:15-09:30	70	0	70	03:15-03:30	61	0	61	09:15-09:30	27	0	27
03:30-03:45	3	0	3	09:30-09:45	56	0	56	03:30-03:45	52	0	52	09:30-09:45	22	0	22
03:45-04:00	8	0	8	09:45-10:00	41	0	41	03:45-04:00	46	0	46	09:45-10:00	22	0	22
04:00-04:15	3	0	3	10:00-10:15	47	0	47	04:00-04:15	53	0	53	10:00-10:15	9	0	9
04:15-04:30	7	0	7	10:15-10:30	75	0	75	04:15-04:30	65	0	65	10:15-10:30	11	0	11
04:30-04:45	8	0	8	10:30-10:45	44	0	44	04:30-04:45	58	0	58	10:30-10:45	5	0	5
04:45-05:00	13	0	13	10:45-11:00	59	0	59	04:45-05:00	61	0	61	10:45-11:00	6	0	6
05:00-05:15	11	0	11	11:00-11:15	56	0	56	05:00-05:15	54	0	54	11:00-11:15	6	0	6
05:15-05:30	22	0	22	11:15-11:30	64	0	64	05:15-05:30	50	0	50	11:15-11:30	8	0	8
05:30-05:45	21	0	21	11:30-11:45	50	0	50	05:30-05:45	42	0	42	11:30-11:45	3	0	3
05:45-06:00	51	0	51	11:45-12:00	47	0	47	05:45-06:00	36	0	36	11:45-12:00	7	0	7

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/16/2017															
12:00-12:15	11	0	11	06:00-06:15	68	0	68	12:00-12:15	41	0	41	06:00-06:15	31	0	31
12:15-12:30	4	0	4	06:15-06:30	106	0	106	12:15-12:30	61	0	61	06:15-06:30	41	0	41
12:30-12:45	3	0	3	06:30-06:45	89	0	89	12:30-12:45	41	0	41	06:30-06:45	30	0	30
12:45-01:00	0	0	0	06:45-07:00	76	0	76	12:45-01:00	32	0	32	06:45-07:00	29	0	29
01:00-01:15	3	0	3	07:00-07:15	72	0	72	01:00-01:15	47	0	47	07:00-07:15	39	0	39
01:15-01:30	3	0	3	07:15-07:30	100	0	100	01:15-01:30	65	0	65	07:15-07:30	27	0	27
01:30-01:45	0	0	0	07:30-07:45	98	0	98	01:30-01:45	44	0	44	07:30-07:45	33	0	33
01:45-02:00	1	0	1	07:45-08:00	74	0	74	01:45-02:00	53	0	53	07:45-08:00	30	0	30
02:00-02:15	2	0	2	08:00-08:15	71	0	71	02:00-02:15	35	0	35	08:00-08:15	26	0	26
02:15-02:30	3	0	3	08:15-08:30	63	0	63	02:15-02:30	40	0	40	08:15-08:30	25	0	25
02:30-02:45	0	0	0	08:30-08:45	73	0	73	02:30-02:45	38	0	38	08:30-08:45	14	0	14
02:45-03:00	0	0	0	08:45-09:00	50	0	50	02:45-03:00	44	0	44	08:45-09:00	25	0	25
03:00-03:15	1	0	1	09:00-09:15	57	0	57	03:00-03:15	56	0	56	09:00-09:15	18	0	18
03:15-03:30	3	0	3	09:15-09:30	38	0	38	03:15-03:30	66	0	66	09:15-09:30	20	0	20
03:30-03:45	1	0	1	09:30-09:45	41	0	41	03:30-03:45	50	0	50	09:30-09:45	22	0	22
03:45-04:00	5	0	5	09:45-10:00	43	0	43	03:45-04:00	50	0	50	09:45-10:00	17	0	17
04:00-04:15	7	0	7	10:00-10:15	38	0	38	04:00-04:15	54	0	54	10:00-10:15	15	0	15
04:15-04:30	6	0	6	10:15-10:30	47	0	47	04:15-04:30	60	0	60	10:15-10:30	13	0	13
04:30-04:45	11	0	11	10:30-10:45	55	0	55	04:30-04:45	52	0	52	10:30-10:45	20	0	20
04:45-05:00	10	0	10	10:45-11:00	44	0	44	04:45-05:00	80	0	80	10:45-11:00	10	0	10
05:00-05:15	17	0	17	11:00-11:15	56	0	56	05:00-05:15	41	0	41	11:00-11:15	9	0	9
05:15-05:30	24	0	24	11:15-11:30	42	0	42	05:15-05:30	54	0	54	11:15-11:30	11	0	11
05:30-05:45	33	0	33	11:30-11:45	46	0	46	05:30-05:45	48	0	48	11:30-11:45	9	0	9
05:45-06:00	61	0	61	11:45-12:00	37	0	37	05:45-06:00	44	0	44	11:45-12:00	9	0	9

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		
DIRECTIONAL PEAK			DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)			PM PERIOD (12:00-24:00)		
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		

NON-COMMUTER PERIOD (09:00-15:00)	6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
TWO DIRECTIONAL PEAK	AM 6-HR PERIOD (06:00-12:00)			
PEAK HR TIME	AM 12-HR PERIOD (00:00-12:00)			
PEAK HR VOLUME	PM 6-HR PERIOD (12:00-18:00)			
DIRECTIONAL PEAK	PM 12-HR PERIOD (12:00-24:00)			
PEAK HR TIME	24 HOUR PERIOD			
PEAK HR VOLUME	D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/17/2017															
12:00-12:15	4	0	4	06:00-06:15	50	0	50	12:00-12:15	54	0	54	06:00-06:15	39	0	39
12:15-12:30	1	0	1	06:15-06:30	50	0	50	12:15-12:30	63	0	63	06:15-06:30	27	0	27
12:30-12:45	2	0	2	06:30-06:45	53	0	53	12:30-12:45	52	0	52	06:30-06:45	33	0	33
12:45-01:00	3	0	3	06:45-07:00	65	0	65	12:45-01:00	55	0	55	06:45-07:00	35	0	35
01:00-01:15	4	0	4	07:00-07:15	60	0	60	01:00-01:15	58	0	58	07:00-07:15	42	0	42
01:15-01:30	5	0	5	07:15-07:30	54	0	54	01:15-01:30	56	0	56	07:15-07:30	39	0	39
01:30-01:45	2	0	2	07:30-07:45	74	0	74	01:30-01:45	51	0	51	07:30-07:45	39	0	39
01:45-02:00	0	0	0	07:45-08:00	71	0	71	01:45-02:00	76	0	76	07:45-08:00	31	0	31
02:00-02:15	2	0	2	08:00-08:15	74	0	74	02:00-02:15	60	0	60	08:00-08:15	24	0	24
02:15-02:30	0	0	0	08:15-08:30	57	0	57	02:15-02:30	51	0	51	08:15-08:30	22	0	22
02:30-02:45	3	0	3	08:30-08:45	57	0	57	02:30-02:45	52	0	52	08:30-08:45	24	0	24
02:45-03:00	0	0	0	08:45-09:00	46	0	46	02:45-03:00	42	0	42	08:45-09:00	16	0	16
03:00-03:15	2	0	2	09:00-09:15	63	0	63	03:00-03:15	38	0	38	09:00-09:15	14	0	14
03:15-03:30	0	0	0	09:15-09:30	53	0	53	03:15-03:30	53	0	53	09:15-09:30	23	0	23
03:30-03:45	2	0	2	09:30-09:45	48	0	48	03:30-03:45	68	0	68	09:30-09:45	10	0	10
03:45-04:00	1	0	1	09:45-10:00	54	0	54	03:45-04:00	45	0	45	09:45-10:00	24	0	24
04:00-04:15	8	0	8	10:00-10:15	66	0	66	04:00-04:15	58	0	58	10:00-10:15	13	0	13
04:15-04:30	10	0	10	10:15-10:30	59	0	59	04:15-04:30	62	0	62	10:15-10:30	11	0	11
04:30-04:45	10	0	10	10:30-10:45	50	0	50	04:30-04:45	63	0	63	10:30-10:45	11	0	11
04:45-05:00	11	0	11	10:45-11:00	74	0	74	04:45-05:00	53	0	53	10:45-11:00	18	0	18
05:00-05:15	13	0	13	11:00-11:15	60	0	60	05:00-05:15	60	0	60	11:00-11:15	13	0	13
05:15-05:30	19	0	19	11:15-11:30	47	0	47	05:15-05:30	33	0	33	11:15-11:30	10	0	10
05:30-05:45	31	0	31	11:30-11:45	45	0	45	05:30-05:45	35	0	35	11:30-11:45	7	0	7
05:45-06:00	34	0	34	11:45-12:00	44	0	44	05:45-06:00	42	0	42	11:45-12:00	9	0	9

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/22/2017															
12:00-12:15	2	0	2	06:00-06:15	61	0	61	12:00-12:15	42	0	42	06:00-06:15	39	0	39
12:15-12:30	6	0	6	06:15-06:30	52	0	52	12:15-12:30	49	0	49	06:15-06:30	24	0	24
12:30-12:45	5	0	5	06:30-06:45	80	0	80	12:30-12:45	43	0	43	06:30-06:45	35	0	35
12:45-01:00	1	0	1	06:45-07:00	86	0	86	12:45-01:00	62	0	62	06:45-07:00	21	0	21
01:00-01:15	2	0	2	07:00-07:15	90	0	90	01:00-01:15	47	0	47	07:00-07:15	24	0	24
01:15-01:30	0	0	0	07:15-07:30	60	0	60	01:15-01:30	31	0	31	07:15-07:30	27	0	27
01:30-01:45	0	0	0	07:30-07:45	86	0	86	01:30-01:45	40	0	40	07:30-07:45	25	0	25
01:45-02:00	3	0	3	07:45-08:00	65	0	65	01:45-02:00	55	0	55	07:45-08:00	19	0	19
02:00-02:15	2	0	2	08:00-08:15	59	0	59	02:00-02:15	46	0	46	08:00-08:15	21	0	21
02:15-02:30	3	0	3	08:15-08:30	58	0	58	02:15-02:30	64	0	64	08:15-08:30	17	0	17
02:30-02:45	1	0	1	08:30-08:45	83	0	83	02:30-02:45	48	0	48	08:30-08:45	28	0	28
02:45-03:00	2	0	2	08:45-09:00	74	0	74	02:45-03:00	50	0	50	08:45-09:00	16	0	16
03:00-03:15	1	0	1	09:00-09:15	43	0	43	03:00-03:15	47	0	47	09:00-09:15	15	0	15
03:15-03:30	3	0	3	09:15-09:30	65	0	65	03:15-03:30	54	0	54	09:15-09:30	11	0	11
03:30-03:45	1	0	1	09:30-09:45	55	0	55	03:30-03:45	54	0	54	09:30-09:45	9	0	9
03:45-04:00	4	0	4	09:45-10:00	52	0	52	03:45-04:00	51	0	51	09:45-10:00	13	0	13
04:00-04:15	6	0	6	10:00-10:15	44	0	44	04:00-04:15	47	0	47	10:00-10:15	14	0	14
04:15-04:30	6	0	6	10:15-10:30	54	0	54	04:15-04:30	65	0	65	10:15-10:30	11	0	11
04:30-04:45	9	0	9	10:30-10:45	64	0	64	04:30-04:45	56	0	56	10:30-10:45	11	0	11
04:45-05:00	9	0	9	10:45-11:00	35	0	35	04:45-05:00	52	0	52	10:45-11:00	11	0	11
05:00-05:15	17	0	17	11:00-11:15	48	0	48	05:00-05:15	43	0	43	11:00-11:15	10	0	10
05:15-05:30	25	0	25	11:15-11:30	45	0	45	05:15-05:30	48	0	48	11:15-11:30	6	0	6
05:30-05:45	30	0	30	11:30-11:45	37	0	37	05:30-05:45	52	0	52	11:30-11:45	4	0	4
05:45-06:00	46	0	46	11:45-12:00	31	0	31	05:45-06:00	42	0	42	11:45-12:00	6	0	6

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/23/2017															
12:00-12:15	8	0	8	06:00-06:15	59	0	59	12:00-12:15	33	0	33	06:00-06:15	40	0	40
12:15-12:30	5	0	5	06:15-06:30	65	0	65	12:15-12:30	38	0	38	06:15-06:30	46	0	46
12:30-12:45	7	0	7	06:30-06:45	64	0	64	12:30-12:45	41	0	41	06:30-06:45	53	0	53
12:45-01:00	2	0	2	06:45-07:00	86	0	86	12:45-01:00	62	0	62	06:45-07:00	37	0	37
01:00-01:15	2	0	2	07:00-07:15	71	0	71	01:00-01:15	51	0	51	07:00-07:15	36	0	36
01:15-01:30	1	0	1	07:15-07:30	75	0	75	01:15-01:30	58	0	58	07:15-07:30	23	0	23
01:30-01:45	3	0	3	07:30-07:45	80	0	80	01:30-01:45	47	0	47	07:30-07:45	30	0	30
01:45-02:00	0	0	0	07:45-08:00	91	0	91	01:45-02:00	71	0	71	07:45-08:00	24	0	24
02:00-02:15	1	0	1	08:00-08:15	59	0	59	02:00-02:15	46	0	46	08:00-08:15	19	0	19
02:15-02:30	1	0	1	08:15-08:30	49	0	49	02:15-02:30	35	0	35	08:15-08:30	30	0	30
02:30-02:45	2	0	2	08:30-08:45	57	0	57	02:30-02:45	51	0	51	08:30-08:45	20	0	20
02:45-03:00	1	0	1	08:45-09:00	65	0	65	02:45-03:00	49	0	49	08:45-09:00	19	0	19
03:00-03:15	1	0	1	09:00-09:15	59	0	59	03:00-03:15	45	0	45	09:00-09:15	17	0	17
03:15-03:30	2	0	2	09:15-09:30	45	0	45	03:15-03:30	53	0	53	09:15-09:30	23	0	23
03:30-03:45	4	0	4	09:30-09:45	39	0	39	03:30-03:45	57	0	57	09:30-09:45	12	0	12
03:45-04:00	2	0	2	09:45-10:00	44	0	44	03:45-04:00	41	0	41	09:45-10:00	11	0	11
04:00-04:15	4	0	4	10:00-10:15	44	0	44	04:00-04:15	46	0	46	10:00-10:15	5	0	5
04:15-04:30	9	0	9	10:15-10:30	43	0	43	04:15-04:30	61	0	61	10:15-10:30	15	0	15
04:30-04:45	9	0	9	10:30-10:45	56	0	56	04:30-04:45	54	0	54	10:30-10:45	7	0	7
04:45-05:00	15	0	15	10:45-11:00	56	0	56	04:45-05:00	61	0	61	10:45-11:00	9	0	9
05:00-05:15	19	0	19	11:00-11:15	32	0	32	05:00-05:15	51	0	51	11:00-11:15	10	0	10
05:15-05:30	20	0	20	11:15-11:30	21	0	21	05:15-05:30	51	0	51	11:15-11:30	10	0	10
05:30-05:45	35	0	35	11:30-11:45	51	0	51	05:30-05:45	47	0	47	11:30-11:45	3	0	3
05:45-06:00	37	0	37	11:45-12:00	40	0	40	05:45-06:00	42	0	42	11:45-12:00	6	0	6

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3A **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 2900
Functional Class: OTHER **Count Type:** VOLUME **Counter Type:** Tube **Route No:** H-1_EB_3
Location: H-1 Fwy EB Palehua IC off ramp R-1 to Kualakai Pkwy

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/24/2017															
12:00-12:15	3	0	3	06:00-06:15	82	0	82	12:00-12:15	39	0	39	06:00-06:15	48	0	48
12:15-12:30	2	0	2	06:15-06:30	77	0	77	12:15-12:30	62	0	62	06:15-06:30	29	0	29
12:30-12:45	5	0	5	06:30-06:45	111	0	111	12:30-12:45	55	0	55	06:30-06:45	35	0	35
12:45-01:00	3	0	3	06:45-07:00	121	0	121	12:45-01:00	49	0	49	06:45-07:00	28	0	28
01:00-01:15	2	0	2	07:00-07:15	116	0	116	01:00-01:15	39	0	39	07:00-07:15	32	0	32
01:15-01:30	2	0	2	07:15-07:30	117	0	117	01:15-01:30	47	0	47	07:15-07:30	28	0	28
01:30-01:45	3	0	3	07:30-07:45	116	0	116	01:30-01:45	44	0	44	07:30-07:45	27	0	27
01:45-02:00	1	0	1	07:45-08:00	79	0	79	01:45-02:00	58	0	58	07:45-08:00	31	0	31
02:00-02:15	1	0	1	08:00-08:15	96	0	96	02:00-02:15	45	0	45	08:00-08:15	13	0	13
02:15-02:30	1	0	1	08:15-08:30	56	0	56	02:15-02:30	47	0	47	08:15-08:30	19	0	19
02:30-02:45	1	0	1	08:30-08:45	61	0	61	02:30-02:45	47	0	47	08:30-08:45	12	0	12
02:45-03:00	1	0	1	08:45-09:00	46	0	46	02:45-03:00	60	0	60	08:45-09:00	16	0	16
03:00-03:15	5	0	5	09:00-09:15	68	0	68	03:00-03:15	41	0	41	09:00-09:15	21	0	21
03:15-03:30	1	0	1	09:15-09:30	52	0	52	03:15-03:30	62	0	62	09:15-09:30	15	0	15
03:30-03:45	1	0	1	09:30-09:45	47	0	47	03:30-03:45	52	0	52	09:30-09:45	12	0	12
03:45-04:00	3	0	3	09:45-10:00	60	0	60	03:45-04:00	43	0	43	09:45-10:00	16	0	16
04:00-04:15	2	0	2	10:00-10:15	57	0	57	04:00-04:15	66	0	66	10:00-10:15	13	0	13
04:15-04:30	8	0	8	10:15-10:30	53	0	53	04:15-04:30	61	0	61	10:15-10:30	10	0	10
04:30-04:45	13	0	13	10:30-10:45	45	0	45	04:30-04:45	57	0	57	10:30-10:45	11	0	11
04:45-05:00	13	0	13	10:45-11:00	62	0	62	04:45-05:00	60	0	60	10:45-11:00	10	0	10
05:00-05:15	24	0	24	11:00-11:15	40	0	40	05:00-05:15	43	0	43	11:00-11:15	7	0	7
05:15-05:30	18	0	18	11:15-11:30	48	0	48	05:15-05:30	42	0	42	11:15-11:30	7	0	7
05:30-05:45	29	0	29	11:30-11:45	33	0	33	05:30-05:45	36	0	36	11:30-11:45	6	0	6
05:45-06:00	39	0	39	11:45-12:00	46	0	46	05:45-06:00	38	0	38	11:45-12:00	6	0	6

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/15/2017															
12:00-12:15	16	0	16	06:00-06:15	143	0	143	12:00-12:15	85	0	85	06:00-06:15	118	0	118
12:15-12:30	10	0	10	06:15-06:30	172	0	172	12:15-12:30	103	0	103	06:15-06:30	87	0	87
12:30-12:45	13	0	13	06:30-06:45	134	0	134	12:30-12:45	105	0	105	06:30-06:45	89	0	89
12:45-01:00	21	0	21	06:45-07:00	146	0	146	12:45-01:00	105	0	105	06:45-07:00	87	0	87
01:00-01:15	15	0	15	07:00-07:15	146	0	146	01:00-01:15	122	0	122	07:00-07:15	82	0	82
01:15-01:30	1	0	1	07:15-07:30	136	0	136	01:15-01:30	91	0	91	07:15-07:30	55	0	55
01:30-01:45	6	0	6	07:30-07:45	127	0	127	01:30-01:45	83	0	83	07:30-07:45	71	0	71
01:45-02:00	7	0	7	07:45-08:00	143	0	143	01:45-02:00	112	0	112	07:45-08:00	87	0	87
02:00-02:15	10	0	10	08:00-08:15	164	0	164	02:00-02:15	112	0	112	08:00-08:15	69	0	69
02:15-02:30	5	0	5	08:15-08:30	116	0	116	02:15-02:30	115	0	115	08:15-08:30	60	0	60
02:30-02:45	5	0	5	08:30-08:45	111	0	111	02:30-02:45	144	0	144	08:30-08:45	77	0	77
02:45-03:00	5	0	5	08:45-09:00	85	0	85	02:45-03:00	143	0	143	08:45-09:00	55	0	55
03:00-03:15	9	0	9	09:00-09:15	110	0	110	03:00-03:15	147	0	147	09:00-09:15	64	0	64
03:15-03:30	12	0	12	09:15-09:30	104	0	104	03:15-03:30	126	0	126	09:15-09:30	55	0	55
03:30-03:45	30	0	30	09:30-09:45	80	0	80	03:30-03:45	187	0	187	09:30-09:45	53	0	53
03:45-04:00	38	0	38	09:45-10:00	109	0	109	03:45-04:00	187	0	187	09:45-10:00	35	0	35
04:00-04:15	36	0	36	10:00-10:15	99	0	99	04:00-04:15	149	0	149	10:00-10:15	53	0	53
04:15-04:30	50	0	50	10:15-10:30	87	0	87	04:15-04:30	170	0	170	10:15-10:30	46	0	46
04:30-04:45	102	0	102	10:30-10:45	85	0	85	04:30-04:45	156	0	156	10:30-10:45	29	0	29
04:45-05:00	127	0	127	10:45-11:00	82	0	82	04:45-05:00	122	0	122	10:45-11:00	31	0	31
05:00-05:15	205	0	205	11:00-11:15	81	0	81	05:00-05:15	132	0	132	11:00-11:15	21	0	21
05:15-05:30	215	0	215	11:15-11:30	85	0	85	05:15-05:30	131	0	131	11:15-11:30	15	0	15
05:30-05:45	181	0	181	11:30-11:45	89	0	89	05:30-05:45	123	0	123	11:30-11:45	13	0	13
05:45-06:00	160	0	160	11:45-12:00	89	0	89	05:45-06:00	99	0	99	11:45-12:00	21	0	21

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/16/2017															
12:00-12:15	16	0	16	06:00-06:15	173	0	173	12:00-12:15	116	0	116	06:00-06:15	118	0	118
12:15-12:30	14	0	14	06:15-06:30	141	0	141	12:15-12:30	98	0	98	06:15-06:30	106	0	106
12:30-12:45	11	0	11	06:30-06:45	144	0	144	12:30-12:45	83	0	83	06:30-06:45	69	0	69
12:45-01:00	19	0	19	06:45-07:00	153	0	153	12:45-01:00	107	0	107	06:45-07:00	72	0	72
01:00-01:15	7	0	7	07:00-07:15	139	0	139	01:00-01:15	118	0	118	07:00-07:15	84	0	84
01:15-01:30	12	0	12	07:15-07:30	154	0	154	01:15-01:30	100	0	100	07:15-07:30	77	0	77
01:30-01:45	8	0	8	07:30-07:45	95	0	95	01:30-01:45	106	0	106	07:30-07:45	84	0	84
01:45-02:00	5	0	5	07:45-08:00	149	0	149	01:45-02:00	109	0	109	07:45-08:00	91	0	91
02:00-02:15	9	0	9	08:00-08:15	153	0	153	02:00-02:15	103	0	103	08:00-08:15	97	0	97
02:15-02:30	7	0	7	08:15-08:30	119	0	119	02:15-02:30	114	0	114	08:15-08:30	87	0	87
02:30-02:45	7	0	7	08:30-08:45	98	0	98	02:30-02:45	115	0	115	08:30-08:45	64	0	64
02:45-03:00	5	0	5	08:45-09:00	117	0	117	02:45-03:00	128	0	128	08:45-09:00	79	0	79
03:00-03:15	12	0	12	09:00-09:15	142	0	142	03:00-03:15	126	0	126	09:00-09:15	64	0	64
03:15-03:30	17	0	17	09:15-09:30	91	0	91	03:15-03:30	121	0	121	09:15-09:30	73	0	73
03:30-03:45	18	0	18	09:30-09:45	92	0	92	03:30-03:45	213	0	213	09:30-09:45	51	0	51
03:45-04:00	39	0	39	09:45-10:00	82	0	82	03:45-04:00	170	0	170	09:45-10:00	41	0	41
04:00-04:15	42	0	42	10:00-10:15	95	0	95	04:00-04:15	150	0	150	10:00-10:15	59	0	59
04:15-04:30	58	0	58	10:15-10:30	93	0	93	04:15-04:30	149	0	149	10:15-10:30	45	0	45
04:30-04:45	93	0	93	10:30-10:45	114	0	114	04:30-04:45	130	0	130	10:30-10:45	33	0	33
04:45-05:00	125	0	125	10:45-11:00	90	0	90	04:45-05:00	138	0	138	10:45-11:00	26	0	26
05:00-05:15	194	0	194	11:00-11:15	91	0	91	05:00-05:15	137	0	137	11:00-11:15	21	0	21
05:15-05:30	210	0	210	11:15-11:30	85	0	85	05:15-05:30	127	0	127	11:15-11:30	24	0	24
05:30-05:45	190	0	190	11:30-11:45	86	0	86	05:30-05:45	111	0	111	11:30-11:45	13	0	13
05:45-06:00	140	0	140	11:45-12:00	102	0	102	05:45-06:00	109	0	109	11:45-12:00	21	0	21

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		
DIRECTIONAL PEAK			DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)			PM PERIOD (12:00-24:00)		
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		

NON-COMMUTER PERIOD (09:00-15:00)	6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
TWO DIRECTIONAL PEAK	AM 6-HR PERIOD (06:00-12:00)			
PEAK HR TIME	AM 12-HR PERIOD (00:00-12:00)			
PEAK HR VOLUME	PM 6-HR PERIOD (12:00-18:00)			
DIRECTIONAL PEAK	PM 12-HR PERIOD (12:00-24:00)			
PEAK HR TIME	24 HOUR PERIOD			
PEAK HR VOLUME	D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/17/2017															
12:00-12:15	17	0	17	06:00-06:15	142	0	142	12:00-12:15	88	0	88	06:00-06:15	92	0	92
12:15-12:30	11	0	11	06:15-06:30	143	0	143	12:15-12:30	113	0	113	06:15-06:30	106	0	106
12:30-12:45	8	0	8	06:30-06:45	144	0	144	12:30-12:45	77	0	77	06:30-06:45	91	0	91
12:45-01:00	16	0	16	06:45-07:00	150	0	150	12:45-01:00	63	0	63	06:45-07:00	76	0	76
01:00-01:15	8	0	8	07:00-07:15	141	0	141	01:00-01:15	101	0	101	07:00-07:15	78	0	78
01:15-01:30	5	0	5	07:15-07:30	109	0	109	01:15-01:30	113	0	113	07:15-07:30	81	0	81
01:30-01:45	9	0	9	07:30-07:45	129	0	129	01:30-01:45	139	0	139	07:30-07:45	107	0	107
01:45-02:00	5	0	5	07:45-08:00	127	0	127	01:45-02:00	108	0	108	07:45-08:00	70	0	70
02:00-02:15	5	0	5	08:00-08:15	164	0	164	02:00-02:15	120	0	120	08:00-08:15	68	0	68
02:15-02:30	7	0	7	08:15-08:30	135	0	135	02:15-02:30	131	0	131	08:15-08:30	74	0	74
02:30-02:45	3	0	3	08:30-08:45	123	0	123	02:30-02:45	129	0	129	08:30-08:45	63	0	63
02:45-03:00	5	0	5	08:45-09:00	100	0	100	02:45-03:00	149	0	149	08:45-09:00	78	0	78
03:00-03:15	11	0	11	09:00-09:15	95	0	95	03:00-03:15	145	0	145	09:00-09:15	99	0	99
03:15-03:30	16	0	16	09:15-09:30	107	0	107	03:15-03:30	144	0	144	09:15-09:30	90	0	90
03:30-03:45	20	0	20	09:30-09:45	93	0	93	03:30-03:45	184	0	184	09:30-09:45	51	0	51
03:45-04:00	26	0	26	09:45-10:00	102	0	102	03:45-04:00	191	0	191	09:45-10:00	53	0	53
04:00-04:15	43	0	43	10:00-10:15	94	0	94	04:00-04:15	174	0	174	10:00-10:15	51	0	51
04:15-04:30	46	0	46	10:15-10:30	97	0	97	04:15-04:30	166	0	166	10:15-10:30	45	0	45
04:30-04:45	105	0	105	10:30-10:45	129	0	129	04:30-04:45	165	0	165	10:30-10:45	36	0	36
04:45-05:00	116	0	116	10:45-11:00	92	0	92	04:45-05:00	150	0	150	10:45-11:00	43	0	43
05:00-05:15	186	0	186	11:00-11:15	95	0	95	05:00-05:15	140	0	140	11:00-11:15	26	0	26
05:15-05:30	220	0	220	11:15-11:30	113	0	113	05:15-05:30	140	0	140	11:15-11:30	23	0	23
05:30-05:45	164	0	164	11:30-11:45	88	0	88	05:30-05:45	97	0	97	11:30-11:45	24	0	24
05:45-06:00	196	0	196	11:45-12:00	104	0	104	05:45-06:00	85	0	85	11:45-12:00	11	0	11

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/22/2017															
12:00-12:15	12	0	12	06:00-06:15	160	0	160	12:00-12:15	89	0	89	06:00-06:15	99	0	99
12:15-12:30	13	0	13	06:15-06:30	144	0	144	12:15-12:30	110	0	110	06:15-06:30	77	0	77
12:30-12:45	16	0	16	06:30-06:45	122	0	122	12:30-12:45	156	0	156	06:30-06:45	96	0	96
12:45-01:00	10	0	10	06:45-07:00	136	0	136	12:45-01:00	122	0	122	06:45-07:00	84	0	84
01:00-01:15	9	0	9	07:00-07:15	120	0	120	01:00-01:15	88	0	88	07:00-07:15	93	0	93
01:15-01:30	5	0	5	07:15-07:30	128	0	128	01:15-01:30	110	0	110	07:15-07:30	59	0	59
01:30-01:45	10	0	10	07:30-07:45	122	0	122	01:30-01:45	104	0	104	07:30-07:45	84	0	84
01:45-02:00	6	0	6	07:45-08:00	142	0	142	01:45-02:00	166	0	166	07:45-08:00	53	0	53
02:00-02:15	4	0	4	08:00-08:15	162	0	162	02:00-02:15	156	0	156	08:00-08:15	64	0	64
02:15-02:30	5	0	5	08:15-08:30	133	0	133	02:15-02:30	136	0	136	08:15-08:30	73	0	73
02:30-02:45	3	0	3	08:30-08:45	116	0	116	02:30-02:45	104	0	104	08:30-08:45	49	0	49
02:45-03:00	8	0	8	08:45-09:00	101	0	101	02:45-03:00	138	0	138	08:45-09:00	49	0	49
03:00-03:15	13	0	13	09:00-09:15	106	0	106	03:00-03:15	140	0	140	09:00-09:15	75	0	75
03:15-03:30	24	0	24	09:15-09:30	126	0	126	03:15-03:30	136	0	136	09:15-09:30	61	0	61
03:30-03:45	32	0	32	09:30-09:45	126	0	126	03:30-03:45	213	0	213	09:30-09:45	68	0	68
03:45-04:00	25	0	25	09:45-10:00	108	0	108	03:45-04:00	198	0	198	09:45-10:00	41	0	41
04:00-04:15	40	0	40	10:00-10:15	98	0	98	04:00-04:15	168	0	168	10:00-10:15	35	0	35
04:15-04:30	73	0	73	10:15-10:30	104	0	104	04:15-04:30	149	0	149	10:15-10:30	37	0	37
04:30-04:45	103	0	103	10:30-10:45	97	0	97	04:30-04:45	155	0	155	10:30-10:45	23	0	23
04:45-05:00	154	0	154	10:45-11:00	124	0	124	04:45-05:00	128	0	128	10:45-11:00	24	0	24
05:00-05:15	203	0	203	11:00-11:15	117	0	117	05:00-05:15	143	0	143	11:00-11:15	21	0	21
05:15-05:30	225	0	225	11:15-11:30	96	0	96	05:15-05:30	106	0	106	11:15-11:30	22	0	22
05:30-05:45	178	0	178	11:30-11:45	106	0	106	05:30-05:45	98	0	98	11:30-11:45	19	0	19
05:45-06:00	194	0	194	11:45-12:00	67	0	67	05:45-06:00	93	0	93	11:45-12:00	18	0	18

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/23/2017															
12:00-12:15	19	0	19	06:00-06:15	142	0	142	12:00-12:15	73	0	73	06:00-06:15	105	0	105
12:15-12:30	18	0	18	06:15-06:30	170	0	170	12:15-12:30	133	0	133	06:15-06:30	105	0	105
12:30-12:45	8	0	8	06:30-06:45	136	0	136	12:30-12:45	109	0	109	06:30-06:45	129	0	129
12:45-01:00	7	0	7	06:45-07:00	135	0	135	12:45-01:00	105	0	105	06:45-07:00	75	0	75
01:00-01:15	10	0	10	07:00-07:15	123	0	123	01:00-01:15	99	0	99	07:00-07:15	89	0	89
01:15-01:30	5	0	5	07:15-07:30	142	0	142	01:15-01:30	113	0	113	07:15-07:30	91	0	91
01:30-01:45	2	0	2	07:30-07:45	109	0	109	01:30-01:45	121	0	121	07:30-07:45	80	0	80
01:45-02:00	7	0	7	07:45-08:00	139	0	139	01:45-02:00	123	0	123	07:45-08:00	67	0	67
02:00-02:15	7	0	7	08:00-08:15	146	0	146	02:00-02:15	167	0	167	08:00-08:15	62	0	62
02:15-02:30	6	0	6	08:15-08:30	120	0	120	02:15-02:30	130	0	130	08:15-08:30	89	0	89
02:30-02:45	5	0	5	08:30-08:45	109	0	109	02:30-02:45	130	0	130	08:30-08:45	61	0	61
02:45-03:00	6	0	6	08:45-09:00	116	0	116	02:45-03:00	131	0	131	08:45-09:00	50	0	50
03:00-03:15	10	0	10	09:00-09:15	116	0	116	03:00-03:15	135	0	135	09:00-09:15	57	0	57
03:15-03:30	23	0	23	09:15-09:30	126	0	126	03:15-03:30	146	0	146	09:15-09:30	72	0	72
03:30-03:45	30	0	30	09:30-09:45	132	0	132	03:30-03:45	236	0	236	09:30-09:45	39	0	39
03:45-04:00	24	0	24	09:45-10:00	119	0	119	03:45-04:00	156	0	156	09:45-10:00	52	0	52
04:00-04:15	36	0	36	10:00-10:15	101	0	101	04:00-04:15	151	0	151	10:00-10:15	50	0	50
04:15-04:30	54	0	54	10:15-10:30	97	0	97	04:15-04:30	139	0	139	10:15-10:30	37	0	37
04:30-04:45	110	0	110	10:30-10:45	113	0	113	04:30-04:45	142	0	142	10:30-10:45	32	0	32
04:45-05:00	127	0	127	10:45-11:00	121	0	121	04:45-05:00	177	0	177	10:45-11:00	28	0	28
05:00-05:15	200	0	200	11:00-11:15	126	0	126	05:00-05:15	173	0	173	11:00-11:15	23	0	23
05:15-05:30	203	0	203	11:15-11:30	100	0	100	05:15-05:30	140	0	140	11:15-11:30	13	0	13
05:30-05:45	195	0	195	11:30-11:45	95	0	95	05:30-05:45	124	0	124	11:30-11:45	18	0	18
05:45-06:00	170	0	170	11:45-12:00	89	0	89	05:45-06:00	107	0	107	11:45-12:00	19	0	19

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3B **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 8700
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_EB_3AA
Location: Kualakai Pkwy Palehua IC on ramp R-2 to H-1 Fwy EB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/24/2017															
12:00-12:15	14	0	14	06:00-06:15	147	0	147	12:00-12:15	107	0	107	06:00-06:15	106	0	106
12:15-12:30	11	0	11	06:15-06:30	147	0	147	12:15-12:30	135	0	135	06:15-06:30	90	0	90
12:30-12:45	13	0	13	06:30-06:45	134	0	134	12:30-12:45	163	0	163	06:30-06:45	104	0	104
12:45-01:00	12	0	12	06:45-07:00	131	0	131	12:45-01:00	102	0	102	06:45-07:00	68	0	68
01:00-01:15	16	0	16	07:00-07:15	117	0	117	01:00-01:15	107	0	107	07:00-07:15	72	0	72
01:15-01:30	9	0	9	07:15-07:30	104	0	104	01:15-01:30	92	0	92	07:15-07:30	62	0	62
01:30-01:45	6	0	6	07:30-07:45	117	0	117	01:30-01:45	116	0	116	07:30-07:45	78	0	78
01:45-02:00	5	0	5	07:45-08:00	141	0	141	01:45-02:00	134	0	134	07:45-08:00	62	0	62
02:00-02:15	8	0	8	08:00-08:15	151	0	151	02:00-02:15	153	0	153	08:00-08:15	58	0	58
02:15-02:30	2	0	2	08:15-08:30	102	0	102	02:15-02:30	126	0	126	08:15-08:30	68	0	68
02:30-02:45	6	0	6	08:30-08:45	110	0	110	02:30-02:45	136	0	136	08:30-08:45	57	0	57
02:45-03:00	5	0	5	08:45-09:00	90	0	90	02:45-03:00	142	0	142	08:45-09:00	73	0	73
03:00-03:15	12	0	12	09:00-09:15	101	0	101	03:00-03:15	132	0	132	09:00-09:15	71	0	71
03:15-03:30	21	0	21	09:15-09:30	118	0	118	03:15-03:30	170	0	170	09:15-09:30	68	0	68
03:30-03:45	25	0	25	09:30-09:45	114	0	114	03:30-03:45	205	0	205	09:30-09:45	62	0	62
03:45-04:00	29	0	29	09:45-10:00	109	0	109	03:45-04:00	146	0	146	09:45-10:00	46	0	46
04:00-04:15	38	0	38	10:00-10:15	94	0	94	04:00-04:15	143	0	143	10:00-10:15	36	0	36
04:15-04:30	61	0	61	10:15-10:30	115	0	115	04:15-04:30	145	0	145	10:15-10:30	33	0	33
04:30-04:45	113	0	113	10:30-10:45	132	0	132	04:30-04:45	150	0	150	10:30-10:45	27	0	27
04:45-05:00	117	0	117	10:45-11:00	125	0	125	04:45-05:00	167	0	167	10:45-11:00	21	0	21
05:00-05:15	201	0	201	11:00-11:15	113	0	113	05:00-05:15	160	0	160	11:00-11:15	18	0	18
05:15-05:30	213	0	213	11:15-11:30	113	0	113	05:15-05:30	153	0	153	11:15-11:30	16	0	16
05:30-05:45	187	0	187	11:30-11:45	108	0	108	05:30-05:45	109	0	109	11:30-11:45	16	0	16
05:45-06:00	184	0	184	11:45-12:00	100	0	100	05:45-06:00	95	0	95	11:45-12:00	17	0	17

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/15/2017															
12:00-12:15	5	0	5	06:00-06:15	27	0	27	12:00-12:15	29	0	29	06:00-06:15	40	0	40
12:15-12:30	1	0	1	06:15-06:30	39	0	39	12:15-12:30	46	0	46	06:15-06:30	41	0	41
12:30-12:45	3	0	3	06:30-06:45	54	0	54	12:30-12:45	50	0	50	06:30-06:45	37	0	37
12:45-01:00	4	0	4	06:45-07:00	62	0	62	12:45-01:00	49	0	49	06:45-07:00	37	0	37
01:00-01:15	1	0	1	07:00-07:15	53	0	53	01:00-01:15	43	0	43	07:00-07:15	54	0	54
01:15-01:30	1	0	1	07:15-07:30	81	0	81	01:15-01:30	41	0	41	07:15-07:30	36	0	36
01:30-01:45	2	0	2	07:30-07:45	69	0	69	01:30-01:45	40	0	40	07:30-07:45	28	0	28
01:45-02:00	1	0	1	07:45-08:00	80	0	80	01:45-02:00	45	0	45	07:45-08:00	28	0	28
02:00-02:15	0	0	0	08:00-08:15	70	0	70	02:00-02:15	52	0	52	08:00-08:15	33	0	33
02:15-02:30	2	0	2	08:15-08:30	53	0	53	02:15-02:30	63	0	63	08:15-08:30	25	0	25
02:30-02:45	4	0	4	08:30-08:45	50	0	50	02:30-02:45	80	0	80	08:30-08:45	28	0	28
02:45-03:00	0	0	0	08:45-09:00	54	0	54	02:45-03:00	72	0	72	08:45-09:00	21	0	21
03:00-03:15	2	0	2	09:00-09:15	35	0	35	03:00-03:15	78	0	78	09:00-09:15	23	0	23
03:15-03:30	3	0	3	09:15-09:30	36	0	36	03:15-03:30	84	0	84	09:15-09:30	23	0	23
03:30-03:45	1	0	1	09:30-09:45	42	0	42	03:30-03:45	92	0	92	09:30-09:45	20	0	20
03:45-04:00	0	0	0	09:45-10:00	49	0	49	03:45-04:00	77	0	77	09:45-10:00	15	0	15
04:00-04:15	5	0	5	10:00-10:15	34	0	34	04:00-04:15	69	0	69	10:00-10:15	16	0	16
04:15-04:30	3	0	3	10:15-10:30	35	0	35	04:15-04:30	77	0	77	10:15-10:30	20	0	20
04:30-04:45	9	0	9	10:30-10:45	37	0	37	04:30-04:45	79	0	79	10:30-10:45	8	0	8
04:45-05:00	9	0	9	10:45-11:00	35	0	35	04:45-05:00	61	0	61	10:45-11:00	9	0	9
05:00-05:15	8	0	8	11:00-11:15	35	0	35	05:00-05:15	71	0	71	11:00-11:15	7	0	7
05:15-05:30	14	0	14	11:15-11:30	29	0	29	05:15-05:30	53	0	53	11:15-11:30	7	0	7
05:30-05:45	13	0	13	11:30-11:45	41	0	41	05:30-05:45	48	0	48	11:30-11:45	2	0	2
05:45-06:00	26	0	26	11:45-12:00	42	0	42	05:45-06:00	45	0	45	11:45-12:00	5	0	5

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/16/2017															
12:00-12:15	8	0	8	06:00-06:15	33	0	33	12:00-12:15	31	0	31	06:00-06:15	43	0	43
12:15-12:30	1	0	1	06:15-06:30	32	0	32	12:15-12:30	30	0	30	06:15-06:30	32	0	32
12:30-12:45	1	0	1	06:30-06:45	57	0	57	12:30-12:45	35	0	35	06:30-06:45	44	0	44
12:45-01:00	1	0	1	06:45-07:00	51	0	51	12:45-01:00	48	0	48	06:45-07:00	44	0	44
01:00-01:15	1	0	1	07:00-07:15	63	0	63	01:00-01:15	36	0	36	07:00-07:15	46	0	46
01:15-01:30	2	0	2	07:15-07:30	97	0	97	01:15-01:30	37	0	37	07:15-07:30	31	0	31
01:30-01:45	4	0	4	07:30-07:45	82	0	82	01:30-01:45	49	0	49	07:30-07:45	46	0	46
01:45-02:00	3	0	3	07:45-08:00	59	0	59	01:45-02:00	55	0	55	07:45-08:00	33	0	33
02:00-02:15	0	0	0	08:00-08:15	64	0	64	02:00-02:15	66	0	66	08:00-08:15	30	0	30
02:15-02:30	2	0	2	08:15-08:30	42	0	42	02:15-02:30	45	0	45	08:15-08:30	33	0	33
02:30-02:45	2	0	2	08:30-08:45	55	0	55	02:30-02:45	60	0	60	08:30-08:45	33	0	33
02:45-03:00	1	0	1	08:45-09:00	34	0	34	02:45-03:00	63	0	63	08:45-09:00	23	0	23
03:00-03:15	4	0	4	09:00-09:15	32	0	32	03:00-03:15	73	0	73	09:00-09:15	21	0	21
03:15-03:30	2	0	2	09:15-09:30	26	0	26	03:15-03:30	63	0	63	09:15-09:30	27	0	27
03:30-03:45	3	0	3	09:30-09:45	42	0	42	03:30-03:45	92	0	92	09:30-09:45	25	0	25
03:45-04:00	2	0	2	09:45-10:00	28	0	28	03:45-04:00	103	0	103	09:45-10:00	15	0	15
04:00-04:15	8	0	8	10:00-10:15	43	0	43	04:00-04:15	60	0	60	10:00-10:15	14	0	14
04:15-04:30	2	0	2	10:15-10:30	40	0	40	04:15-04:30	83	0	83	10:15-10:30	13	0	13
04:30-04:45	10	0	10	10:30-10:45	41	0	41	04:30-04:45	61	0	61	10:30-10:45	19	0	19
04:45-05:00	9	0	9	10:45-11:00	34	0	34	04:45-05:00	78	0	78	10:45-11:00	8	0	8
05:00-05:15	7	0	7	11:00-11:15	35	0	35	05:00-05:15	53	0	53	11:00-11:15	13	0	13
05:15-05:30	13	0	13	11:15-11:30	30	0	30	05:15-05:30	63	0	63	11:15-11:30	7	0	7
05:30-05:45	26	0	26	11:30-11:45	36	0	36	05:30-05:45	40	0	40	11:30-11:45	5	0	5
05:45-06:00	15	0	15	11:45-12:00	43	0	43	05:45-06:00	50	0	50	11:45-12:00	7	0	7

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/17/2017															
12:00-12:15	5	0	5	06:00-06:15	31	0	31	12:00-12:15	49	0	49	06:00-06:15	43	0	43
12:15-12:30	2	0	2	06:15-06:30	44	0	44	12:15-12:30	37	0	37	06:15-06:30	54	0	54
12:30-12:45	2	0	2	06:30-06:45	52	0	52	12:30-12:45	41	0	41	06:30-06:45	42	0	42
12:45-01:00	3	0	3	06:45-07:00	65	0	65	12:45-01:00	47	0	47	06:45-07:00	44	0	44
01:00-01:15	2	0	2	07:00-07:15	49	0	49	01:00-01:15	56	0	56	07:00-07:15	50	0	50
01:15-01:30	3	0	3	07:15-07:30	69	0	69	01:15-01:30	41	0	41	07:15-07:30	50	0	50
01:30-01:45	4	0	4	07:30-07:45	72	0	72	01:30-01:45	56	0	56	07:30-07:45	48	0	48
01:45-02:00	1	0	1	07:45-08:00	81	0	81	01:45-02:00	42	0	42	07:45-08:00	32	0	32
02:00-02:15	1	0	1	08:00-08:15	74	0	74	02:00-02:15	53	0	53	08:00-08:15	22	0	22
02:15-02:30	1	0	1	08:15-08:30	44	0	44	02:15-02:30	58	0	58	08:15-08:30	30	0	30
02:30-02:45	3	0	3	08:30-08:45	39	0	39	02:30-02:45	76	0	76	08:30-08:45	32	0	32
02:45-03:00	1	0	1	08:45-09:00	33	0	33	02:45-03:00	60	0	60	08:45-09:00	17	0	17
03:00-03:15	3	0	3	09:00-09:15	32	0	32	03:00-03:15	65	0	65	09:00-09:15	32	0	32
03:15-03:30	4	0	4	09:15-09:30	34	0	34	03:15-03:30	60	0	60	09:15-09:30	30	0	30
03:30-03:45	2	0	2	09:30-09:45	52	0	52	03:30-03:45	86	0	86	09:30-09:45	23	0	23
03:45-04:00	4	0	4	09:45-10:00	40	0	40	03:45-04:00	81	0	81	09:45-10:00	18	0	18
04:00-04:15	4	0	4	10:00-10:15	44	0	44	04:00-04:15	66	0	66	10:00-10:15	25	0	25
04:15-04:30	4	0	4	10:15-10:30	34	0	34	04:15-04:30	78	0	78	10:15-10:30	18	0	18
04:30-04:45	5	0	5	10:30-10:45	45	0	45	04:30-04:45	64	0	64	10:30-10:45	10	0	10
04:45-05:00	9	0	9	10:45-11:00	36	0	36	04:45-05:00	73	0	73	10:45-11:00	13	0	13
05:00-05:15	12	0	12	11:00-11:15	30	0	30	05:00-05:15	54	0	54	11:00-11:15	6	0	6
05:15-05:30	13	0	13	11:15-11:30	46	0	46	05:15-05:30	56	0	56	11:15-11:30	6	0	6
05:30-05:45	18	0	18	11:30-11:45	38	0	38	05:30-05:45	46	0	46	11:30-11:45	3	0	3
05:45-06:00	26	0	26	11:45-12:00	42	0	42	05:45-06:00	40	0	40	11:45-12:00	4	0	4

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/22/2017															
12:00-12:15	3	0	3	06:00-06:15	29	0	29	12:00-12:15	33	0	33	06:00-06:15	49	0	49
12:15-12:30	1	0	1	06:15-06:30	40	0	40	12:15-12:30	35	0	35	06:15-06:30	44	0	44
12:30-12:45	2	0	2	06:30-06:45	44	0	44	12:30-12:45	45	0	45	06:30-06:45	32	0	32
12:45-01:00	1	0	1	06:45-07:00	60	0	60	12:45-01:00	28	0	28	06:45-07:00	42	0	42
01:00-01:15	3	0	3	07:00-07:15	55	0	55	01:00-01:15	47	0	47	07:00-07:15	49	0	49
01:15-01:30	1	0	1	07:15-07:30	85	0	85	01:15-01:30	52	0	52	07:15-07:30	39	0	39
01:30-01:45	1	0	1	07:30-07:45	85	0	85	01:30-01:45	39	0	39	07:30-07:45	43	0	43
01:45-02:00	0	0	0	07:45-08:00	78	0	78	01:45-02:00	35	0	35	07:45-08:00	25	0	25
02:00-02:15	1	0	1	08:00-08:15	83	0	83	02:00-02:15	53	0	53	08:00-08:15	33	0	33
02:15-02:30	0	0	0	08:15-08:30	52	0	52	02:15-02:30	58	0	58	08:15-08:30	25	0	25
02:30-02:45	4	0	4	08:30-08:45	38	0	38	02:30-02:45	68	0	68	08:30-08:45	14	0	14
02:45-03:00	2	0	2	08:45-09:00	37	0	37	02:45-03:00	72	0	72	08:45-09:00	21	0	21
03:00-03:15	0	0	0	09:00-09:15	47	0	47	03:00-03:15	57	0	57	09:00-09:15	19	0	19
03:15-03:30	2	0	2	09:15-09:30	30	0	30	03:15-03:30	64	0	64	09:15-09:30	24	0	24
03:30-03:45	1	0	1	09:30-09:45	54	0	54	03:30-03:45	89	0	89	09:30-09:45	20	0	20
03:45-04:00	1	0	1	09:45-10:00	28	0	28	03:45-04:00	87	0	87	09:45-10:00	15	0	15
04:00-04:15	1	0	1	10:00-10:15	33	0	33	04:00-04:15	67	0	67	10:00-10:15	12	0	12
04:15-04:30	3	0	3	10:15-10:30	30	0	30	04:15-04:30	78	0	78	10:15-10:30	14	0	14
04:30-04:45	9	0	9	10:30-10:45	35	0	35	04:30-04:45	77	0	77	10:30-10:45	15	0	15
04:45-05:00	7	0	7	10:45-11:00	37	0	37	04:45-05:00	61	0	61	10:45-11:00	6	0	6
05:00-05:15	5	0	5	11:00-11:15	25	0	25	05:00-05:15	73	0	73	11:00-11:15	12	0	12
05:15-05:30	11	0	11	11:15-11:30	34	0	34	05:15-05:30	58	0	58	11:15-11:30	5	0	5
05:30-05:45	15	0	15	11:30-11:45	32	0	32	05:30-05:45	43	0	43	11:30-11:45	3	0	3
05:45-06:00	22	0	22	11:45-12:00	27	0	27	05:45-06:00	56	0	56	11:45-12:00	5	0	5

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/23/2017															
12:00-12:15	4	0	4	06:00-06:15	28	0	28	12:00-12:15	43	0	43	06:00-06:15	55	0	55
12:15-12:30	5	0	5	06:15-06:30	39	0	39	12:15-12:30	32	0	32	06:15-06:30	58	0	58
12:30-12:45	4	0	4	06:30-06:45	49	0	49	12:30-12:45	43	0	43	06:30-06:45	41	0	41
12:45-01:00	4	0	4	06:45-07:00	64	0	64	12:45-01:00	40	0	40	06:45-07:00	50	0	50
01:00-01:15	0	0	0	07:00-07:15	59	0	59	01:00-01:15	29	0	29	07:00-07:15	46	0	46
01:15-01:30	0	0	0	07:15-07:30	71	0	71	01:15-01:30	36	0	36	07:15-07:30	40	0	40
01:30-01:45	1	0	1	07:30-07:45	92	0	92	01:30-01:45	43	0	43	07:30-07:45	32	0	32
01:45-02:00	1	0	1	07:45-08:00	77	0	77	01:45-02:00	14	0	14	07:45-08:00	21	0	21
02:00-02:15	1	0	1	08:00-08:15	72	0	72	02:00-02:15	19	0	19	08:00-08:15	38	0	38
02:15-02:30	1	0	1	08:15-08:30	46	0	46	02:15-02:30	24	0	24	08:15-08:30	30	0	30
02:30-02:45	0	0	0	08:30-08:45	31	0	31	02:30-02:45	35	0	35	08:30-08:45	21	0	21
02:45-03:00	3	0	3	08:45-09:00	39	0	39	02:45-03:00	17	0	17	08:45-09:00	24	0	24
03:00-03:15	2	0	2	09:00-09:15	38	0	38	03:00-03:15	19	0	19	09:00-09:15	29	0	29
03:15-03:30	1	0	1	09:15-09:30	37	0	37	03:15-03:30	22	0	22	09:15-09:30	36	0	36
03:30-03:45	2	0	2	09:30-09:45	40	0	40	03:30-03:45	37	0	37	09:30-09:45	16	0	16
03:45-04:00	2	0	2	09:45-10:00	49	0	49	03:45-04:00	38	0	38	09:45-10:00	17	0	17
04:00-04:15	3	0	3	10:00-10:15	34	0	34	04:00-04:15	41	0	41	10:00-10:15	21	0	21
04:15-04:30	3	0	3	10:15-10:30	36	0	36	04:15-04:30	62	0	62	10:15-10:30	15	0	15
04:30-04:45	7	0	7	10:30-10:45	39	0	39	04:30-04:45	91	0	91	10:30-10:45	9	0	9
04:45-05:00	8	0	8	10:45-11:00	36	0	36	04:45-05:00	80	0	80	10:45-11:00	7	0	7
05:00-05:15	6	0	6	11:00-11:15	32	0	32	05:00-05:15	72	0	72	11:00-11:15	10	0	10
05:15-05:30	10	0	10	11:15-11:30	34	0	34	05:15-05:30	50	0	50	11:15-11:30	8	0	8
05:30-05:45	18	0	18	11:30-11:45	37	0	37	05:30-05:45	51	0	51	11:30-11:45	4	0	4
05:45-06:00	22	0	22	11:45-12:00	33	0	33	05:45-06:00	49	0	49	11:45-12:00	8	0	8

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3C **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 3100
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3AA
Location: Kualakai Pkwy WB Palehua IC on ramp R-3 to H-1 Fwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/24/2017															
12:00-12:15	5	0	5	06:00-06:15	33	0	33	12:00-12:15	46	0	46	06:00-06:15	54	0	54
12:15-12:30	3	0	3	06:15-06:30	30	0	30	12:15-12:30	51	0	51	06:15-06:30	36	0	36
12:30-12:45	3	0	3	06:30-06:45	42	0	42	12:30-12:45	50	0	50	06:30-06:45	46	0	46
12:45-01:00	1	0	1	06:45-07:00	62	0	62	12:45-01:00	36	0	36	06:45-07:00	47	0	47
01:00-01:15	1	0	1	07:00-07:15	81	0	81	01:00-01:15	56	0	56	07:00-07:15	41	0	41
01:15-01:30	0	0	0	07:15-07:30	67	0	67	01:15-01:30	49	0	49	07:15-07:30	46	0	46
01:30-01:45	0	0	0	07:30-07:45	66	0	66	01:30-01:45	61	0	61	07:30-07:45	54	0	54
01:45-02:00	3	0	3	07:45-08:00	99	0	99	01:45-02:00	35	0	35	07:45-08:00	28	0	28
02:00-02:15	1	0	1	08:00-08:15	84	0	84	02:00-02:15	56	0	56	08:00-08:15	31	0	31
02:15-02:30	1	0	1	08:15-08:30	47	0	47	02:15-02:30	57	0	57	08:15-08:30	23	0	23
02:30-02:45	0	0	0	08:30-08:45	49	0	49	02:30-02:45	71	0	71	08:30-08:45	29	0	29
02:45-03:00	3	0	3	08:45-09:00	39	0	39	02:45-03:00	55	0	55	08:45-09:00	19	0	19
03:00-03:15	1	0	1	09:00-09:15	36	0	36	03:00-03:15	64	0	64	09:00-09:15	20	0	20
03:15-03:30	2	0	2	09:15-09:30	46	0	46	03:15-03:30	58	0	58	09:15-09:30	25	0	25
03:30-03:45	4	0	4	09:30-09:45	40	0	40	03:30-03:45	93	0	93	09:30-09:45	17	0	17
03:45-04:00	4	0	4	09:45-10:00	27	0	27	03:45-04:00	76	0	76	09:45-10:00	20	0	20
04:00-04:15	2	0	2	10:00-10:15	39	0	39	04:00-04:15	64	0	64	10:00-10:15	15	0	15
04:15-04:30	4	0	4	10:15-10:30	39	0	39	04:15-04:30	72	0	72	10:15-10:30	13	0	13
04:30-04:45	7	0	7	10:30-10:45	29	0	29	04:30-04:45	73	0	73	10:30-10:45	14	0	14
04:45-05:00	5	0	5	10:45-11:00	43	0	43	04:45-05:00	74	0	74	10:45-11:00	9	0	9
05:00-05:15	13	0	13	11:00-11:15	31	0	31	05:00-05:15	51	0	51	11:00-11:15	8	0	8
05:15-05:30	7	0	7	11:15-11:30	42	0	42	05:15-05:30	61	0	61	11:15-11:30	9	0	9
05:30-05:45	19	0	19	11:30-11:45	29	0	29	05:30-05:45	61	0	61	11:30-11:45	3	0	3
05:45-06:00	24	0	24	11:45-12:00	30	0	30	05:45-06:00	40	0	40	11:45-12:00	7	0	7

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/15/2017															
12:00-12:15	26	0	26	06:00-06:15	93	0	93	12:00-12:15	106	0	106	06:00-06:15	242	0	242
12:15-12:30	22	0	22	06:15-06:30	129	0	129	12:15-12:30	108	0	108	06:15-06:30	222	0	222
12:30-12:45	18	0	18	06:30-06:45	135	0	135	12:30-12:45	120	0	120	06:30-06:45	207	0	207
12:45-01:00	17	0	17	06:45-07:00	129	0	129	12:45-01:00	125	0	125	06:45-07:00	197	0	197
01:00-01:15	8	0	8	07:00-07:15	101	0	101	01:00-01:15	116	0	116	07:00-07:15	176	0	176
01:15-01:30	6	0	6	07:15-07:30	121	0	121	01:15-01:30	107	0	107	07:15-07:30	154	0	154
01:30-01:45	8	0	8	07:30-07:45	155	0	155	01:30-01:45	146	0	146	07:30-07:45	149	0	149
01:45-02:00	4	0	4	07:45-08:00	144	0	144	01:45-02:00	162	0	162	07:45-08:00	132	0	132
02:00-02:15	9	0	9	08:00-08:15	123	0	123	02:00-02:15	148	0	148	08:00-08:15	86	0	86
02:15-02:30	4	0	4	08:15-08:30	105	0	105	02:15-02:30	170	0	170	08:15-08:30	92	0	92
02:30-02:45	6	0	6	08:30-08:45	100	0	100	02:30-02:45	209	0	209	08:30-08:45	92	0	92
02:45-03:00	6	0	6	08:45-09:00	93	0	93	02:45-03:00	221	0	221	08:45-09:00	85	0	85
03:00-03:15	4	0	4	09:00-09:15	86	0	86	03:00-03:15	241	0	241	09:00-09:15	83	0	83
03:15-03:30	11	0	11	09:15-09:30	82	0	82	03:15-03:30	223	0	223	09:15-09:30	52	0	52
03:30-03:45	13	0	13	09:30-09:45	99	0	99	03:30-03:45	224	0	224	09:30-09:45	71	0	71
03:45-04:00	11	0	11	09:45-10:00	98	0	98	03:45-04:00	230	0	230	09:45-10:00	62	0	62
04:00-04:15	14	0	14	10:00-10:15	87	0	87	04:00-04:15	247	0	247	10:00-10:15	59	0	59
04:15-04:30	13	0	13	10:15-10:30	86	0	86	04:15-04:30	236	0	236	10:15-10:30	42	0	42
04:30-04:45	24	0	24	10:30-10:45	96	0	96	04:30-04:45	245	0	245	10:30-10:45	51	0	51
04:45-05:00	22	0	22	10:45-11:00	96	0	96	04:45-05:00	246	0	246	10:45-11:00	36	0	36
05:00-05:15	29	0	29	11:00-11:15	90	0	90	05:00-05:15	252	0	252	11:00-11:15	27	0	27
05:15-05:30	30	0	30	11:15-11:30	120	0	120	05:15-05:30	259	0	259	11:15-11:30	48	0	48
05:30-05:45	40	0	40	11:30-11:45	106	0	106	05:30-05:45	251	0	251	11:30-11:45	43	0	43
05:45-06:00	60	0	60	11:45-12:00	117	0	117	05:45-06:00	234	0	234	11:45-12:00	26	0	26

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/16/2017															
12:00-12:15	14	0	14	06:00-06:15	94	0	94	12:00-12:15	124	0	124	06:00-06:15	271	0	271
12:15-12:30	21	0	21	06:15-06:30	133	0	133	12:15-12:30	130	0	130	06:15-06:30	280	0	280
12:30-12:45	12	0	12	06:30-06:45	131	0	131	12:30-12:45	129	0	129	06:30-06:45	217	0	217
12:45-01:00	16	0	16	06:45-07:00	122	0	122	12:45-01:00	143	0	143	06:45-07:00	208	0	208
01:00-01:15	8	0	8	07:00-07:15	95	0	95	01:00-01:15	134	0	134	07:00-07:15	159	0	159
01:15-01:30	16	0	16	07:15-07:30	123	0	123	01:15-01:30	151	0	151	07:15-07:30	134	0	134
01:30-01:45	10	0	10	07:30-07:45	123	0	123	01:30-01:45	135	0	135	07:30-07:45	117	0	117
01:45-02:00	8	0	8	07:45-08:00	136	0	136	01:45-02:00	156	0	156	07:45-08:00	140	0	140
02:00-02:15	6	0	6	08:00-08:15	97	0	97	02:00-02:15	156	0	156	08:00-08:15	120	0	120
02:15-02:30	6	0	6	08:15-08:30	96	0	96	02:15-02:30	169	0	169	08:15-08:30	112	0	112
02:30-02:45	11	0	11	08:30-08:45	109	0	109	02:30-02:45	205	0	205	08:30-08:45	79	0	79
02:45-03:00	3	0	3	08:45-09:00	88	0	88	02:45-03:00	233	0	233	08:45-09:00	89	0	89
03:00-03:15	6	0	6	09:00-09:15	70	0	70	03:00-03:15	197	0	197	09:00-09:15	99	0	99
03:15-03:30	7	0	7	09:15-09:30	81	0	81	03:15-03:30	207	0	207	09:15-09:30	79	0	79
03:30-03:45	11	0	11	09:30-09:45	100	0	100	03:30-03:45	243	0	243	09:30-09:45	68	0	68
03:45-04:00	10	0	10	09:45-10:00	110	0	110	03:45-04:00	243	0	243	09:45-10:00	72	0	72
04:00-04:15	5	0	5	10:00-10:15	98	0	98	04:00-04:15	274	0	274	10:00-10:15	65	0	65
04:15-04:30	12	0	12	10:15-10:30	92	0	92	04:15-04:30	278	0	278	10:15-10:30	61	0	61
04:30-04:45	21	0	21	10:30-10:45	103	0	103	04:30-04:45	272	0	272	10:30-10:45	51	0	51
04:45-05:00	23	0	23	10:45-11:00	124	0	124	04:45-05:00	285	0	285	10:45-11:00	41	0	41
05:00-05:15	15	0	15	11:00-11:15	109	0	109	05:00-05:15	269	0	269	11:00-11:15	42	0	42
05:15-05:30	37	0	37	11:15-11:30	112	0	112	05:15-05:30	270	0	270	11:15-11:30	33	0	33
05:30-05:45	45	0	45	11:30-11:45	104	0	104	05:30-05:45	296	0	296	11:30-11:45	28	0	28
05:45-06:00	58	0	58	11:45-12:00	122	0	122	05:45-06:00	320	0	320	11:45-12:00	33	0	33

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/17/2017															
12:00-12:15	23	0	23	06:00-06:15	78	0	78	12:00-12:15	113	0	113	06:00-06:15	222	0	222
12:15-12:30	19	0	19	06:15-06:30	106	0	106	12:15-12:30	120	0	120	06:15-06:30	212	0	212
12:30-12:45	16	0	16	06:30-06:45	136	0	136	12:30-12:45	132	0	132	06:30-06:45	207	0	207
12:45-01:00	17	0	17	06:45-07:00	96	0	96	12:45-01:00	134	0	134	06:45-07:00	231	0	231
01:00-01:15	13	0	13	07:00-07:15	94	0	94	01:00-01:15	143	0	143	07:00-07:15	249	0	249
01:15-01:30	13	0	13	07:15-07:30	134	0	134	01:15-01:30	139	0	139	07:15-07:30	166	0	166
01:30-01:45	17	0	17	07:30-07:45	127	0	127	01:30-01:45	153	0	153	07:30-07:45	124	0	124
01:45-02:00	9	0	9	07:45-08:00	135	0	135	01:45-02:00	165	0	165	07:45-08:00	143	0	143
02:00-02:15	8	0	8	08:00-08:15	109	0	109	02:00-02:15	173	0	173	08:00-08:15	137	0	137
02:15-02:30	13	0	13	08:15-08:30	95	0	95	02:15-02:30	179	0	179	08:15-08:30	104	0	104
02:30-02:45	11	0	11	08:30-08:45	103	0	103	02:30-02:45	172	0	172	08:30-08:45	94	0	94
02:45-03:00	9	0	9	08:45-09:00	129	0	129	02:45-03:00	240	0	240	08:45-09:00	111	0	111
03:00-03:15	8	0	8	09:00-09:15	95	0	95	03:00-03:15	217	0	217	09:00-09:15	108	0	108
03:15-03:30	9	0	9	09:15-09:30	77	0	77	03:15-03:30	240	0	240	09:15-09:30	91	0	91
03:30-03:45	5	0	5	09:30-09:45	114	0	114	03:30-03:45	253	0	253	09:30-09:45	94	0	94
03:45-04:00	12	0	12	09:45-10:00	128	0	128	03:45-04:00	260	0	260	09:45-10:00	62	0	62
04:00-04:15	11	0	11	10:00-10:15	87	0	87	04:00-04:15	247	0	247	10:00-10:15	67	0	67
04:15-04:30	12	0	12	10:15-10:30	108	0	108	04:15-04:30	291	0	291	10:15-10:30	72	0	72
04:30-04:45	20	0	20	10:30-10:45	80	0	80	04:30-04:45	271	0	271	10:30-10:45	61	0	61
04:45-05:00	18	0	18	10:45-11:00	119	0	119	04:45-05:00	267	0	267	10:45-11:00	51	0	51
05:00-05:15	17	0	17	11:00-11:15	95	0	95	05:00-05:15	260	0	260	11:00-11:15	51	0	51
05:15-05:30	30	0	30	11:15-11:30	94	0	94	05:15-05:30	251	0	251	11:15-11:30	41	0	41
05:30-05:45	47	0	47	11:30-11:45	123	0	123	05:30-05:45	226	0	226	11:30-11:45	38	0	38
05:45-06:00	79	0	79	11:45-12:00	94	0	94	05:45-06:00	192	0	192	11:45-12:00	24	0	24

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/22/2017															
12:00-12:15	16	0	16	06:00-06:15	75	0	75	12:00-12:15	127	0	127	06:00-06:15	227	0	227
12:15-12:30	13	0	13	06:15-06:30	113	0	113	12:15-12:30	140	0	140	06:15-06:30	217	0	217
12:30-12:45	17	0	17	06:30-06:45	120	0	120	12:30-12:45	131	0	131	06:30-06:45	207	0	207
12:45-01:00	15	0	15	06:45-07:00	109	0	109	12:45-01:00	137	0	137	06:45-07:00	217	0	217
01:00-01:15	12	0	12	07:00-07:15	104	0	104	01:00-01:15	90	0	90	07:00-07:15	205	0	205
01:15-01:30	7	0	7	07:15-07:30	149	0	149	01:15-01:30	135	0	135	07:15-07:30	162	0	162
01:30-01:45	7	0	7	07:30-07:45	179	0	179	01:30-01:45	147	0	147	07:30-07:45	151	0	151
01:45-02:00	7	0	7	07:45-08:00	145	0	145	01:45-02:00	157	0	157	07:45-08:00	139	0	139
02:00-02:15	5	0	5	08:00-08:15	140	0	140	02:00-02:15	141	0	141	08:00-08:15	84	0	84
02:15-02:30	4	0	4	08:15-08:30	108	0	108	02:15-02:30	181	0	181	08:15-08:30	100	0	100
02:30-02:45	10	0	10	08:30-08:45	101	0	101	02:30-02:45	190	0	190	08:30-08:45	88	0	88
02:45-03:00	8	0	8	08:45-09:00	112	0	112	02:45-03:00	220	0	220	08:45-09:00	86	0	86
03:00-03:15	4	0	4	09:00-09:15	122	0	122	03:00-03:15	202	0	202	09:00-09:15	74	0	74
03:15-03:30	5	0	5	09:15-09:30	125	0	125	03:15-03:30	235	0	235	09:15-09:30	87	0	87
03:30-03:45	7	0	7	09:30-09:45	88	0	88	03:30-03:45	233	0	233	09:30-09:45	68	0	68
03:45-04:00	14	0	14	09:45-10:00	92	0	92	03:45-04:00	238	0	238	09:45-10:00	48	0	48
04:00-04:15	13	0	13	10:00-10:15	90	0	90	04:00-04:15	228	0	228	10:00-10:15	67	0	67
04:15-04:30	20	0	20	10:15-10:30	127	0	127	04:15-04:30	233	0	233	10:15-10:30	56	0	56
04:30-04:45	19	0	19	10:30-10:45	133	0	133	04:30-04:45	231	0	231	10:30-10:45	42	0	42
04:45-05:00	21	0	21	10:45-11:00	105	0	105	04:45-05:00	248	0	248	10:45-11:00	39	0	39
05:00-05:15	17	0	17	11:00-11:15	100	0	100	05:00-05:15	235	0	235	11:00-11:15	35	0	35
05:15-05:30	24	0	24	11:15-11:30	106	0	106	05:15-05:30	251	0	251	11:15-11:30	30	0	30
05:30-05:45	33	0	33	11:30-11:45	133	0	133	05:30-05:45	267	0	267	11:30-11:45	29	0	29
05:45-06:00	62	0	62	11:45-12:00	123	0	123	05:45-06:00	259	0	259	11:45-12:00	34	0	34

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		
DIRECTIONAL PEAK			DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)			PM PERIOD (12:00-24:00)		
TWO DIRECTIONAL PEAK			TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME			PM - PEAK HR TIME		
AM - PEAK HR VOLUME			PM - PEAK HR VOLUME		
AM - K FACTOR (%)			PM - K FACTOR (%)		-
AM - D (%)			PM - D (%)		

NON-COMMUTER PERIOD (09:00-15:00)	6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
TWO DIRECTIONAL PEAK	AM 6-HR PERIOD (06:00-12:00)			
PEAK HR TIME	AM 12-HR PERIOD (00:00-12:00)			
PEAK HR VOLUME	PM 6-HR PERIOD (12:00-18:00)			
DIRECTIONAL PEAK	PM 12-HR PERIOD (12:00-24:00)			
PEAK HR TIME	24 HOUR PERIOD			
PEAK HR VOLUME	D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/23/2017															
12:00-12:15	26	0	26	06:00-06:15	84	0	84	12:00-12:15	121	0	121	06:00-06:15	233	0	233
12:15-12:30	20	0	20	06:15-06:30	108	0	108	12:15-12:30	151	0	151	06:15-06:30	216	0	216
12:30-12:45	15	0	15	06:30-06:45	130	0	130	12:30-12:45	116	0	116	06:30-06:45	240	0	240
12:45-01:00	14	0	14	06:45-07:00	123	0	123	12:45-01:00	131	0	131	06:45-07:00	208	0	208
01:00-01:15	14	0	14	07:00-07:15	115	0	115	01:00-01:15	117	0	117	07:00-07:15	184	0	184
01:15-01:30	7	0	7	07:15-07:30	148	0	148	01:15-01:30	147	0	147	07:15-07:30	139	0	139
01:30-01:45	12	0	12	07:30-07:45	184	0	184	01:30-01:45	229	0	229	07:30-07:45	154	0	154
01:45-02:00	7	0	7	07:45-08:00	152	0	152	01:45-02:00	453	0	453	07:45-08:00	128	0	128
02:00-02:15	6	0	6	08:00-08:15	117	0	117	02:00-02:15	502	0	502	08:00-08:15	92	0	92
02:15-02:30	6	0	6	08:15-08:30	100	0	100	02:15-02:30	483	0	483	08:15-08:30	115	0	115
02:30-02:45	12	0	12	08:30-08:45	80	0	80	02:30-02:45	459	0	459	08:30-08:45	113	0	113
02:45-03:00	10	0	10	08:45-09:00	95	0	95	02:45-03:00	401	0	401	08:45-09:00	100	0	100
03:00-03:15	7	0	7	09:00-09:15	120	0	120	03:00-03:15	366	0	366	09:00-09:15	82	0	82
03:15-03:30	5	0	5	09:15-09:30	114	0	114	03:15-03:30	427	0	427	09:15-09:30	73	0	73
03:30-03:45	6	0	6	09:30-09:45	104	0	104	03:30-03:45	390	0	390	09:30-09:45	79	0	79
03:45-04:00	8	0	8	09:45-10:00	105	0	105	03:45-04:00	394	0	394	09:45-10:00	64	0	64
04:00-04:15	11	0	11	10:00-10:15	101	0	101	04:00-04:15	369	0	369	10:00-10:15	52	0	52
04:15-04:30	12	0	12	10:15-10:30	111	0	111	04:15-04:30	306	0	306	10:15-10:30	67	0	67
04:30-04:45	16	0	16	10:30-10:45	105	0	105	04:30-04:45	291	0	291	10:30-10:45	43	0	43
04:45-05:00	13	0	13	10:45-11:00	114	0	114	04:45-05:00	287	0	287	10:45-11:00	43	0	43
05:00-05:15	20	0	20	11:00-11:15	103	0	103	05:00-05:15	273	0	273	11:00-11:15	37	0	37
05:15-05:30	32	0	32	11:15-11:30	88	0	88	05:15-05:30	269	0	269	11:15-11:30	33	0	33
05:30-05:45	40	0	40	11:30-11:45	103	0	103	05:30-05:45	265	0	265	11:30-11:45	35	0	35
05:45-06:00	71	0	71	11:45-12:00	126	0	126	05:45-06:00	279	0	279	11:45-12:00	25	0	25

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

Run Date: 2018/08/27

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2017 Program Count - Summary

Site ID: B720000H1-3D **Town:** Oahu **DIR 1:** +MP **DIR 2:** None **Final AADT:** 10200
Functional Class: OTHER **Count Type:** CLASS **Counter Type:** Tube **Route No:** H-1_WB_3
Location: H-1 Fwy WB Palehua IC off ramp R-4 to Kualakai Pkwy WB

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 08/24/2017															
12:00-12:15	25	0	25	06:00-06:15	73	0	73	12:00-12:15	136	0	136	06:00-06:15	212	0	212
12:15-12:30	19	0	19	06:15-06:30	101	0	101	12:15-12:30	142	0	142	06:15-06:30	225	0	225
12:30-12:45	13	0	13	06:30-06:45	139	0	139	12:30-12:45	114	0	114	06:30-06:45	225	0	225
12:45-01:00	7	0	7	06:45-07:00	119	0	119	12:45-01:00	146	0	146	06:45-07:00	197	0	197
01:00-01:15	13	0	13	07:00-07:15	97	0	97	01:00-01:15	125	0	125	07:00-07:15	206	0	206
01:15-01:30	12	0	12	07:15-07:30	117	0	117	01:15-01:30	135	0	135	07:15-07:30	155	0	155
01:30-01:45	12	0	12	07:30-07:45	200	0	200	01:30-01:45	148	0	148	07:30-07:45	144	0	144
01:45-02:00	14	0	14	07:45-08:00	155	0	155	01:45-02:00	142	0	142	07:45-08:00	116	0	116
02:00-02:15	7	0	7	08:00-08:15	124	0	124	02:00-02:15	166	0	166	08:00-08:15	107	0	107
02:15-02:30	4	0	4	08:15-08:30	104	0	104	02:15-02:30	178	0	178	08:15-08:30	87	0	87
02:30-02:45	7	0	7	08:30-08:45	103	0	103	02:30-02:45	218	0	218	08:30-08:45	122	0	122
02:45-03:00	10	0	10	08:45-09:00	112	0	112	02:45-03:00	226	0	226	08:45-09:00	84	0	84
03:00-03:15	4	0	4	09:00-09:15	132	0	132	03:00-03:15	233	0	233	09:00-09:15	94	0	94
03:15-03:30	9	0	9	09:15-09:30	135	0	135	03:15-03:30	218	0	218	09:15-09:30	91	0	91
03:30-03:45	7	0	7	09:30-09:45	100	0	100	03:30-03:45	233	0	233	09:30-09:45	71	0	71
03:45-04:00	8	0	8	09:45-10:00	94	0	94	03:45-04:00	227	0	227	09:45-10:00	70	0	70
04:00-04:15	11	0	11	10:00-10:15	89	0	89	04:00-04:15	223	0	223	10:00-10:15	68	0	68
04:15-04:30	17	0	17	10:15-10:30	118	0	118	04:15-04:30	221	0	221	10:15-10:30	53	0	53
04:30-04:45	12	0	12	10:30-10:45	121	0	121	04:30-04:45	245	0	245	10:30-10:45	54	0	54
04:45-05:00	13	0	13	10:45-11:00	127	0	127	04:45-05:00	242	0	242	10:45-11:00	38	0	38
05:00-05:15	22	0	22	11:00-11:15	92	0	92	05:00-05:15	246	0	246	11:00-11:15	25	0	25
05:15-05:30	32	0	32	11:15-11:30	112	0	112	05:15-05:30	230	0	230	11:15-11:30	33	0	33
05:30-05:45	49	0	49	11:30-11:45	102	0	102	05:30-05:45	250	0	250	11:30-11:45	27	0	27
05:45-06:00	78	0	78	11:45-12:00	119	0	119	05:45-06:00	257	0	257	11:45-12:00	32	0	32

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		
AM - K FACTOR (%)		
AM - D (%)		
DIRECTIONAL PEAK		
AM - PEAK HR TIME		
AM - PEAK HR VOLUME		

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2
TWO DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		
PM - K FACTOR (%)		-
PM - D (%)		
DIRECTIONAL PEAK		
PM - PEAK HR TIME		
PM - PEAK HR VOLUME		

AM PERIOD (00:00-12:00)	
TWO DIRECTIONAL PEAK	
AM - PEAK HR TIME	
AM - PEAK HR VOLUME	
AM - K FACTOR (%)	
AM - D (%)	

PM PERIOD (12:00-24:00)	
TWO DIRECTIONAL PEAK	
PM - PEAK HR TIME	
PM - PEAK HR VOLUME	
PM - K FACTOR (%)	-
PM - D (%)	

NON-COMMUTER PERIOD (09:00-15:00)
TWO DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME
DIRECTIONAL PEAK
PEAK HR TIME
PEAK HR VOLUME

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)			
AM 12-HR PERIOD (00:00-12:00)			
PM 6-HR PERIOD (12:00-18:00)			
PM 12-HR PERIOD (12:00-24:00)			
24 HOUR PERIOD			
D (%)			

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	16	2	0	1	0	0	0	0	0	0	0	0	0	20
1:00 AM	0	7	2	2	1	0	0	0	0	0	0	0	0	0	12
2:00 AM	0	8	5	1	1	0	0	0	0	0	0	0	0	0	15
3:00 AM	0	17	5	1	0	0	0	0	0	0	0	0	0	0	23
4:00 AM	0	90	34	1	9	0	0	0	0	0	0	0	0	0	134
5:00 AM	1	270	111	3	**36**	0	0	0	0	0	0	0	0	3	424
6:00 AM	3	**308**	**145**	3	21	**2**	0	0	0	0	0	0	0	9	**491**
7:00 AM	**4**	256	97	**4**	20	1	0	0	0	0	0	0	0	**10**	392
8:00 AM	2	229	82	3	26	1	0	0	**1**	0	0	0	0	5	349
9:00 AM	1	185	60	1	15	0	0	0	0	0	0	0	0	1	263
10:00 AM	2	161	63	2	16	0	0	**1**	0	0	0	0	0	3	248
11:00 AM	2	171	53	3	8	1	0	0	0	0	0	0	0	3	241
12:00 PM	**6**	142	62	3	14	1	0	0	0	0	0	0	0	5	233
1:00 PM	1	149	60	2	18	1	0	0	0	0	0	0	0	5	236
2:00 PM	3	198	67	2	15	1	0	**1**	0	0	0	0	0	7	294
3:00 PM	1	231	**112**	4	19	1	0	0	0	0	0	0	0	6	374
4:00 PM	2	**255**	97	3	**23**	1	0	1	0	0	0	0	0	**13**	**395**
5:00 PM	4	252	86	**5**	16	**3**	0	1	0	0	0	0	0	8	375
6:00 PM	0	190	68	1	11	1	0	0	0	0	0	0	0	10	281
7:00 PM	2	161	50	1	12	0	0	0	0	0	0	0	0	2	228
8:00 PM	0	90	47	3	8	0	0	0	0	0	0	0	0	3	151
9:00 PM	0	82	25	2	5	0	0	0	0	0	0	0	0	3	117
10:00 PM	0	38	17	1	3	0	0	0	0	0	0	0	0	2	61
11:00 PM	0	21	9	2	2	0	0	0	0	0	0	0	0	0	34
Day Total	35	3527	1359	53	300	14	0	4	1	0	0	0	0	98	5391
Percent	0.6%	65.4%	25.2%	1.0%	5.6%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	
ADT 5391															
AM Peak	7:00 AM	6:00 AM	6:00 AM	7:00 AM	5:00 AM	6:00 AM		10:00 AM	8:00 AM					7:00 AM	6:00 AM
Volume	4	308	145	4	36	2		1	1					10	491
PM Peak	12:00 PM	4:00 PM	3:00 PM	5:00 PM	4:00 PM	5:00 PM		2:00 PM						4:00 PM	4:00 PM
Volume	6	255	112	5	23	3		1						13	395

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	11	6	0	0	0	0	0	0	0	0	0	0	0	18
1:00 AM	0	9	3	2	0	0	0	0	0	0	0	0	0	0	14
2:00 AM	0	11	1	1	1	0	0	0	0	0	0	0	0	0	14
3:00 AM	0	20	12	1	0	0	0	0	0	0	0	0	0	0	33
4:00 AM	1	90	32	1	6	1	0	0	0	0	0	0	0	0	131
5:00 AM	1	264	**140**	3	25	0	0	**1**	0	0	0	0	0	3	437
6:00 AM	0	**316**	122	4	20	0	0	1	0	0	0	0	0	5	**468**
7:00 AM	3	259	89	1	15	0	0	1	0	0	0	0	0	5	373
8:00 AM	2	217	76	4	**26**	**2**	0	1	**2**	0	0	0	0	**8**	338
9:00 AM	**4**	182	77	**5**	19	1	0	1	0	0	0	0	0	3	292
10:00 AM	3	177	61	2	13	1	0	0	0	**2**	0	0	0	3	262
11:00 AM	0	184	62	4	14	0	0	0	0	1	0	0	0	4	269
12:00 PM	2	174	59	**3**	13	2	0	1	0	0	0	0	0	3	257
1:00 PM	2	174	75	2	25	**4**	**2**	1	0	0	0	0	0	5	290
2:00 PM	2	213	88	3	18	0	0	0	0	0	0	0	0	7	331
3:00 PM	**5**	201	**91**	3	**36**	2	0	0	0	0	0	0	0	10	348
4:00 PM	3	**240**	83	3	19	1	0	**2**	0	0	0	0	0	9	**360**
5:00 PM	2	197	63	2	14	1	0	0	0	0	0	0	0	**15**	294
6:00 PM	0	183	49	2	7	0	0	0	0	0	0	0	0	2	243
7:00 PM	0	98	41	1	8	1	0	0	0	0	0	0	0	4	153
8:00 PM	1	89	27	3	12	0	0	0	0	0	0	0	0	3	135
9:00 PM	0	73	19	2	4	0	0	0	0	0	0	0	0	1	99
10:00 PM	1	43	12	2	3	0	0	0	0	0	0	0	0	2	63
11:00 PM	0	14	4	1	1	0	0	0	0	0	0	0	0	1	21
Day Total	33	3439	1292	55	299	16	2	9	2	3	0	0	0	93	5243
Percent	0.6%	65.6%	24.6%	1.0%	5.7%	0.3%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	1.8%	
ADT 5243															
AM Peak Volume	9:00 AM 4	6:00 AM 316	5:00 AM 140	9:00 AM 5	8:00 AM 26	8:00 AM 2		5:00 AM 1	8:00 AM 2	10:00 AM 2				8:00 AM 8	6:00 AM 468
PM Peak Volume	3:00 PM 5	4:00 PM 240	3:00 PM 91	12:00 PM 3	3:00 PM 36	1:00 PM 4	1:00 PM 2	4:00 PM 2						5:00 PM 15	4:00 PM 360

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	14	5	1	0	0	0	0	0	0	0	0	0	1	21
1:00 AM	0	10	4	1	0	0	0	0	0	0	0	0	0	0	15
2:00 AM	0	15	3	1	0	0	0	0	0	0	0	0	0	0	19
3:00 AM	0	26	13	2	0	0	0	0	0	0	0	0	0	0	41
4:00 AM	1	84	41	1	8	0	0	0	0	0	0	0	0	0	135
5:00 AM	1	265	119	**3**	**30**	0	0	0	0	0	0	0	0	3	421
6:00 AM	0	**292**	**135**	3	21	1	0	0	0	0	0	0	0	5	**457**
7:00 AM	**5**	249	75	0	27	**2**	0	0	**1**	0	0	0	0	**7**	366
8:00 AM	3	191	84	2	12	0	0	0	0	0	0	0	0	7	299
9:00 AM	2	207	82	3	17	0	0	0	0	0	0	0	0	3	314
10:00 AM	2	160	63	3	12	0	0	0	0	0	0	0	0	3	243
11:00 AM	2	155	72	2	21	1	0	**1**	0	0	0	0	0	4	258
12:00 PM	1	132	58	**5**	11	0	0	0	0	0	0	0	0	1	208
1:00 PM	1	160	73	2	20	1	0	0	0	0	0	0	0	3	260
2:00 PM	4	198	76	2	13	0	**1**	0	0	0	0	0	0	6	300
3:00 PM	4	219	**100**	5	22	0	0	0	0	0	0	0	0	**11**	**361**
4:00 PM	3	**225**	84	2	**25**	1	0	0	0	0	0	0	0	11	351
5:00 PM	**7**	224	66	3	16	1	0	0	0	0	0	0	0	11	328
6:00 PM	2	177	62	1	13	0	0	0	0	0	0	0	0	7	262
7:00 PM	1	112	25	2	11	0	0	0	0	0	0	0	0	8	159
8:00 PM	1	96	45	2	6	**2**	0	0	0	0	0	0	0	5	157
9:00 PM	0	83	27	1	8	0	0	0	0	0	0	0	0	2	121
10:00 PM	1	51	21	1	3	0	0	0	0	0	0	0	0	1	78
11:00 PM	0	32	10	2	0	0	0	0	0	0	0	0	0	0	44
Day Total	41	3377	1343	50	296	9	1	1	1	0	0	0	0	99	5218
Percent	0.8%	64.7%	25.7%	1.0%	5.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	
ADT 5218															
AM Peak Volume	7:00 AM 5	6:00 AM 292	6:00 AM 135	5:00 AM 3	5:00 AM 30	7:00 AM 2		11:00 AM 1	7:00 AM 1					7:00 AM 7	6:00 AM 457
PM Peak Volume	5:00 PM 7	4:00 PM 225	3:00 PM 100	12:00 PM 5	4:00 PM 25	8:00 PM 2	2:00 PM 1							3:00 PM 11	3:00 PM 361

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	18	8	1	2	0	0	0	0	0	0	0	0	0	29
1:00 AM	0	5	8	1	0	0	0	0	0	0	0	0	0	0	14
2:00 AM	2	11	3	1	1	0	0	0	0	0	0	0	0	0	18
3:00 AM	0	19	8	1	0	0	0	0	0	0	0	0	0	0	28
4:00 AM	0	75	27	2	8	0	0	0	0	0	0	0	0	0	112
5:00 AM	0	242	**113**	4	**27**	0	0	0	0	0	0	0	0	0	386
6:00 AM	2	**305**	109	3	25	0	0	**1**	0	0	0	0	0	6	**451**
7:00 AM	**4**	263	97	4	10	**2**	0	0	0	0	0	0	0	**10**	390
8:00 AM	2	202	82	3	21	0	0	0	0	0	0	0	0	4	314
9:00 AM	3	202	73	**6**	11	1	0	0	0	0	0	0	0	5	301
10:00 AM	1	187	71	2	19	1	0	0	0	0	0	0	0	5	286
11:00 AM	0	178	57	3	12	0	0	1	0	0	0	0	0	4	255
12:00 PM	1	175	67	2	**22**	1	0	0	0	0	0	0	0	6	274
1:00 PM	1	162	84	2	7	**4**	0	1	0	0	0	0	0	4	265
2:00 PM	4	196	69	2	15	1	0	**2**	0	0	0	0	0	12	301
3:00 PM	**5**	203	**98**	**4**	22	2	**1**	0	0	0	0	0	0	**13**	348
4:00 PM	4	**252**	82	3	19	1	0	0	0	0	0	0	0	2	**363**
5:00 PM	3	220	77	4	15	0	0	2	0	0	0	0	0	5	326
6:00 PM	1	195	74	2	18	1	0	0	0	0	0	0	0	6	297
7:00 PM	0	136	45	2	12	0	0	0	0	0	0	0	0	4	199
8:00 PM	0	106	34	2	9	0	0	0	0	0	0	0	0	0	151
9:00 PM	1	82	29	2	4	0	0	0	0	0	0	0	0	5	123
10:00 PM	1	65	24	2	5	0	0	0	0	0	0	0	0	1	98
11:00 PM	0	42	16	1	2	0	0	0	0	0	0	0	0	0	61
Day Total	35	3541	1355	59	286	14	1	7	0	0	0	0	0	92	5390
Percent	0.6%	65.7%	25.1%	1.1%	5.3%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	

ADT 5390

AM Peak Volume	7:00 AM 4	6:00 AM 305	5:00 AM 113	9:00 AM 6	5:00 AM 27	7:00 AM 2		6:00 AM 1						7:00 AM 10	6:00 AM 451
PM Peak Volume	3:00 PM 5	4:00 PM 252	3:00 PM 98	3:00 PM 4	12:00 PM 22	1:00 PM 4	3:00 PM 1	2:00 PM 2						3:00 PM 13	4:00 PM 363

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 12 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	21	9	1	1	0	0	0	0	0	0	0	0	0	33
1:00 AM	0	15	3	0	1	0	0	0	0	0	0	0	0	0	19
2:00 AM	0	12	4	1	0	0	0	0	0	0	0	0	0	0	17
3:00 AM	0	12	5	1	2	0	0	0	0	0	0	0	0	0	20
4:00 AM	1	25	6	1	2	0	0	0	0	0	0	0	0	0	35
5:00 AM	1	53	30	2	4	0	0	0	0	0	0	0	0	0	90
6:00 AM	0	89	46	2	8	0	0	**1**	0	0	0	0	0	0	146
7:00 AM	**4**	137	50	**3**	**19**	0	0	0	0	0	0	0	0	0	213
8:00 AM	0	201	69	2	9	0	0	0	0	0	0	0	0	**8**	289
9:00 AM	2	189	74	2	14	0	0	1	0	0	0	0	0	5	287
10:00 AM	1	**216**	80	2	13	0	0	0	0	0	0	0	0	8	**320**
11:00 AM	2	181	**84**	3	14	0	0	0	0	0	0	0	0	3	287
12:00 PM	0	**204**	**73**	1	20	0	0	**1**	0	0	0	0	0	**9**	**308**
1:00 PM	5	186	61	2	**21**	**1**	0	0	0	0	0	0	0	7	283
2:00 PM	**6**	179	61	**3**	8	0	0	0	0	0	0	0	0	9	266
3:00 PM	3	175	66	3	10	0	0	0	0	0	0	0	0	3	260
4:00 PM	1	191	70	2	9	0	0	0	0	0	0	0	0	6	279
5:00 PM	1	197	67	1	15	0	0	0	0	0	0	0	0	2	283
6:00 PM	6	173	68	3	8	1	0	0	0	0	0	0	0	6	265
7:00 PM	4	139	43	2	10	1	0	0	0	0	0	0	0	2	201
8:00 PM	4	102	35	1	7	0	0	0	0	0	0	0	0	4	153
9:00 PM	0	101	45	3	6	0	0	0	0	0	0	0	0	0	155
10:00 PM	0	98	17	0	8	0	0	0	0	0	0	0	0	6	129
11:00 PM	0	39	13	1	1	0	0	0	0	0	0	0	0	1	55
Day Total	42	2935	1079	42	210	3	0	3	0	0	0	0	0	79	4393
Percent	1.0%	66.8%	24.6%	1.0%	4.8%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	
ADT 4393															
AM Peak	7:00 AM	10:00 AM	11:00 AM	7:00 AM	7:00 AM			6:00 AM						8:00 AM	10:00 AM
Volume	4	216	84	3	19			1						8	320
PM Peak	2:00 PM	12:00 PM	12:00 PM	2:00 PM	1:00 PM	1:00 PM		12:00 PM						12:00 PM	12:00 PM
Volume	6	204	73	3	21	1		1						9	308

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 13 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	27	12	1	2	0	0	0	0	0	0	0	0	0	42
1:00 AM	1	16	4	1	0	0	0	0	0	0	0	0	0	0	22
2:00 AM	0	17	5	1	0	0	0	0	0	0	0	0	0	0	23
3:00 AM	0	12	4	1	0	0	0	0	0	0	0	0	0	0	17
4:00 AM	1	20	10	2	2	0	0	0	0	0	0	0	0	1	36
5:00 AM	0	36	18	2	3	0	0	0	0	0	0	0	0	0	59
6:00 AM	2	60	24	2	1	0	0	0	0	0	0	0	0	1	90
7:00 AM	1	105	44	**3**	10	0	0	0	0	0	0	0	0	**4**	167
8:00 AM	0	153	64	2	**18**	0	0	0	0	0	0	0	0	0	237
9:00 AM	**4**	157	**75**	2	13	0	0	0	0	0	0	0	0	2	253
10:00 AM	1	181	64	2	9	0	0	**1**	0	0	0	0	0	3	261
11:00 AM	0	**190**	70	2	15	0	0	0	0	0	0	0	0	1	**278**
12:00 PM	**6**	**190**	68	2	**13**	0	0	0	0	0	0	0	0	6	**285**
1:00 PM	1	156	53	2	9	0	0	0	0	0	0	0	0	3	224
2:00 PM	6	157	54	1	9	0	0	0	0	0	0	0	0	**7**	234
3:00 PM	0	158	54	**3**	4	0	0	0	0	0	0	0	0	3	222
4:00 PM	1	163	58	1	9	0	0	0	0	0	0	0	0	1	233
5:00 PM	1	166	**73**	2	8	0	0	0	0	0	0	0	0	6	256
6:00 PM	0	153	57	2	6	**1**	0	0	0	0	0	0	0	0	219
7:00 PM	2	110	36	1	6	0	0	0	0	0	0	0	0	2	157
8:00 PM	0	104	35	3	5	0	0	0	0	0	0	0	0	2	149
9:00 PM	0	87	22	1	2	0	0	0	0	0	0	0	0	2	114
10:00 PM	0	43	11	0	4	0	0	0	0	0	0	0	0	1	59
11:00 PM	0	42	5	1	1	0	0	0	0	0	0	0	0	1	50
Day Total	27	2503	920	40	149	1	0	1	0	0	0	0	0	46	3687
Percent	0.7%	67.9%	25.0%	1.1%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	

ADT 3687

AM Peak	9:00 AM	11:00 AM	9:00 AM	7:00 AM	8:00 AM			10:00 AM						7:00 AM	11:00 AM
Volume	4	190	75	3	18			1						4	278
PM Peak	12:00 PM	12:00 PM	5:00 PM	3:00 PM	12:00 PM	6:00 PM								2:00 PM	12:00 PM
Volume	6	190	73	3	13	1								7	285

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	16	4	2	2	0	0	0	0	0	0	0	0	0	24
1:00 AM	2	5	0	2	1	0	0	0	0	0	0	0	0	0	10
2:00 AM	0	9	2	1	0	0	0	0	0	0	0	0	0	0	12
3:00 AM	0	18	12	1	1	0	0	0	0	0	0	0	0	0	32
4:00 AM	1	85	31	3	10	0	0	0	0	0	0	0	0	0	130
5:00 AM	0	258	111	3	**30**	0	0	0	0	0	0	0	0	3	405
6:00 AM	0	**330**	**125**	**4**	14	0	0	**2**	0	0	0	0	0	8	**483**
7:00 AM	1	273	83	2	18	1	0	0	0	0	0	0	0	**15**	393
8:00 AM	**3**	211	105	3	27	1	0	1	0	0	0	0	0	8	359
9:00 AM	1	171	76	3	21	**3**	0	2	0	0	0	0	0	3	280
10:00 AM	0	183	57	2	22	0	0	1	0	0	0	0	0	4	269
11:00 AM	1	162	58	2	21	2	0	1	0	0	0	0	0	1	248
12:00 PM	1	152	55	4	12	0	0	**2**	0	**1**	0	0	0	4	231
1:00 PM	0	131	66	4	13	0	0	1	0	0	0	0	0	7	222
2:00 PM	**6**	213	81	2	21	1	0	0	**1**	0	0	0	0	8	333
3:00 PM	2	220	**86**	3	**23**	**2**	0	2	0	0	0	0	0	**21**	**359**
4:00 PM	2	**254**	68	1	18	2	0	0	0	0	0	0	0	9	354
5:00 PM	2	193	60	**5**	14	0	0	1	0	0	0	0	0	5	280
6:00 PM	3	160	53	2	12	0	0	0	0	0	0	0	0	5	235
7:00 PM	0	132	38	2	5	0	0	0	0	0	0	0	0	2	179
8:00 PM	0	72	29	3	4	0	0	0	0	0	0	0	0	1	109
9:00 PM	2	74	25	2	3	0	0	0	0	0	0	0	0	3	109
10:00 PM	0	38	13	1	1	0	0	0	0	0	0	0	0	0	53
11:00 PM	0	27	6	2	0	0	0	0	0	0	0	0	0	0	35
Day Total	27	3387	1244	59	293	12	0	13	1	1	0	0	0	107	5144
Percent	0.5%	65.8%	24.2%	1.1%	5.7%	0.2%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	
ADT 5144															
AM Peak Volume	8:00 AM 3	6:00 AM 330	6:00 AM 125	6:00 AM 4	5:00 AM 30	9:00 AM 3		6:00 AM 2						7:00 AM 15	6:00 AM 483
PM Peak Volume	2:00 PM 6	4:00 PM 254	3:00 PM 86	5:00 PM 5	3:00 PM 23	3:00 PM 2		12:00 PM 2	2:00 PM 1	12:00 PM 1				3:00 PM 21	3:00 PM 359

Comments:

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: EB
DATE: May 08 2018 - May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	240	22709	8592	358	1833	69	4	38	5	4	0	0	0	614	34466
Percent	0.7%	65.9%	24.9%	1.0%	5.3%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	

ADT 4923

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	41	5	2	2	0	0	0	0	0	0	0	0	0	50
1:00 AM	0	13	2	1	1	0	0	0	0	0	0	0	0	0	17
2:00 AM	0	10	4	1	0	0	0	0	0	0	0	0	0	0	15
3:00 AM	0	12	4	2	0	0	0	0	0	0	0	0	0	0	18
4:00 AM	1	20	13	0	1	0	0	0	0	0	0	0	0	1	36
5:00 AM	1	50	29	2	5	0	0	0	0	0	0	0	0	7	94
6:00 AM	**4**	92	68	**4**	6	0	0	0	0	0	0	0	0	13	187
7:00 AM	2	**210**	**77**	3	8	**2**	0	**1**	0	0	0	0	0	**24**	**327**
8:00 AM	2	166	62	1	9	0	**1**	0	0	0	0	0	0	23	264
9:00 AM	2	174	60	3	8	1	0	1	0	0	0	0	0	8	257
10:00 AM	2	205	64	3	**17**	1	0	0	0	0	0	0	0	12	304
11:00 AM	4	197	73	2	12	1	0	1	**1**	0	0	0	0	10	301
12:00 PM	2	243	58	2	20	**1**	0	0	0	0	0	0	0	9	335
1:00 PM	**5**	249	89	3	5	1	0	0	0	0	0	0	0	11	363
2:00 PM	1	288	87	4	**23**	1	0	**1**	0	0	0	0	0	6	411
3:00 PM	3	318	134	**5**	12	0	0	0	0	0	0	0	0	29	501
4:00 PM	4	**352**	**152**	2	23	0	0	0	0	0	0	0	0	**31**	**564**
5:00 PM	0	341	114	3	17	0	0	0	0	0	0	0	0	24	499
6:00 PM	2	289	112	1	14	0	0	0	0	0	0	0	0	14	432
7:00 PM	3	203	68	4	11	0	0	0	0	0	0	0	0	6	295
8:00 PM	1	167	51	2	4	0	0	0	0	0	0	0	0	7	232
9:00 PM	1	156	39	2	1	0	0	0	0	0	0	0	0	3	202
10:00 PM	2	100	32	1	5	0	0	0	0	0	0	0	0	1	141
11:00 PM	0	44	16	1	1	0	0	0	0	0	0	0	0	0	62
Day Total	42	3940	1413	54	205	8	1	4	1	0	0	0	0	239	5907
Percent	0.7%	66.7%	23.9%	0.9%	3.5%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	
ADT 5907															
AM Peak	6:00 AM	7:00 AM	7:00 AM	6:00 AM	10:00 AM	7:00 AM	8:00 AM	7:00 AM	11:00 AM					7:00 AM	7:00 AM
Volume	4	210	77	4	17	2	1	1	1					24	327
PM Peak	1:00 PM	4:00 PM	4:00 PM	3:00 PM	2:00 PM	12:00 PM		2:00 PM						4:00 PM	4:00 PM
Volume	5	352	152	5	23	1		1						31	564

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	25	7	2	2	0	0	0	0	0	0	0	0	1	37
1:00 AM	0	16	5	1	1	0	0	0	0	0	0	0	0	0	23
2:00 AM	0	16	6	1	2	0	0	0	0	0	0	0	0	0	25
3:00 AM	1	11	7	2	0	0	0	0	0	0	0	0	0	0	21
4:00 AM	0	18	15	1	2	0	0	0	0	0	0	0	0	1	37
5:00 AM	1	48	26	3	4	0	0	0	0	0	0	0	0	5	87
6:00 AM	1	115	65	4	6	0	0	0	0	0	0	0	0	14	205
7:00 AM	**2**	**198**	68	**5**	13	0	0	0	0	0	0	0	0	17	**303**
8:00 AM	1	164	61	3	9	**1**	0	**1**	**1**	0	0	0	0	**18**	259
9:00 AM	1	153	58	2	**15**	0	0	0	1	0	0	0	0	10	240
10:00 AM	1	139	**71**	3	6	0	0	0	0	0	0	0	0	6	226
11:00 AM	2	169	62	4	11	1	0	1	0	0	0	0	0	9	259
12:00 PM	1	180	60	**6**	23	**1**	0	0	0	0	0	0	0	12	283
1:00 PM	**2**	220	76	4	16	1	0	**1**	0	0	0	0	0	11	331
2:00 PM	2	232	94	3	24	0	0	0	**1**	0	0	0	0	15	371
3:00 PM	1	320	116	4	25	0	0	0	0	0	0	0	0	**27**	493
4:00 PM	2	326	**132**	3	**27**	0	0	1	0	0	0	0	0	21	512
5:00 PM	1	**343**	132	1	23	0	0	0	0	0	0	0	0	20	**520**
6:00 PM	2	286	94	3	11	0	0	0	0	0	0	0	0	11	407
7:00 PM	0	244	61	3	12	0	0	0	0	0	0	0	0	8	328
8:00 PM	1	174	59	1	8	0	0	0	0	0	0	0	0	8	251
9:00 PM	1	142	43	3	5	0	0	0	0	0	0	0	0	3	197
10:00 PM	0	90	22	1	2	0	0	0	0	0	0	0	0	3	118
11:00 PM	1	51	22	2	1	0	0	0	0	0	0	0	0	1	78
Day Total	24	3680	1362	65	248	4	0	4	3	0	0	0	0	221	5611
Percent	0.4%	65.6%	24.3%	1.2%	4.4%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	3.9%	
ADT 5611															
AM Peak	7:00 AM	7:00 AM	10:00 AM	7:00 AM	9:00 AM	8:00 AM		8:00 AM	8:00 AM					8:00 AM	7:00 AM
Volume	2	198	71	5	15	1		1	1					18	303
PM Peak	1:00 PM	5:00 PM	4:00 PM	12:00 PM	4:00 PM	12:00 PM		1:00 PM	2:00 PM					3:00 PM	5:00 PM
Volume	2	343	132	6	27	1		1	1					27	520

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	26	3	2	1	0	0	0	0	0	0	0	0	0	33
1:00 AM	0	21	0	1	0	0	0	0	0	0	0	0	0	0	22
2:00 AM	0	15	5	1	2	0	0	0	0	0	0	0	0	0	23
3:00 AM	0	11	8	2	0	0	0	0	0	0	0	0	0	0	21
4:00 AM	1	17	8	1	3	0	0	0	0	0	0	0	0	1	31
5:00 AM	1	47	22	3	6	0	0	0	0	0	0	0	0	5	84
6:00 AM	3	101	52	3	10	0	0	0	0	0	0	0	0	8	177
7:00 AM	1	**218**	71	**6**	11	0	0	**1**	0	0	0	0	0	**18**	**326**
8:00 AM	**4**	185	61	3	11	0	0	0	0	0	0	0	0	16	280
9:00 AM	2	157	63	2	7	0	0	0	0	0	0	0	0	7	238
10:00 AM	2	198	**78**	3	12	**1**	0	0	0	0	0	0	0	14	308
11:00 AM	1	206	76	5	**13**	0	0	0	**1**	0	0	0	0	7	309
12:00 PM	3	214	85	**4**	13	0	0	0	0	0	0	0	0	6	325
1:00 PM	3	234	96	3	15	**1**	0	0	0	0	0	0	0	13	365
2:00 PM	5	261	94	4	17	0	0	**1**	0	0	0	0	0	17	399
3:00 PM	4	302	113	4	27	0	0	1	0	0	0	0	0	**34**	485
4:00 PM	0	**359**	**133**	2	24	0	0	0	0	0	0	0	0	27	**545**
5:00 PM	**6**	340	125	2	21	0	**1**	1	0	0	0	0	0	22	518
6:00 PM	0	310	108	3	19	0	0	0	0	0	0	0	0	9	449
7:00 PM	1	300	105	3	16	0	0	0	0	0	0	0	0	13	438
8:00 PM	3	322	127	4	**28**	0	0	0	0	0	0	0	0	7	491
9:00 PM	1	266	81	2	6	0	0	0	0	**1**	0	0	0	4	361
10:00 PM	1	150	56	1	8	0	0	0	0	0	0	0	0	3	219
11:00 PM	0	99	27	2	1	0	0	0	0	0	0	0	0	1	130
Day Total	43	4359	1597	66	271	2	1	4	1	1	0	0	0	232	6577
Percent	0.7%	66.3%	24.3%	1.0%	4.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%	
ADT 6577															
AM Peak	8:00 AM	7:00 AM	10:00 AM	7:00 AM	11:00 AM	10:00 AM		7:00 AM	11:00 AM					7:00 AM	7:00 AM
Volume	4	218	78	6	13	1		1	1					18	326
PM Peak	5:00 PM	4:00 PM	4:00 PM	12:00 PM	8:00 PM	1:00 PM	5:00 PM	2:00 PM		9:00 PM				3:00 PM	4:00 PM
Volume	6	359	133	4	28	1	1	1		1				34	545

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	2	36	7	2	3	0	0	0	0	0	0	0	0	0	50
1:00 AM	0	26	10	1	5	0	0	0	0	0	0	0	0	0	42
2:00 AM	0	17	9	1	3	0	0	0	0	0	0	0	0	0	30
3:00 AM	0	9	8	2	1	0	0	0	0	0	0	0	0	0	20
4:00 AM	1	21	12	0	1	0	0	0	0	0	0	0	0	2	37
5:00 AM	2	51	28	4	8	0	0	0	0	0	0	0	0	7	100
6:00 AM	2	93	60	**6**	9	**1**	0	0	0	0	0	0	0	**19**	190
7:00 AM	3	**206**	74	3	15	0	0	**1**	0	0	0	0	0	16	318
8:00 AM	**4**	170	56	4	15	0	0	1	0	0	0	0	0	17	267
9:00 AM	3	191	81	5	10	0	0	1	0	0	0	0	0	12	303
10:00 AM	2	165	75	2	**21**	1	0	0	0	0	0	0	0	10	276
11:00 AM	1	197	**92**	3	20	1	0	0	0	0	0	0	0	11	**325**
12:00 PM	4	249	83	2	14	**1**	0	**1**	0	0	0	0	0	19	373
1:00 PM	1	258	95	2	19	0	0	1	0	0	0	0	0	17	393
2:00 PM	0	265	105	**7**	19	1	0	1	0	0	0	0	0	27	425
3:00 PM	**5**	338	**133**	2	20	0	0	0	0	0	0	0	0	**33**	531
4:00 PM	4	328	121	4	22	1	0	0	0	0	0	0	0	15	495
5:00 PM	1	**368**	119	1	**26**	0	0	0	0	0	0	0	0	19	**534**
6:00 PM	4	300	88	2	19	0	0	0	0	0	0	0	0	17	430
7:00 PM	3	213	80	3	12	0	0	1	0	0	0	0	0	9	321
8:00 PM	0	189	63	1	13	0	0	0	0	0	0	0	0	1	267
9:00 PM	5	180	55	1	9	0	0	0	0	0	0	0	0	4	254
10:00 PM	0	166	44	2	5	0	0	0	0	0	0	0	0	1	218
11:00 PM	0	101	19	2	4	0	0	0	0	0	0	0	0	0	126
Day Total	47	4137	1517	62	293	6	0	7	0	0	0	0	0	256	6325
Percent	0.7%	65.4%	24.0%	1.0%	4.6%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	

ADT 6325

AM Peak	8:00 AM	7:00 AM	11:00 AM	6:00 AM	10:00 AM	6:00 AM		7:00 AM						6:00 AM	11:00 AM
Volume	4	206	92	6	21	1		1						19	325
PM Peak	3:00 PM	5:00 PM	3:00 PM	2:00 PM	5:00 PM	12:00 PM		12:00 PM						3:00 PM	5:00 PM
Volume	5	368	133	7	26	1		1						33	534

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 12 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	49	11	2	1	0	0	0	0	0	0	0	0	0	64
1:00 AM	1	30	9	1	2	0	0	0	0	0	0	0	0	0	43
2:00 AM	0	22	5	1	1	0	0	0	0	0	0	0	0	0	29
3:00 AM	0	13	4	2	1	0	0	0	0	0	0	0	0	0	20
4:00 AM	1	18	4	2	0	0	0	0	0	0	0	0	0	2	27
5:00 AM	4	30	10	1	3	**1**	0	0	0	0	0	0	0	0	49
6:00 AM	0	71	34	1	6	0	0	0	0	0	0	0	0	2	114
7:00 AM	2	79	35	**3**	13	0	0	0	0	0	0	0	0	1	133
8:00 AM	0	132	50	2	8	0	0	0	0	0	0	0	0	6	198
9:00 AM	3	196	60	2	8	0	0	**2**	0	0	0	0	0	9	280
10:00 AM	1	229	75	3	**17**	0	0	1	0	0	0	0	0	**18**	344
11:00 AM	**8**	**250**	**102**	2	17	0	0	0	0	0	0	0	0	16	**395**
12:00 PM	1	240	**98**	**3**	21	0	0	**3**	0	0	0	0	0	**15**	**381**
1:00 PM	**7**	242	86	2	**22**	0	0	1	0	0	0	0	0	15	375
2:00 PM	2	261	86	2	14	0	0	0	0	0	0	0	0	11	376
3:00 PM	4	259	80	2	16	0	0	0	0	0	0	0	0	11	372
4:00 PM	4	**262**	84	2	12	0	0	0	0	0	0	0	0	11	375
5:00 PM	3	213	65	2	12	0	0	0	0	0	0	0	0	10	305
6:00 PM	2	214	50	1	11	0	0	0	0	0	0	0	0	8	286
7:00 PM	5	218	69	3	10	0	0	0	0	0	0	0	0	1	306
8:00 PM	5	190	73	0	9	0	0	0	0	0	0	0	0	9	286
9:00 PM	3	173	48	1	6	0	0	0	0	0	0	0	0	2	233
10:00 PM	3	133	38	1	5	0	0	0	0	0	0	0	0	5	185
11:00 PM	2	86	24	1	1	0	0	0	0	0	0	0	0	3	117
Day Total	62	3610	1200	42	216	1	0	7	0	0	0	0	0	155	5293
Percent	1.2%	68.2%	22.7%	0.8%	4.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	

ADT 5293

AM Peak	11:00 AM	11:00 AM	11:00 AM	7:00 AM	10:00 AM	5:00 AM		9:00 AM						10:00 AM	11:00 AM
Volume	8	250	102	3	17	1		2						18	395
PM Peak	1:00 PM	4:00 PM	12:00 PM	12:00 PM	1:00 PM			12:00 PM						12:00 PM	12:00 PM
Volume	7	262	98	3	22			3						15	381

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 13 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	53	9	2	2	0	0	0	0	0	0	0	0	2	68
1:00 AM	1	26	3	1	1	0	0	0	0	0	0	0	0	0	32
2:00 AM	0	27	5	1	2	0	0	0	0	0	0	0	0	0	35
3:00 AM	0	15	4	1	1	0	0	0	0	0	0	0	0	0	21
4:00 AM	0	14	9	2	1	0	0	0	0	0	0	0	0	0	26
5:00 AM	1	31	10	1	2	0	0	0	0	0	0	0	0	1	46
6:00 AM	1	52	27	1	3	0	0	0	0	0	0	0	0	0	84
7:00 AM	0	87	43	**3**	3	0	0	0	0	0	0	0	0	3	139
8:00 AM	1	107	42	2	6	0	0	0	**1**	0	0	0	0	3	162
9:00 AM	0	156	64	2	9	0	0	0	0	0	0	0	0	10	241
10:00 AM	**8**	198	55	2	**10**	**1**	0	0	0	0	0	0	0	10	284
11:00 AM	2	**211**	**82**	3	6	0	0	0	0	0	0	0	0	**11**	**315**
12:00 PM	2	219	80	**2**	8	0	0	0	0	0	0	0	0	**17**	328
1:00 PM	**6**	**251**	**93**	2	12	0	0	0	0	0	0	0	0	6	**370**
2:00 PM	4	239	80	2	**14**	0	0	0	0	0	0	0	0	9	348
3:00 PM	2	226	75	2	6	0	0	0	0	0	0	0	0	10	321
4:00 PM	6	213	74	2	8	0	0	0	0	0	0	0	0	8	311
5:00 PM	3	214	84	2	7	0	0	0	0	0	0	0	0	9	319
6:00 PM	1	195	51	2	7	0	0	0	0	0	0	0	0	4	260
7:00 PM	6	166	44	2	4	0	0	0	0	0	0	0	0	2	224
8:00 PM	0	181	49	0	3	0	0	0	0	0	0	0	0	5	238
9:00 PM	1	131	35	1	2	0	0	0	0	0	0	0	0	4	174
10:00 PM	0	70	22	1	4	0	0	0	0	0	0	0	0	1	98
11:00 PM	0	37	12	1	6	0	0	0	0	0	0	0	0	1	57
Day Total	45	3119	1052	40	127	1	0	0	1	0	0	0	0	116	4501
Percent	1.0%	69.3%	23.4%	0.9%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	
ADT 4501															
AM Peak	10:00 AM	11:00 AM	11:00 AM	7:00 AM	10:00 AM	10:00 AM			8:00 AM					11:00 AM	11:00 AM
Volume	8	211	82	3	10	1			1					11	315
PM Peak	1:00 PM	1:00 PM	1:00 PM	12:00 PM	2:00 PM									12:00 PM	1:00 PM
Volume	6	251	93	2	14									17	370

Comments:

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	28	9	2	2	0	0	0	0	0	0	0	0	0	41
1:00 AM	0	13	6	1	0	0	0	0	0	0	0	0	0	0	20
2:00 AM	2	12	2	1	2	0	0	0	0	0	0	0	0	2	21
3:00 AM	0	11	6	1	0	0	0	0	0	0	0	0	0	0	18
4:00 AM	1	16	14	2	3	0	0	0	0	0	0	0	0	0	36
5:00 AM	0	49	25	1	7	0	0	0	0	0	0	0	0	5	87
6:00 AM	2	95	55	4	6	0	0	0	0	0	0	0	0	25	187
7:00 AM	1	186	71	4	14	0	0	0	0	0	0	0	0	**27**	303
8:00 AM	0	203	69	**5**	15	0	0	2	0	0	0	0	0	11	305
9:00 AM	3	173	55	2	14	**1**	0	0	0	0	0	0	0	6	254
10:00 AM	0	200	70	2	8	0	0	**3**	0	0	0	0	0	4	287
11:00 AM	**4**	**215**	**86**	4	**21**	0	0	1	0	0	0	0	0	9	**340**
12:00 PM	1	196	74	**7**	17	**1**	0	**1**	0	0	0	0	0	10	307
1:00 PM	3	233	88	2	18	1	0	1	0	**1**	0	0	0	10	357
2:00 PM	**7**	275	110	4	**29**	0	0	1	0	0	0	0	0	10	436
3:00 PM	4	358	**134**	5	26	1	0	0	0	0	0	0	0	**25**	553
4:00 PM	1	**377**	133	4	18	0	0	0	0	0	0	0	0	25	**558**
5:00 PM	1	350	112	2	20	0	0	0	0	0	0	0	0	17	502
6:00 PM	2	298	93	2	14	0	0	0	0	0	0	0	0	11	420
7:00 PM	1	210	64	4	5	0	0	0	0	0	0	0	0	6	290
8:00 PM	5	169	41	2	5	0	0	0	0	0	0	0	0	2	224
9:00 PM	0	114	31	2	5	0	0	0	0	0	0	0	0	5	157
10:00 PM	0	90	40	1	1	0	0	0	0	0	0	0	0	2	134
11:00 PM	0	59	18	2	0	0	0	0	0	0	0	0	0	0	79
Day Total	38	3930	1406	66	250	4	0	9	0	1	0	0	0	212	5916
Percent	0.6%	66.4%	23.8%	1.1%	4.2%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%	

ADT 5916

AM Peak	11:00 AM	11:00 AM	11:00 AM	8:00 AM	11:00 AM	9:00 AM		10:00 AM						7:00 AM	11:00 AM
Volume	4	215	86	5	21	1		3						27	340
PM Peak	2:00 PM	4:00 PM	3:00 PM	12:00 PM	2:00 PM	12:00 PM		12:00 PM		1:00 PM				3:00 PM	4:00 PM
Volume	7	377	134	7	29	1		1		1				25	558

Comments:

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy W of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy W of Kualakai Pkwy
CITY/STATE: Kapolei, HI

QC JOB #: 14681201
DIRECTION: WB
DATE: May 08 2018 - May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	301	26775	9547	395	1610	26	2	35	6	2	0	0	0	1431	40130
Percent	0.8%	66.7%	23.8%	1.0%	4.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%	
ADT 5732															

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 07 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM															
1:00 AM															
2:00 AM															
3:00 AM															
4:00 AM															
5:00 AM															
6:00 AM															
7:00 AM															
8:00 AM															
9:00 AM															
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM															
4:00 PM															
5:00 PM															
6:00 PM	**1**	**106**	**32**	2	**4**	0	0	0	0	0	0	0	0	**9**	**154**
7:00 PM	1	90	22	2	1	0	0	0	0	0	0	0	0	1	117
8:00 PM	0	68	19	2	2	0	0	0	0	0	0	0	0	2	93
9:00 PM	0	44	16	**3**	1	0	0	0	0	0	0	0	0	2	66
10:00 PM	0	41	9	2	0	0	0	0	0	0	0	0	0	0	52
11:00 PM	0	19	6	1	1	0	0	0	0	0	0	0	0	0	27
Day Total	2	368	104	12	9	0	0	0	0	0	0	0	0	14	509
Percent	0.4%	72.3%	20.4%	2.4%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	
AM Peak Volume															
PM Peak Volume	6:00 PM 1	6:00 PM 106	6:00 PM 32	9:00 PM 3	6:00 PM 4									6:00 PM 9	6:00 PM 154

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	18	2	0	0	0	0	0	0	0	0	0	0	0	21
1:00 AM	0	4	2	2	1	0	0	0	0	0	0	0	0	0	9
2:00 AM	0	4	2	1	0	0	0	0	0	0	0	0	0	0	7
3:00 AM	0	7	3	1	1	0	0	0	0	0	0	0	0	0	12
4:00 AM	0	25	27	1	2	0	0	0	0	0	0	0	0	0	55
5:00 AM	4	403	173	4	11	0	0	0	0	0	0	0	0	6	601
6:00 AM	**6**	**621**	**212**	3	11	1	0	0	0	0	0	0	0	**19**	**873**
7:00 AM	3	342	109	2	9	**2**	0	**1**	0	0	0	0	0	14	482
8:00 AM	0	157	80	2	**15**	1	0	0	0	0	0	0	0	5	260
9:00 AM	1	111	61	2	11	0	0	0	0	**1**	0	0	0	2	189
10:00 AM	0	143	54	**6**	15	1	0	1	0	0	0	0	0	4	224
11:00 AM	2	114	46	4	3	1	0	0	**1**	0	0	0	0	5	176
12:00 PM	**5**	116	49	3	**15**	**2**	0	0	0	0	0	0	0	1	191
1:00 PM	1	124	48	3	14	1	0	0	0	0	0	0	0	3	194
2:00 PM	2	158	67	5	5	0	0	0	**1**	0	0	0	0	5	243
3:00 PM	1	**172**	**96**	**6**	11	1	0	0	1	**1**	0	0	0	9	**298**
4:00 PM	2	161	75	3	10	1	0	0	0	0	0	0	0	10	262
5:00 PM	3	151	47	2	5	0	0	0	0	0	0	0	0	**11**	219
6:00 PM	1	143	51	2	2	0	0	0	0	0	0	0	0	3	202
7:00 PM	2	95	25	3	1	0	0	0	0	0	0	0	0	2	128
8:00 PM	0	70	25	3	1	0	0	0	0	0	0	0	0	1	100
9:00 PM	0	61	22	2	0	0	0	0	0	0	0	0	0	0	85
10:00 PM	0	40	12	2	1	0	0	0	0	0	0	0	0	1	56
11:00 PM	0	19	9	2	0	0	0	0	0	0	0	0	0	0	30
Day Total	34	3259	1297	64	144	11	0	2	3	2	0	0	0	101	4917
Percent	0.7%	66.3%	26.4%	1.3%	2.9%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	2.1%	
ADT 4917															
AM Peak	6:00 AM	6:00 AM	6:00 AM	10:00 AM	8:00 AM	7:00 AM		7:00 AM	11:00 AM	9:00 AM				6:00 AM	6:00 AM
Volume	6	621	212	6	15	2		1	1	1				19	873
PM Peak	12:00 PM	3:00 PM	3:00 PM	3:00 PM	12:00 PM	12:00 PM			2:00 PM	3:00 PM				5:00 PM	3:00 PM
Volume	5	172	96	6	15	2			1	1				11	298

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	15	5	0	0	0	0	0	0	0	0	0	0	0	20
1:00 AM	0	9	2	2	0	0	0	0	0	0	0	0	0	0	13
2:00 AM	0	11	6	1	0	0	0	0	0	0	0	0	0	0	18
3:00 AM	0	8	4	0	1	0	0	0	0	0	0	0	0	0	13
4:00 AM	1	32	20	1	0	0	0	0	0	0	0	0	0	0	54
5:00 AM	5	394	158	**4**	7	0	0	0	0	0	0	0	0	6	574
6:00 AM	**6**	**577**	**215**	4	**16**	0	0	1	1	0	0	0	0	**12**	**832**
7:00 AM	5	323	95	4	7	0	2	**2**	5	**5**	0	0	0	10	458
8:00 AM	4	143	56	2	8	0	**4**	0	**6**	3	0	0	0	6	232
9:00 AM	3	104	36	4	8	1	1	0	6	5	0	0	0	1	169
10:00 AM	2	76	35	2	6	**2**	3	0	5	3	0	0	0	9	143
11:00 AM	2	90	46	2	10	1	2	1	5	2	0	0	0	1	162
12:00 PM	1	75	36	**4**	5	**4**	2	0	**5**	2	0	0	0	6	140
1:00 PM	1	81	32	4	6	0	2	0	4	2	0	0	0	5	137
2:00 PM	0	126	43	3	11	3	**3**	0	4	**3**	0	0	0	4	200
3:00 PM	1	**159**	**71**	3	**12**	0	0	0	0	0	0	0	0	8	**254**
4:00 PM	**2**	129	38	3	4	0	0	0	0	0	0	0	0	**11**	187
5:00 PM	1	121	46	3	6	0	0	0	0	0	0	0	0	3	180
6:00 PM	0	114	37	2	9	0	0	0	0	0	0	0	0	3	165
7:00 PM	0	92	30	2	2	0	0	0	0	0	0	0	0	3	129
8:00 PM	1	71	14	4	4	0	0	0	0	0	0	0	0	2	96
9:00 PM	0	51	15	2	1	0	0	0	0	0	0	0	0	0	69
10:00 PM	0	48	14	0	2	0	0	0	0	0	0	0	0	1	65
11:00 PM	0	24	3	2	1	0	0	0	0	0	0	0	0	0	30
Day Total	35	2873	1057	58	126	11	19	4	41	25	0	0	0	91	4340
Percent	0.8%	66.2%	24.4%	1.3%	2.9%	0.3%	0.4%	0.1%	0.9%	0.6%	0.0%	0.0%	0.0%	2.1%	
ADT 4340															
AM Peak Volume	6:00 AM 6	6:00 AM 577	6:00 AM 215	5:00 AM 4	6:00 AM 16	10:00 AM 2	8:00 AM 4	7:00 AM 2	8:00 AM 6	7:00 AM 5				6:00 AM 12	6:00 AM 832
PM Peak Volume	4:00 PM 2	3:00 PM 159	3:00 PM 71	12:00 PM 4	3:00 PM 12	12:00 PM 4	2:00 PM 3		12:00 PM 5	2:00 PM 3				4:00 PM 11	3:00 PM 254

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	14	3	1	1	0	0	0	0	0	0	0	0	0	20
1:00 AM	0	10	3	1	0	0	0	0	0	0	0	0	0	0	14
2:00 AM	0	5	4	1	1	0	0	0	0	0	0	0	0	0	11
3:00 AM	0	6	7	2	1	0	0	0	0	0	0	0	0	0	16
4:00 AM	1	44	17	1	3	1	0	0	0	0	0	0	0	0	67
5:00 AM	**8**	415	103	5	8	0	0	0	0	0	0	0	0	4	543
6:00 AM	4	**572**	**133**	3	14	1	0	0	3	0	0	0	0	**18**	**748**
7:00 AM	1	303	101	**6**	**18**	0	**4**	**2**	5	1	0	0	0	14	455
8:00 AM	2	178	62	2	15	0	3	0	6	2	0	0	0	9	279
9:00 AM	2	144	41	4	7	**2**	2	1	6	**4**	0	0	**1**	6	220
10:00 AM	1	134	45	5	7	1	3	0	**7**	4	0	0	1	5	213
11:00 AM	0	127	48	4	14	2	0	0	5	1	0	0	0	7	208
12:00 PM	2	129	36	**5**	7	0	**6**	0	5	2	0	0	**1**	5	198
1:00 PM	0	135	48	3	5	**2**	4	0	**7**	2	0	0	1	5	212
2:00 PM	3	177	40	2	8	0	1	**1**	4	**4**	0	0	0	**9**	249
3:00 PM	3	174	**67**	5	3	2	1	0	0	0	0	0	0	7	262
4:00 PM	1	**179**	60	2	10	1	0	1	0	0	0	0	0	9	**263**
5:00 PM	**5**	142	45	3	6	0	0	0	0	0	0	0	0	7	208
6:00 PM	0	90	45	2	**16**	1	0	0	0	0	0	0	0	5	159
7:00 PM	1	93	31	1	7	0	0	0	0	0	0	0	0	2	135
8:00 PM	0	57	38	3	3	0	0	0	0	0	0	0	0	0	101
9:00 PM	0	53	28	2	3	0	0	0	0	0	0	0	0	4	90
10:00 PM	0	40	19	1	2	0	0	0	0	0	0	0	0	0	62
11:00 PM	0	23	13	2	1	0	0	0	0	0	0	0	0	0	39
Day Total	35	3244	1037	66	160	13	24	5	48	20	0	0	4	116	4772
Percent	0.7%	68.0%	21.7%	1.4%	3.4%	0.3%	0.5%	0.1%	1.0%	0.4%	0.0%	0.0%	0.1%	2.4%	
ADT 4772															
AM Peak Volume	5:00 AM 8	6:00 AM 572	6:00 AM 133	7:00 AM 6	7:00 AM 18	9:00 AM 2	7:00 AM 4	7:00 AM 2	10:00 AM 7	9:00 AM 4			9:00 AM 1	6:00 AM 18	6:00 AM 748
PM Peak Volume	5:00 PM 5	4:00 PM 179	3:00 PM 67	12:00 PM 5	6:00 PM 16	1:00 PM 2	12:00 PM 6	2:00 PM 1	1:00 PM 7	2:00 PM 4			12:00 PM 1	2:00 PM 9	4:00 PM 263

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	10	12	1	2	0	0	0	0	0	0	0	0	0	25
1:00 AM	0	7	6	1	0	0	0	0	0	0	0	0	0	0	14
2:00 AM	0	6	4	1	1	0	0	0	0	0	0	0	0	0	12
3:00 AM	0	4	3	1	2	0	0	0	0	0	0	0	0	0	10
4:00 AM	0	35	15	2	5	0	0	0	0	0	0	0	0	0	57
5:00 AM	4	363	91	**4**	6	0	0	0	0	0	0	0	0	5	473
6:00 AM	**5**	**483**	**102**	3	**20**	1	0	0	1	1	0	0	0	11	**627**
7:00 AM	3	292	72	3	14	0	**4**	0	2	3	0	0	0	**12**	405
8:00 AM	4	161	79	4	18	0	4	**2**	**3**	2	0	0	0	7	284
9:00 AM	2	61	20	3	4	**2**	0	0	2	**4**	0	0	0	7	105
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM															
4:00 PM															
5:00 PM															
6:00 PM															
7:00 PM															
8:00 PM															
9:00 PM															
10:00 PM															
11:00 PM															
Day Total	18	1422	404	23	72	3	8	2	8	10	0	0	0	42	2012
Percent	0.9%	70.7%	20.1%	1.1%	3.6%	0.1%	0.4%	0.1%	0.4%	0.5%	0.0%	0.0%	0.0%	2.1%	
AM Peak Volume	6:00 AM 5	6:00 AM 483	6:00 AM 102	5:00 AM 4	6:00 AM 20	9:00 AM 2	7:00 AM 4	8:00 AM 2	8:00 AM 3	9:00 AM 4				7:00 AM 12	6:00 AM 627
PM Peak Volume															

Comments:

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: EB
DATE: May 07 2018 - May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	124	11166	3899	223	511	38	51	13	100	57	0	0	4	364	16550
Percent	0.7%	67.5%	23.6%	1.3%	3.1%	0.2%	0.3%	0.1%	0.6%	0.3%	0.0%	0.0%	0.0%	2.2%	
ADT 4650															

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 07 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM															
1:00 AM															
2:00 AM															
3:00 AM															
4:00 AM															
5:00 AM															
6:00 AM															
7:00 AM															
8:00 AM															
9:00 AM															
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM															
4:00 PM															
5:00 PM															
6:00 PM	**3**	**167**	**59**	**3**	**13**	0	0	**1**	0	0	0	0	0	**5**	**251**
7:00 PM	1	110	41	3	7	0	0	0	0	0	0	0	0	1	163
8:00 PM	0	79	19	2	6	0	0	0	0	0	0	0	0	2	108
9:00 PM	0	62	24	1	3	0	0	0	0	0	0	0	0	2	92
10:00 PM	0	32	19	1	3	0	0	0	0	0	0	0	0	0	55
11:00 PM	0	21	11	2	2	0	0	0	0	0	0	0	0	1	37
Day Total	4	471	173	12	34	0	0	1	0	0	0	0	0	11	706
Percent	0.6%	66.7%	24.5%	1.7%	4.8%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	
AM Peak Volume															
PM Peak Volume	6:00 PM 3	6:00 PM 167	6:00 PM 59	6:00 PM 3	6:00 PM 13			6:00 PM 1						6:00 PM 5	6:00 PM 251

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	12	2	2	0	0	0	0	0	0	0	0	0	0	16
1:00 AM	1	4	3	1	1	0	0	0	0	0	0	0	0	0	10
2:00 AM	0	3	2	1	0	0	0	0	0	0	0	0	0	0	6
3:00 AM	0	8	3	1	2	0	0	0	0	0	0	0	0	2	16
4:00 AM	2	10	14	1	2	0	0	0	0	0	0	0	0	0	29
5:00 AM	0	40	29	2	8	0	0	0	0	0	0	0	0	4	83
6:00 AM	2	78	51	**6**	14	0	0	0	**1**	**1**	0	0	0	**14**	167
7:00 AM	0	128	59	5	**21**	0	0	**2**	0	0	0	0	0	8	223
8:00 AM	0	71	50	5	19	0	0	0	1	0	0	0	0	1	147
9:00 AM	4	98	44	6	21	0	**1**	0	0	0	0	0	0	2	176
10:00 AM	1	121	50	6	13	0	0	2	0	0	0	0	0	3	196
11:00 AM	**7**	**146**	**64**	4	20	**2**	0	1	1	0	0	0	0	2	**247**
12:00 PM	2	134	50	4	23	0	**1**	0	**1**	0	0	0	0	5	220
1:00 PM	**3**	137	78	4	21	**2**	0	2	1	0	0	0	0	5	253
2:00 PM	1	154	46	**6**	7	2	0	**3**	1	0	0	0	0	0	220
3:00 PM	1	184	**114**	5	**33**	0	0	1	1	0	0	0	0	5	344
4:00 PM	2	**261**	94	2	20	0	0	1	0	0	0	0	0	**8**	**388**
5:00 PM	2	185	90	3	22	0	0	0	0	0	0	0	0	7	309
6:00 PM	1	165	56	2	10	0	0	0	0	0	0	0	0	2	236
7:00 PM	1	98	58	4	8	0	0	1	0	0	0	0	0	1	171
8:00 PM	0	77	35	2	7	0	0	0	0	0	0	0	0	1	122
9:00 PM	0	64	33	2	7	0	0	0	0	0	0	0	0	0	106
10:00 PM	0	34	11	1	9	0	0	0	0	0	0	0	0	0	55
11:00 PM	0	17	9	1	2	0	0	0	0	0	0	0	0	0	29
Day Total	30	2229	1045	76	290	6	2	13	7	1	0	0	0	70	3769
Percent	0.8%	59.1%	27.7%	2.0%	7.7%	0.2%	0.1%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	1.9%	
ADT 3769															
AM Peak	11:00 AM	11:00 AM	11:00 AM	6:00 AM	7:00 AM	11:00 AM	9:00 AM	7:00 AM	6:00 AM	6:00 AM				6:00 AM	11:00 AM
Volume	7	146	64	6	21	2	1	2	1	1				14	247
PM Peak	1:00 PM	4:00 PM	3:00 PM	2:00 PM	3:00 PM	1:00 PM	12:00 PM	2:00 PM	12:00 PM					4:00 PM	4:00 PM
Volume	3	261	114	6	33	2	1	3	1					8	388

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	14	1	2	2	0	0	0	0	0	0	0	0	1	20
1:00 AM	0	6	1	1	0	0	0	0	0	0	0	0	0	0	8
2:00 AM	0	7	3	1	1	0	0	0	0	0	0	0	0	0	12
3:00 AM	1	7	3	3	0	0	0	0	0	0	0	0	0	2	16
4:00 AM	1	19	11	1	2	0	0	0	0	0	0	0	0	0	34
5:00 AM	1	43	18	2	4	0	0	0	0	0	0	0	0	5	73
6:00 AM	1	96	45	3	4	1	0	0	0	0	0	0	0	**9**	159
7:00 AM	0	**154**	30	6	9	5	0	0	**6**	0	0	0	0	7	217
8:00 AM	**5**	122	34	**8**	7	2	0	**4**	4	0	0	0	0	5	191
9:00 AM	1	107	38	5	**11**	5	0	3	6	0	0	0	0	1	177
10:00 AM	4	120	48	7	11	**10**	0	0	5	0	0	0	0	5	210
11:00 AM	2	143	**50**	6	8	4	0	3	5	0	0	0	0	4	**225**
12:00 PM	2	143	45	5	**13**	**5**	0	0	2	0	0	0	**1**	2	218
1:00 PM	2	129	43	**10**	6	3	0	0	**7**	0	0	0	0	3	203
2:00 PM	2	178	60	6	10	2	0	1	4	0	0	0	0	4	267
3:00 PM	3	234	**75**	4	4	3	0	**3**	0	0	0	0	0	**11**	337
4:00 PM	**4**	**271**	70	4	3	1	0	0	0	0	0	0	0	6	**359**
5:00 PM	4	242	58	1	7	0	0	0	0	0	0	0	0	5	317
6:00 PM	2	170	38	3	4	0	0	0	0	0	0	0	0	1	218
7:00 PM	1	159	27	3	1	0	0	0	0	0	0	0	0	3	194
8:00 PM	1	116	11	1	2	0	0	0	0	0	0	0	0	0	131
9:00 PM	0	72	14	3	0	0	0	0	0	0	0	0	0	1	90
10:00 PM	0	42	8	1	1	0	0	0	0	0	0	0	0	0	52
11:00 PM	0	32	5	2	0	0	0	0	0	0	0	0	0	0	39
Day Total	37	2626	736	88	110	41	0	14	39	0	0	0	1	75	3767
Percent	1.0%	69.7%	19.5%	2.3%	2.9%	1.1%	0.0%	0.4%	1.0%	0.0%	0.0%	0.0%	0.0%	2.0%	
ADT 3767															
AM Peak	8:00 AM	7:00 AM	11:00 AM	8:00 AM	9:00 AM	10:00 AM		8:00 AM	7:00 AM					6:00 AM	11:00 AM
Volume	5	154	50	8	11	10		4	6					9	225
PM Peak	4:00 PM	4:00 PM	3:00 PM	1:00 PM	12:00 PM	12:00 PM		3:00 PM	1:00 PM				12:00 PM	3:00 PM	4:00 PM
Volume	4	271	75	10	13	5		3	7				1	11	359

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	7	1	2	0	0	0	0	0	0	0	0	0	0	11
1:00 AM	0	3	0	1	0	0	0	0	0	0	0	0	0	0	4
2:00 AM	0	6	1	1	0	0	0	0	0	0	0	0	0	0	8
3:00 AM	0	8	2	2	1	0	0	0	0	0	0	0	0	0	13
4:00 AM	1	15	7	1	1	0	0	0	0	0	0	0	0	0	25
5:00 AM	**2**	63	9	3	1	0	0	0	0	0	0	0	0	5	83
6:00 AM	2	89	34	2	3	2	0	0	0	0	0	0	0	**10**	142
7:00 AM	1	124	**53**	**8**	**11**	5	0	**4**	3	0	0	0	0	6	215
8:00 AM	2	93	39	7	6	6	0	0	**8**	**1**	0	0	0	5	167
9:00 AM	0	98	38	2	4	7	0	3	4	0	0	0	0	5	161
10:00 AM	1	**155**	42	5	6	**9**	0	1	5	0	0	0	0	9	**233**
11:00 AM	1	140	42	7	5	6	**1**	1	4	0	0	0	0	10	217
12:00 PM	2	165	26	3	7	7	0	**1**	2	**1**	0	0	0	4	218
1:00 PM	4	177	47	**6**	5	**10**	0	0	**6**	0	0	0	0	2	257
2:00 PM	6	194	40	3	**10**	5	0	1	2	1	0	0	0	**7**	269
3:00 PM	4	254	54	4	7	3	0	1	2	0	0	0	0	6	335
4:00 PM	1	**297**	58	2	3	0	0	1	0	0	0	0	0	6	**368**
5:00 PM	**10**	262	56	2	10	1	0	1	0	0	0	0	0	7	349
6:00 PM	1	194	**66**	3	6	0	0	0	0	0	0	0	0	5	275
7:00 PM	1	161	38	4	3	0	0	0	0	0	0	0	0	3	210
8:00 PM	1	135	32	2	4	0	0	0	0	0	0	0	0	0	174
9:00 PM	1	151	29	1	4	0	0	1	0	0	0	0	0	2	189
10:00 PM	0	65	19	1	3	0	0	0	0	0	0	0	0	0	88
11:00 PM	1	41	8	2	2	0	0	0	0	0	0	0	0	0	54
Day Total	43	2897	741	74	102	61	1	15	36	3	0	0	0	92	4065
Percent	1.1%	71.3%	18.2%	1.8%	2.5%	1.5%	0.0%	0.4%	0.9%	0.1%	0.0%	0.0%	0.0%	2.3%	

ADT 4065

AM Peak	5:00 AM	10:00 AM	7:00 AM	7:00 AM	7:00 AM	10:00 AM	11:00 AM	7:00 AM	8:00 AM	8:00 AM				6:00 AM	10:00 AM
Volume	2	155	53	8	11	9	1	4	8	1				10	233
PM Peak	5:00 PM	4:00 PM	6:00 PM	1:00 PM	2:00 PM	1:00 PM		12:00 PM	1:00 PM	12:00 PM				2:00 PM	4:00 PM
Volume	10	297	66	6	10	10		1	6	1				7	368

Comments:

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	15	5	2	3	0	0	0	0	0	0	0	0	1	27
1:00 AM	0	12	2	1	0	0	0	0	0	0	0	0	0	0	15
2:00 AM	0	9	3	1	1	0	0	0	0	0	0	0	0	0	14
3:00 AM	0	4	5	3	1	0	0	0	0	0	0	0	0	0	13
4:00 AM	**3**	22	10	0	0	0	0	0	0	0	0	0	0	0	35
5:00 AM	0	51	11	3	3	0	0	0	0	0	0	0	0	5	73
6:00 AM	1	77	37	3	10	0	0	0	0	0	0	0	0	10	138
7:00 AM	3	**117**	53	**10**	**19**	1	0	0	3	0	0	0	0	**15**	**221**
8:00 AM	1	78	**58**	5	16	2	0	0	**5**	0	0	0	0	5	170
9:00 AM	1	50	13	3	8	**5**	0	0	0	0	0	0	0	5	85
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM															
4:00 PM															
5:00 PM															
6:00 PM															
7:00 PM															
8:00 PM															
9:00 PM															
10:00 PM															
11:00 PM															
Day Total	10	435	197	31	61	8	0	0	8	0	0	0	0	41	791
Percent	1.3%	55.0%	24.9%	3.9%	7.7%	1.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	5.2%	
AM Peak Volume	4:00 AM 3	7:00 AM 117	8:00 AM 58	7:00 AM 10	7:00 AM 19	9:00 AM 5			8:00 AM 5					7:00 AM 15	7:00 AM 221
PM Peak Volume															

Comments:

Quality Counts
TRANSPORTATION DATA COLLECTION

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy E of Kualakai Pkwy
SPECIFIC LOCATION: Farrington Hwy E of Kualakai Pkwy
CITY/STATE: Ewa Beach, HI

QC JOB #: 14681202
DIRECTION: WB
DATE: May 07 2018 - May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	124	8658	2892	281	597	116	3	43	90	4	0	0	1	289	13098
Percent	0.9%	66.1%	22.1%	2.1%	4.6%	0.9%	0.0%	0.3%	0.7%	0.0%	0.0%	0.0%	0.0%	2.2%	

ADT 3772

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	25	5	0	1	0	0	0	0	0	0	0	0	1	32
1:00 AM	**2**	7	3	2	0	0	0	0	0	0	0	0	0	1	15
2:00 AM	0	8	5	1	0	0	0	0	0	0	0	0	0	1	15
3:00 AM	0	15	7	1	0	0	0	0	0	0	0	0	0	0	23
4:00 AM	0	53	19	1	0	0	0	0	0	0	0	0	0	0	73
5:00 AM	1	186	77	**4**	5	0	0	1	0	**1**	0	0	0	5	280
6:00 AM	0	222	**93**	4	7	**2**	0	0	0	0	0	0	0	2	330
7:00 AM	0	**269**	83	4	**9**	1	0	**3**	0	0	0	0	0	**6**	**375**
8:00 AM	0	197	82	1	7	0	0	1	**1**	0	0	0	0	3	292
9:00 AM	0	161	51	2	6	0	0	1	0	0	0	0	0	0	221
10:00 AM	1	155	41	2	9	0	0	1	0	0	0	0	0	3	212
11:00 AM	1	157	59	2	6	0	0	0	0	0	0	0	0	1	226
12:00 PM	0	158	69	3	5	0	0	0	0	0	0	0	0	4	239
1:00 PM	**2**	170	48	2	8	0	0	0	0	0	0	0	**1**	5	236
2:00 PM	2	250	69	4	5	0	0	3	0	0	0	0	0	4	337
3:00 PM	0	240	**100**	0	7	0	0	**5**	0	0	0	0	0	4	356
4:00 PM	0	266	95	3	12	0	0	2	**1**	0	0	0	0	**10**	389
5:00 PM	1	**283**	97	**5**	**15**	0	0	0	0	**2**	0	0	0	10	**413**
6:00 PM	1	222	74	2	6	0	0	1	0	0	0	0	0	6	312
7:00 PM	1	188	58	2	2	0	0	0	0	0	0	0	0	2	253
8:00 PM	1	149	47	3	6	0	0	1	0	0	0	0	0	2	209
9:00 PM	0	113	35	2	1	0	0	0	0	0	0	0	0	2	153
10:00 PM	0	64	22	3	2	0	0	0	0	0	0	0	0	0	91
11:00 PM	0	27	13	1	0	0	0	0	0	0	0	0	0	0	41
Day Total	13	3585	1252	54	119	3	0	19	2	3	0	0	1	72	5123
Percent	0.3%	70.0%	24.4%	1.1%	2.3%	0.1%	0.0%	0.4%	0.0%	0.1%	0.0%	0.0%	0.0%	1.4%	
ADT 5123															
AM Peak Volume	1:00 AM 2	7:00 AM 269	6:00 AM 93	5:00 AM 4	7:00 AM 9	6:00 AM 2		7:00 AM 3	8:00 AM 1	5:00 AM 1				7:00 AM 6	7:00 AM 375
PM Peak Volume	1:00 PM 2	5:00 PM 283	3:00 PM 100	5:00 PM 5	5:00 PM 15			3:00 PM 5	4:00 PM 1	5:00 PM 2			1:00 PM 1	4:00 PM 10	5:00 PM 413

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	24	7	0	0	0	0	0	0	0	0	0	0	0	31
1:00 AM	0	10	3	2	0	0	0	0	0	0	0	0	0	0	15
2:00 AM	0	8	6	1	0	0	0	0	0	0	0	0	0	0	15
3:00 AM	0	7	8	1	0	0	0	0	0	0	0	0	0	0	16
4:00 AM	1	55	19	1	0	1	0	0	0	0	0	0	0	0	77
5:00 AM	0	177	78	4	1	1	0	1	**1**	0	0	0	0	6	269
6:00 AM	1	223	**90**	4	8	0	0	1	0	0	0	0	0	5	332
7:00 AM	0	**263**	87	3	10	0	0	**2**	0	1	0	0	0	**8**	**374**
8:00 AM	**2**	199	77	3	**13**	1	0	1	1	0	0	0	0	8	305
9:00 AM	0	173	76	**5**	9	1	0	1	0	**2**	0	0	0	5	272
10:00 AM	2	194	57	0	6	**4**	0	0	0	0	0	0	0	5	268
11:00 AM	0	194	58	1	6	1	**1**	2	0	0	0	0	0	3	266
12:00 PM	0	191	66	3	9	1	0	2	**1**	0	0	0	0	4	277
1:00 PM	2	202	89	**5**	**11**	**2**	**1**	**5**	0	1	0	0	0	**8**	326
2:00 PM	0	**266**	88	4	11	0	0	4	0	0	0	0	0	4	**377**
3:00 PM	**3**	248	**104**	4	6	0	0	4	0	0	0	0	0	6	375
4:00 PM	3	259	80	2	7	0	0	1	0	0	0	0	0	4	356
5:00 PM	3	214	61	4	4	0	0	1	0	**2**	0	0	0	5	294
6:00 PM	1	209	52	2	8	0	0	2	0	0	0	0	0	5	279
7:00 PM	1	168	61	2	4	0	1	1	0	0	0	0	0	3	241
8:00 PM	1	147	51	2	4	0	0	1	0	0	0	0	0	3	209
9:00 PM	0	116	26	2	4	0	0	0	0	0	0	0	0	1	149
10:00 PM	0	78	21	2	0	0	0	0	0	0	0	0	0	0	101
11:00 PM	0	37	10	1	0	0	0	0	0	0	0	0	0	0	48
Day Total	20	3662	1275	58	121	12	3	29	3	6	0	0	0	83	5272
Percent	0.4%	69.5%	24.2%	1.1%	2.3%	0.2%	0.1%	0.6%	0.1%	0.1%	0.0%	0.0%	0.0%	1.6%	
ADT 5272															
AM Peak Volume	8:00 AM 2	7:00 AM 263	6:00 AM 90	9:00 AM 5	8:00 AM 13	10:00 AM 4	11:00 AM 1	7:00 AM 2	5:00 AM 1	9:00 AM 2				7:00 AM 8	7:00 AM 374
PM Peak Volume	3:00 PM 3	2:00 PM 266	3:00 PM 104	1:00 PM 5	1:00 PM 11	1:00 PM 2	1:00 PM 1	1:00 PM 5	12:00 PM 1	5:00 PM 2				1:00 PM 8	2:00 PM 377

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	13	6	1	0	0	0	0	0	0	0	0	0	0	20
1:00 AM	0	12	1	1	0	0	0	0	0	0	0	0	0	0	14
2:00 AM	0	14	5	1	0	0	0	0	0	0	0	0	0	1	21
3:00 AM	0	15	8	2	0	0	0	0	0	0	0	0	0	0	25
4:00 AM	0	51	25	1	0	0	0	0	0	0	0	0	0	2	79
5:00 AM	**1**	173	78	3	3	0	0	1	0	0	0	0	0	4	263
6:00 AM	0	196	**82**	**5**	8	0	0	2	0	0	0	0	0	**7**	300
7:00 AM	1	**265**	77	3	6	**1**	0	**3**	**1**	**2**	0	0	0	2	**361**
8:00 AM	1	195	76	3	8	0	0	0	0	0	0	0	0	7	290
9:00 AM	1	153	71	1	4	0	0	2	0	0	0	0	0	4	236
10:00 AM	0	149	61	2	4	0	0	0	0	0	0	0	0	2	218
11:00 AM	1	177	75	2	**10**	1	0	2	0	0	0	0	0	4	272
12:00 PM	0	144	62	2	6	**1**	0	1	0	0	0	0	0	9	225
1:00 PM	0	151	63	2	6	0	0	2	0	0	0	0	0	4	228
2:00 PM	1	240	82	2	4	0	0	0	0	0	0	0	0	8	337
3:00 PM	0	214	86	5	**7**	0	0	0	0	0	0	0	0	**12**	324
4:00 PM	1	232	**91**	2	7	1	0	**3**	0	0	0	0	0	10	**347**
5:00 PM	**4**	**244**	76	**6**	7	0	0	1	0	0	0	0	0	4	342
6:00 PM	1	215	70	2	4	0	0	1	0	0	0	0	0	9	302
7:00 PM	0	168	44	2	3	0	0	1	0	0	0	0	0	6	224
8:00 PM	0	139	45	0	4	0	0	1	0	0	0	0	0	2	191
9:00 PM	1	115	37	2	2	0	0	1	0	0	0	0	0	1	159
10:00 PM	0	73	23	1	0	0	0	0	0	0	0	0	0	3	100
11:00 PM	0	38	16	2	0	0	0	0	0	0	0	0	0	0	56
Day Total	13	3386	1260	53	93	4	0	21	1	2	0	0	0	101	4934
Percent	0.3%	68.6%	25.5%	1.1%	1.9%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	
ADT 4934															
AM Peak	5:00 AM	7:00 AM	6:00 AM	6:00 AM	11:00 AM	7:00 AM		7:00 AM	7:00 AM	7:00 AM				6:00 AM	7:00 AM
Volume	1	265	82	5	10	1		3	1	2				7	361
PM Peak	5:00 PM	5:00 PM	4:00 PM	5:00 PM	3:00 PM	12:00 PM		4:00 PM						3:00 PM	4:00 PM
Volume	4	244	91	6	7	1		3						12	347

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	24	8	1	1	0	0	0	0	0	0	0	0	0	34
1:00 AM	0	14	5	1	0	0	0	0	0	0	0	0	0	0	20
2:00 AM	**2**	5	3	1	1	0	0	0	0	0	0	0	0	1	13
3:00 AM	0	12	5	2	0	0	0	0	0	0	0	0	0	0	19
4:00 AM	0	38	20	1	1	0	0	0	0	0	0	0	0	0	60
5:00 AM	0	168	74	**5**	6	0	0	0	0	0	0	0	0	2	255
6:00 AM	1	209	77	4	7	0	0	2	0	0	0	0	0	**5**	305
7:00 AM	2	**243**	**81**	4	5	**1**	0	1	0	0	**1**	0	0	4	**342**
8:00 AM	2	214	67	4	7	0	0	0	0	0	0	0	**1**	5	300
9:00 AM	1	178	68	3	4	0	0	0	0	**1**	0	0	0	2	257
10:00 AM	2	172	75	2	7	0	0	1	0	0	0	0	0	2	261
11:00 AM	0	199	55	2	**8**	0	0	**3**	0	0	0	0	0	4	271
12:00 PM	0	195	59	2	10	0	0	1	**1**	0	0	0	0	5	273
1:00 PM	0	206	72	1	7	**2**	0	4	0	0	0	0	0	10	302
2:00 PM	0	251	89	3	5	1	0	3	0	0	0	0	0	**15**	**367**
3:00 PM	0	**255**	**92**	3	4	0	0	2	1	0	0	0	0	8	365
4:00 PM	1	245	90	3	**13**	0	0	0	0	**2**	0	0	0	11	365
5:00 PM	0	233	80	**5**	6	0	0	1	0	1	0	0	0	10	336
6:00 PM	**3**	241	52	3	7	0	0	**6**	0	0	0	0	0	7	319
7:00 PM	0	194	65	2	7	1	0	4	0	1	0	**1**	0	3	278
8:00 PM	0	154	38	2	2	0	0	0	0	0	0	0	0	3	199
9:00 PM	1	136	39	1	2	0	0	2	0	0	0	0	0	1	182
10:00 PM	0	96	35	2	1	0	0	0	0	0	0	0	0	1	135
11:00 PM	0	65	19	1	3	0	0	0	0	0	0	0	0	0	88
Day Total	15	3747	1268	58	114	5	0	30	2	5	1	1	1	99	5346
Percent	0.3%	70.1%	23.7%	1.1%	2.1%	0.1%	0.0%	0.6%	0.0%	0.1%	0.0%	0.0%	0.0%	1.9%	
ADT 5346															
AM Peak Volume	2:00 AM 2	7:00 AM 243	7:00 AM 81	5:00 AM 5	11:00 AM 8	7:00 AM 1		11:00 AM 3		9:00 AM 1	7:00 AM 1		8:00 AM 1	6:00 AM 5	7:00 AM 342
PM Peak Volume	6:00 PM 3	3:00 PM 255	3:00 PM 92	5:00 PM 5	4:00 PM 13	1:00 PM 2		6:00 PM 6	12:00 PM 1	4:00 PM 2		7:00 PM 1		2:00 PM 15	2:00 PM 367

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 12 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	31	8	1	0	0	0	0	0	0	0	0	0	1	41
1:00 AM	0	25	2	1	3	0	0	0	0	0	0	0	0	0	31
2:00 AM	0	20	6	0	0	0	0	0	0	0	0	0	0	0	26
3:00 AM	0	16	5	1	1	0	0	0	0	0	0	0	0	0	23
4:00 AM	0	26	10	1	0	0	0	0	0	0	0	0	0	1	38
5:00 AM	1	31	21	**2**	1	0	0	0	0	0	0	0	0	2	58
6:00 AM	0	64	28	2	3	0	0	2	0	0	0	0	0	0	99
7:00 AM	2	108	47	2	5	0	0	1	0	0	0	0	0	4	169
8:00 AM	0	169	68	2	0	0	0	0	**1**	0	0	0	0	5	245
9:00 AM	0	187	55	2	6	0	0	**3**	0	0	0	0	0	**7**	260
10:00 AM	0	**214**	77	2	5	0	0	1	0	0	0	0	0	5	304
11:00 AM	**3**	205	**85**	1	**10**	0	0	2	0	0	0	0	0	6	**312**
12:00 PM	2	215	**86**	2	3	1	0	2	0	0	0	0	0	7	**318**
1:00 PM	2	208	68	**3**	**5**	0	0	**3**	0	0	0	0	0	6	295
2:00 PM	2	**223**	67	1	4	**2**	0	3	0	0	0	0	0	3	305
3:00 PM	1	185	57	2	4	0	0	2	0	0	0	0	0	6	257
4:00 PM	1	210	75	2	5	1	0	0	0	**1**	0	0	0	**8**	303
5:00 PM	1	204	55	2	5	0	0	1	0	0	0	0	0	4	272
6:00 PM	**3**	206	66	2	2	0	0	1	0	0	0	0	0	3	283
7:00 PM	0	169	49	2	1	1	0	1	0	0	0	0	0	1	224
8:00 PM	1	154	53	1	0	0	0	0	0	0	0	0	0	3	212
9:00 PM	1	142	45	3	3	0	0	0	0	0	0	0	0	0	194
10:00 PM	0	118	25	1	3	0	0	1	0	0	0	0	0	3	151
11:00 PM	0	67	25	0	2	0	0	0	0	0	0	0	0	1	95
Day Total	20	3197	1083	38	71	5	0	23	1	1	0	0	0	76	4515
Percent	0.4%	70.8%	24.0%	0.8%	1.6%	0.1%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	
ADT 4515															
AM Peak	11:00 AM	10:00 AM	11:00 AM	5:00 AM	11:00 AM			9:00 AM	8:00 AM					9:00 AM	11:00 AM
Volume	3	214	85	2	10			3	1					7	312
PM Peak	6:00 PM	2:00 PM	12:00 PM	1:00 PM	1:00 PM	2:00 PM		1:00 PM		4:00 PM				4:00 PM	12:00 PM
Volume	3	223	86	3	5	2		3		1				8	318

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 13 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	49	10	1	0	0	0	0	0	0	0	0	0	1	61
1:00 AM	1	26	6	1	0	0	0	0	0	0	0	0	0	0	34
2:00 AM	0	19	6	1	0	0	0	0	0	0	0	0	0	1	27
3:00 AM	0	14	5	1	1	0	0	0	0	0	0	0	0	0	21
4:00 AM	0	17	9	1	2	0	0	1	0	0	0	0	0	1	31
5:00 AM	0	26	14	**2**	1	0	0	0	0	0	0	0	0	0	43
6:00 AM	0	52	17	2	2	0	0	0	0	0	0	0	0	**3**	76
7:00 AM	1	101	55	2	1	0	0	0	0	0	0	0	0	1	161
8:00 AM	1	160	**70**	2	6	0	0	0	0	0	0	0	0	2	241
9:00 AM	**4**	161	70	2	**7**	0	0	0	0	0	0	0	0	3	247
10:00 AM	4	179	63	2	5	0	0	**2**	0	0	0	0	0	3	258
11:00 AM	2	**183**	65	1	5	0	0	2	0	0	0	0	0	3	**261**
12:00 PM	**5**	193	**66**	**2**	2	0	0	1	0	0	0	0	0	6	275
1:00 PM	0	188	63	1	**6**	0	0	1	0	0	0	0	0	**9**	268
2:00 PM	1	184	60	2	4	0	0	**5**	0	0	0	0	0	2	258
3:00 PM	0	171	50	2	3	0	0	0	0	**1**	0	0	0	5	232
4:00 PM	2	**202**	61	2	5	0	0	0	0	1	0	0	0	5	**278**
5:00 PM	1	198	57	1	2	0	0	1	0	0	0	0	0	7	267
6:00 PM	0	181	42	2	2	0	0	0	0	0	0	0	0	5	232
7:00 PM	0	144	45	2	2	0	0	2	0	0	0	0	0	4	199
8:00 PM	1	132	39	2	4	0	0	1	0	0	0	0	0	5	184
9:00 PM	0	100	33	1	0	0	0	2	0	0	0	0	0	0	136
10:00 PM	0	57	15	1	3	0	0	0	0	0	0	0	0	2	78
11:00 PM	0	45	6	1	0	0	0	0	0	0	0	0	0	0	52
Day Total	23	2782	927	37	63	0	0	18	0	2	0	0	0	68	3920
Percent	0.6%	71.0%	23.6%	0.9%	1.6%	0.0%	0.0%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	1.7%	
ADT 3920															
AM Peak Volume	9:00 AM 4	11:00 AM 183	8:00 AM 70	5:00 AM 2	9:00 AM 7			10:00 AM 2						6:00 AM 3	11:00 AM 261
PM Peak Volume	12:00 PM 5	4:00 PM 202	12:00 PM 66	12:00 PM 2	1:00 PM 6			2:00 PM 5		3:00 PM 1				1:00 PM 9	4:00 PM 278

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	21	4	1	1	0	0	0	0	0	0	0	0	0	27
1:00 AM	0	3	1	2	0	0	0	0	0	0	0	0	0	1	7
2:00 AM	0	9	6	1	0	0	0	0	0	0	0	0	0	0	16
3:00 AM	0	7	9	1	0	0	0	0	0	0	0	0	0	0	17
4:00 AM	0	53	19	3	1	0	0	0	0	0	0	0	0	1	77
5:00 AM	0	185	81	5	4	0	0	0	0	0	0	0	0	3	278
6:00 AM	0	233	79	**6**	8	0	0	1	0	0	0	0	0	**7**	334
7:00 AM	0	**277**	84	3	10	**1**	0	**6**	0	0	0	0	0	6	**387**
8:00 AM	**1**	205	**85**	1	**13**	1	0	3	0	**1**	0	0	0	5	315
9:00 AM	1	157	65	2	12	1	0	0	0	0	0	0	0	7	245
10:00 AM	1	170	47	1	8	1	0	1	0	0	0	0	0	4	233
11:00 AM	0	161	65	2	13	1	0	0	0	0	0	0	0	4	246
12:00 PM	0	136	50	**4**	6	**1**	0	2	0	0	0	0	0	3	202
1:00 PM	0	145	68	3	5	0	0	0	0	0	0	0	0	1	222
2:00 PM	1	264	**85**	1	5	1	0	1	0	**1**	0	0	0	**9**	368
3:00 PM	1	255	79	3	**13**	1	0	**5**	0	0	0	0	0	8	365
4:00 PM	0	**274**	78	3	9	1	0	3	0	0	0	0	0	2	**370**
5:00 PM	**2**	216	72	4	7	0	0	1	0	0	**1**	0	0	7	310
6:00 PM	2	214	67	2	5	0	0	0	0	0	0	0	0	7	297
7:00 PM	0	153	48	2	2	0	0	0	0	0	0	0	0	3	208
8:00 PM	1	143	42	2	3	0	0	2	0	0	0	0	0	3	196
9:00 PM	0	117	31	1	1	0	0	0	0	1	0	0	0	2	153
10:00 PM	0	62	16	2	3	0	0	1	0	0	0	0	0	2	86
11:00 PM	0	34	9	1	1	0	0	0	0	0	0	0	0	0	45
Day Total	10	3494	1190	56	130	9	0	26	0	3	1	0	0	85	5004
Percent	0.2%	69.8%	23.8%	1.1%	2.6%	0.2%	0.0%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	1.7%	

ADT 5004

AM Peak	8:00 AM	7:00 AM	8:00 AM	6:00 AM	8:00 AM	7:00 AM		7:00 AM		8:00 AM				6:00 AM	7:00 AM
Volume	1	277	85	6	13	1		6		1				7	387
PM Peak	5:00 PM	4:00 PM	2:00 PM	12:00 PM	3:00 PM	12:00 PM		3:00 PM		2:00 PM	5:00 PM			2:00 PM	4:00 PM
Volume	2	274	85	4	13	1		5		1	1			9	370

Comments:

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: EB
DATE: May 08 2018 - May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	114	23853	8255	354	711	38	3	166	9	22	2	1	2	584	34114
Percent	0.3%	69.9%	24.2%	1.0%	2.1%	0.1%	0.0%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	1.7%	

ADT 4873

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 08 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	32	6	2	0	0	0	0	0	0	0	0	0	0	40
1:00 AM	0	11	5	1	0	0	0	0	0	0	0	0	0	0	17
2:00 AM	0	10	2	1	0	0	0	0	0	0	0	0	0	0	13
3:00 AM	0	12	2	1	1	0	0	0	0	0	0	0	0	0	16
4:00 AM	0	22	11	1	1	0	0	0	0	0	0	0	0	2	37
5:00 AM	0	88	25	4	3	0	0	1	0	0	0	0	0	1	122
6:00 AM	0	130	48	**5**	4	0	0	**2**	0	0	0	0	0	3	192
7:00 AM	0	**319**	**54**	5	**10**	0	0	1	0	0	0	0	0	**6**	**395**
8:00 AM	0	191	42	1	4	0	0	1	0	0	0	0	0	3	242
9:00 AM	0	199	54	3	7	0	0	1	0	0	0	0	0	6	270
10:00 AM	0	229	46	5	8	**1**	0	1	0	0	0	0	0	6	296
11:00 AM	**1**	215	52	2	5	1	0	1	0	**1**	0	0	0	5	283
12:00 PM	0	236	41	3	9	**1**	0	2	0	0	0	0	0	8	300
1:00 PM	0	306	59	3	3	0	0	2	0	0	0	0	0	9	382
2:00 PM	0	296	57	2	6	0	0	1	0	0	0	0	0	7	369
3:00 PM	1	355	83	3	3	0	0	2	0	0	0	0	0	8	455
4:00 PM	**2**	**365**	**94**	2	**12**	0	0	**3**	0	**1**	0	0	0	**14**	**493**
5:00 PM	0	337	77	**4**	3	0	0	2	0	0	0	0	0	5	428
6:00 PM	1	296	69	4	3	0	0	3	0	0	0	0	0	8	384
7:00 PM	1	228	42	4	3	0	0	1	0	0	0	0	0	2	281
8:00 PM	0	177	34	1	2	1	0	0	0	0	0	0	0	3	218
9:00 PM	0	149	32	3	1	0	0	0	0	0	0	0	0	4	189
10:00 PM	1	93	21	1	0	0	0	0	0	0	0	0	0	1	117
11:00 PM	0	37	9	1	1	0	0	0	0	0	0	0	0	1	49
Day Total	7	4333	965	62	89	4	0	24	0	2	0	0	0	102	5588
Percent	0.1%	77.5%	17.3%	1.1%	1.6%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	
ADT 5588															
AM Peak	11:00 AM	7:00 AM	7:00 AM	6:00 AM	7:00 AM	10:00 AM		6:00 AM		11:00 AM				7:00 AM	7:00 AM
Volume	1	319	54	5	10	1		2		1				6	395
PM Peak	4:00 PM	4:00 PM	4:00 PM	5:00 PM	4:00 PM	12:00 PM		4:00 PM		4:00 PM				4:00 PM	4:00 PM
Volume	2	365	94	4	12	1		3		1				14	493

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 09 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	25	7	2	1	0	0	0	0	0	0	0	0	0	35
1:00 AM	0	10	2	1	0	0	0	0	0	0	0	0	0	0	13
2:00 AM	0	13	5	1	0	0	0	0	0	0	0	0	0	0	19
3:00 AM	0	7	4	2	1	0	0	0	0	0	0	0	0	1	15
4:00 AM	0	36	5	1	0	**1**	0	0	0	0	0	0	0	0	43
5:00 AM	0	82	25	**4**	4	0	0	0	0	0	0	0	0	1	116
6:00 AM	**1**	156	33	4	7	0	0	0	0	0	0	0	0	6	207
7:00 AM	1	**330**	**62**	4	7	0	0	3	0	0	0	0	0	5	**412**
8:00 AM	0	190	36	2	4	1	0	**4**	0	0	0	0	0	**10**	247
9:00 AM	1	193	46	2	**10**	0	0	0	0	0	0	0	0	4	256
10:00 AM	0	196	44	2	3	0	0	1	0	**1**	0	0	0	5	252
11:00 AM	1	207	46	1	6	0	0	1	0	0	0	0	0	8	270
12:00 PM	**1**	238	52	4	**15**	0	0	0	0	0	0	0	0	5	315
1:00 PM	1	260	65	**7**	8	0	0	0	0	0	0	0	0	4	345
2:00 PM	1	292	64	3	7	0	0	**3**	0	0	**1**	0	0	7	378
3:00 PM	0	367	**80**	3	6	**1**	0	1	0	0	0	0	0	7	465
4:00 PM	0	358	78	5	7	0	0	3	0	0	0	0	0	**11**	462
5:00 PM	0	**395**	63	4	4	0	0	2	0	0	0	0	0	6	**474**
6:00 PM	0	327	61	3	3	0	0	2	0	0	0	0	0	5	401
7:00 PM	1	258	52	5	3	0	0	0	0	0	0	0	0	4	323
8:00 PM	1	179	31	1	2	0	0	1	0	0	0	0	0	6	221
9:00 PM	1	132	35	3	3	0	0	0	0	0	0	0	0	1	175
10:00 PM	0	89	16	1	0	0	0	0	0	0	0	0	0	1	107
11:00 PM	0	55	13	2	0	0	0	0	0	0	0	0	0	1	71
Day Total	10	4395	925	67	101	3	0	21	0	1	1	0	0	98	5622
Percent	0.2%	78.2%	16.5%	1.2%	1.8%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	

ADT 5622

AM Peak	6:00 AM	7:00 AM	7:00 AM	5:00 AM	9:00 AM	4:00 AM		8:00 AM		10:00 AM				8:00 AM	7:00 AM
Volume	1	330	62	4	10	1		4		1				10	412
PM Peak	12:00 PM	5:00 PM	3:00 PM	1:00 PM	12:00 PM	3:00 PM		2:00 PM			2:00 PM			4:00 PM	5:00 PM
Volume	1	395	80	7	15	1		3			1			11	474

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 10 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	26	6	2	0	0	0	0	0	0	0	0	0	0	34
1:00 AM	0	16	2	1	0	0	0	0	0	0	0	0	0	0	19
2:00 AM	0	13	3	1	1	0	0	0	0	0	0	0	0	1	19
3:00 AM	0	8	5	2	0	0	0	0	0	0	0	0	0	1	16
4:00 AM	0	30	7	0	0	0	0	0	0	0	0	0	0	1	38
5:00 AM	0	85	22	**6**	2	0	0	0	0	0	0	0	0	2	117
6:00 AM	0	139	40	4	5	0	0	0	0	0	0	0	0	4	192
7:00 AM	0	**333**	51	4	**7**	**1**	0	**2**	0	0	0	**1**	0	5	**404**
8:00 AM	0	188	37	4	5	1	0	0	0	0	0	0	0	6	241
9:00 AM	0	178	45	2	5	1	0	0	0	**1**	0	0	0	3	235
10:00 AM	**2**	224	48	2	4	0	0	0	0	0	0	0	0	**8**	288
11:00 AM	0	211	**55**	4	2	0	0	1	**1**	0	0	0	0	6	280
12:00 PM	0	252	46	2	9	0	0	3	0	0	0	0	0	8	320
1:00 PM	0	258	76	3	7	0	0	4	0	0	0	0	0	12	360
2:00 PM	1	302	71	5	4	0	0	1	0	0	0	0	0	8	392
3:00 PM	2	354	77	3	6	0	0	1	0	0	**1**	0	0	**18**	462
4:00 PM	2	349	93	0	6	0	0	**6**	0	0	0	0	0	7	463
5:00 PM	**4**	**369**	**94**	4	8	**1**	0	1	0	0	0	0	0	10	**491**
6:00 PM	0	317	60	**6**	4	0	0	0	0	0	0	0	0	10	397
7:00 PM	1	288	67	4	3	0	0	2	0	0	0	0	0	5	370
8:00 PM	0	351	68	3	**10**	0	0	2	0	0	0	0	0	14	448
9:00 PM	0	279	50	3	0	1	0	0	0	0	0	0	0	4	337
10:00 PM	0	158	29	1	3	0	0	1	0	0	0	0	0	4	196
11:00 PM	0	83	14	2	1	0	0	0	0	0	0	0	0	0	100
Day Total	12	4811	1066	68	92	5	0	24	1	1	1	1	0	137	6219
Percent	0.2%	77.4%	17.1%	1.1%	1.5%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	
ADT 6219															
AM Peak	10:00 AM	7:00 AM	11:00 AM	5:00 AM	7:00 AM	7:00 AM		7:00 AM	11:00 AM	9:00 AM		7:00 AM		10:00 AM	7:00 AM
Volume	2	333	55	6	7	1		2	1	1		1		8	404
PM Peak	5:00 PM	5:00 PM	5:00 PM	6:00 PM	8:00 PM	5:00 PM		4:00 PM			3:00 PM			3:00 PM	5:00 PM
Volume	4	369	94	6	10	1		6			1			18	491

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 11 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	33	5	2	1	0	0	0	0	0	0	0	0	1	42
1:00 AM	0	19	6	1	1	0	0	0	0	0	0	0	0	1	28
2:00 AM	0	13	5	1	0	0	0	0	0	0	0	0	0	0	19
3:00 AM	0	7	8	2	0	0	0	0	0	0	0	0	0	0	17
4:00 AM	0	31	5	0	0	0	0	0	0	0	0	0	0	0	36
5:00 AM	0	96	22	**6**	6	0	0	0	0	0	0	0	0	1	131
6:00 AM	0	146	41	5	5	0	0	0	0	0	0	0	0	4	201
7:00 AM	**1**	**334**	54	3	4	1	0	**3**	0	0	0	0	0	6	**406**
8:00 AM	0	196	52	2	7	0	0	3	0	0	0	0	0	5	265
9:00 AM	1	210	59	3	4	0	0	1	0	**1**	0	0	0	4	283
10:00 AM	0	247	61	3	**10**	0	0	1	0	0	0	0	0	**7**	329
11:00 AM	0	230	**67**	4	4	**2**	0	1	0	0	0	0	0	4	312
12:00 PM	2	198	67	**8**	27	0	0	**2**	0	0	0	0	0	**44**	348
1:00 PM	0	205	112	7	**61**	0	0	1	0	0	0	0	0	34	420
2:00 PM	0	245	112	4	31	0	0	0	0	0	0	0	0	22	414
3:00 PM	**3**	309	94	4	27	**1**	0	0	0	0	0	0	0	26	464
4:00 PM	0	309	93	7	34	0	0	0	0	0	0	0	0	42	485
5:00 PM	1	**329**	**129**	5	31	0	0	0	0	0	0	0	0	38	**533**
6:00 PM	0	287	94	4	24	0	0	0	0	0	0	0	0	22	431
7:00 PM	1	206	57	3	22	0	0	0	0	0	0	0	0	18	307
8:00 PM	0	185	40	4	12	0	0	0	0	0	0	0	0	11	252
9:00 PM	1	168	43	1	10	0	0	0	0	0	0	0	0	5	228
10:00 PM	1	128	35	1	12	0	0	0	0	0	0	0	0	2	179
11:00 PM	1	88	13	4	3	0	0	0	0	0	0	0	0	1	110
Day Total	12	4219	1274	84	336	4	0	12	0	1	0	0	0	298	6240
Percent	0.2%	67.6%	20.4%	1.3%	5.4%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	

ADT 6240

AM Peak	7:00 AM	7:00 AM	11:00 AM	5:00 AM	10:00 AM	11:00 AM		7:00 AM		9:00 AM				10:00 AM	7:00 AM
Volume	1	334	67	6	10	2		3		1				7	406
PM Peak	3:00 PM	5:00 PM	5:00 PM	12:00 PM	1:00 PM	3:00 PM		12:00 PM						12:00 PM	5:00 PM
Volume	3	329	129	8	61	1		2						44	533

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 12 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	30	4	1	7	0	0	0	0	0	0	0	0	0	42
1:00 AM	0	23	4	0	8	0	0	0	0	0	0	0	0	1	36
2:00 AM	0	19	7	1	0	0	0	0	0	0	0	0	0	0	27
3:00 AM	1	17	1	1	2	0	0	0	0	0	0	0	0	1	23
4:00 AM	0	25	5	0	2	0	0	0	0	0	0	0	0	1	33
5:00 AM	5	41	4	1	3	0	0	0	0	0	0	0	0	3	57
6:00 AM	2	84	19	2	9	0	0	0	0	0	0	0	0	4	120
7:00 AM	11	118	24	1	18	0	0	0	0	0	0	0	0	5	177
8:00 AM	11	169	30	**3**	22	0	0	0	0	0	0	0	0	9	244
9:00 AM	**14**	226	45	3	39	0	0	0	0	0	0	0	0	14	341
10:00 AM	9	258	**58**	1	35	0	0	0	0	0	0	0	0	23	384
11:00 AM	11	**275**	51	3	**42**	0	0	0	0	0	0	0	0	**26**	**408**
12:00 PM	**19**	**281**	51	1	**38**	0	0	0	0	0	0	0	0	8	**398**
1:00 PM	6	246	55	0	37	0	0	0	0	0	0	0	0	23	367
2:00 PM	2	275	55	**6**	15	0	0	0	0	0	0	0	0	23	376
3:00 PM	5	254	53	0	16	0	0	0	0	0	0	0	0	**27**	355
4:00 PM	13	273	40	2	21	0	0	0	0	0	0	0	0	25	374
5:00 PM	4	233	42	3	16	0	0	0	0	0	0	0	0	14	312
6:00 PM	4	230	41	1	10	0	0	0	0	0	0	0	0	15	301
7:00 PM	2	231	47	2	6	0	0	0	0	0	0	0	0	9	297
8:00 PM	2	184	**57**	4	19	0	0	0	0	0	0	0	0	9	275
9:00 PM	2	160	34	2	8	0	0	0	0	0	0	0	0	11	217
10:00 PM	1	104	25	1	9	0	0	0	0	0	0	0	0	4	144
11:00 PM	0	73	15	1	8	0	0	0	0	0	0	0	0	2	99
Day Total	124	3829	767	40	390	0	0	0	0	0	0	0	0	257	5407
Percent	2.3%	70.8%	14.2%	0.7%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	

ADT 5407

AM Peak	9:00 AM	11:00 AM	10:00 AM	8:00 AM	11:00 AM									11:00 AM	11:00 AM
Volume	14	275	58	3	42									26	408
PM Peak	12:00 PM	12:00 PM	8:00 PM	2:00 PM	12:00 PM									3:00 PM	12:00 PM
Volume	19	281	57	6	38									27	398

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 13 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	46	10	1	5	0	0	0	0	0	0	0	0	1	64
1:00 AM	1	21	0	0	4	0	0	0	0	0	0	0	0	0	26
2:00 AM	0	15	1	1	4	0	0	0	0	0	0	0	0	1	22
3:00 AM	0	13	3	0	5	0	0	0	0	0	0	0	0	1	22
4:00 AM	0	8	7	1	3	0	0	0	0	0	0	0	0	1	20
5:00 AM	0	36	9	0	5	0	0	0	0	0	0	0	0	4	54
6:00 AM	9	78	24	1	5	0	0	0	0	0	0	0	0	5	122
7:00 AM	3	111	20	**4**	13	0	0	0	0	0	0	0	0	2	153
8:00 AM	7	149	35	0	17	0	0	**1**	0	0	0	0	0	5	214
9:00 AM	13	192	**47**	2	**24**	0	0	0	0	0	0	0	0	11	289
10:00 AM	**15**	244	47	3	24	0	0	0	0	0	0	0	0	12	345
11:00 AM	11	**263**	38	3	20	0	0	0	0	0	0	0	0	**17**	**352**
12:00 PM	5	**272**	29	1	21	0	0	0	0	0	0	0	0	15	343
1:00 PM	8	240	**54**	1	25	0	0	0	0	0	0	0	0	16	**344**
2:00 PM	6	243	45	0	19	0	0	0	0	0	0	0	0	**23**	336
3:00 PM	**10**	210	43	0	**28**	0	0	0	0	0	0	0	0	10	301
4:00 PM	8	260	36	1	18	0	0	0	0	0	0	0	0	9	332
5:00 PM	8	230	51	0	18	0	0	0	0	0	0	0	0	19	326
6:00 PM	8	208	34	**2**	16	0	0	0	0	0	0	0	0	8	276
7:00 PM	4	177	39	1	8	0	0	0	0	0	0	0	0	8	237
8:00 PM	2	170	27	2	12	0	0	0	0	0	0	0	0	7	220
9:00 PM	7	97	24	0	16	0	0	0	0	0	0	0	0	5	149
10:00 PM	0	57	13	1	8	0	0	0	0	0	0	0	0	2	81
11:00 PM	0	42	10	2	2	0	0	0	0	0	0	0	0	0	56
Day Total	126	3382	646	27	320	0	0	1	0	0	0	0	0	182	4684
Percent	2.7%	72.2%	13.8%	0.6%	6.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.9%	
ADT 4684															
AM Peak	10:00 AM	11:00 AM	9:00 AM	7:00 AM	9:00 AM			8:00 AM						11:00 AM	11:00 AM
Volume	15	263	47	4	24			1						17	352
PM Peak	3:00 PM	12:00 PM	1:00 PM	6:00 PM	3:00 PM									2:00 PM	1:00 PM
Volume	10	272	54	2	28									23	344

Comments:

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	1	20	5	1	3	0	0	0	0	0	0	0	0	1	31
1:00 AM	0	9	2	0	3	0	0	0	0	0	0	0	0	1	15
2:00 AM	0	12	0	0	1	0	0	0	0	0	0	0	0	1	14
3:00 AM	0	8	3	0	2	0	0	0	0	0	0	0	0	0	13
4:00 AM	0	27	9	0	2	0	0	0	0	0	0	0	0	3	41
5:00 AM	3	79	27	3	9	0	0	0	0	0	0	0	0	3	124
6:00 AM	6	136	23	2	16	0	0	0	0	0	0	0	0	2	185
7:00 AM	10	**296**	38	**5**	**48**	0	0	0	0	0	0	0	0	20	**417**
8:00 AM	8	176	35	1	38	0	0	0	0	0	0	0	0	10	268
9:00 AM	11	155	**47**	2	34	0	0	0	0	0	0	0	0	10	259
10:00 AM	20	160	35	5	43	0	0	0	0	0	0	0	0	10	273
11:00 AM	**36**	200	41	2	43	0	0	0	0	0	0	0	0	**21**	343
12:00 PM	**18**	186	48	4	35	**1**	0	0	0	0	0	0	0	15	307
1:00 PM	11	241	48	2	27	0	0	**1**	0	0	0	0	0	20	350
2:00 PM	4	294	69	3	31	0	0	0	0	0	0	0	0	23	424
3:00 PM	4	338	75	2	36	0	0	0	0	0	0	0	0	27	482
4:00 PM	10	**360**	59	1	36	0	0	0	0	0	0	0	0	**32**	**498**
5:00 PM	11	293	**78**	4	**48**	0	0	0	0	0	0	0	0	20	454
6:00 PM	2	306	65	1	24	0	0	0	0	0	0	0	0	13	411
7:00 PM	1	236	48	3	19	0	0	0	0	0	0	0	0	8	315
8:00 PM	5	139	32	**6**	13	0	0	0	0	0	0	0	0	11	206
9:00 PM	3	110	29	3	13	0	0	0	0	0	0	0	0	0	158
10:00 PM	0	85	23	1	8	0	0	0	0	0	0	0	0	1	118
11:00 PM	0	49	13	2	3	0	0	0	0	0	0	0	0	1	68
Day Total	164	3915	852	53	535	1	0	1	0	0	0	0	0	253	5774
Percent	2.8%	67.8%	14.8%	0.9%	9.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	
ADT 5774															
AM Peak Volume	11:00 AM 36	7:00 AM 296	9:00 AM 47	7:00 AM 5	7:00 AM 48									11:00 AM 21	7:00 AM 417
PM Peak Volume	12:00 PM 18	4:00 PM 360	5:00 PM 78	8:00 PM 6	5:00 PM 48	12:00 PM 1		1:00 PM 1						4:00 PM 32	4:00 PM 498

Comments:

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Farrington Hwy E of Kealanani Ave
SPECIFIC LOCATION: Farrington Hwy E of Kealanani Ave
CITY/STATE: Kapolei, HI

QC JOB #: 14681203
DIRECTION: WB
DATE: May 08 2018 - May 14 2018

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	455	28884	6495	401	1863	17	0	83	1	5	2	1	0	1327	39534
Percent	1.2%	73.1%	16.4%	1.0%	4.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	
ADT 5647															

Comments:

Report generated on 5/23/2018 12:23 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

Appendix B

Existing (2018) Intersection Reports

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↖	↑		↗
Traffic Vol, veh/h	645	0	50	215	0	70
Future Vol, veh/h	645	0	50	215	0	70
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	88	88	65	65
Heavy Vehicles, %	1	1	10	10	11	11
Mvmt Flow	838	0	57	244	0	108

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	848	0	-	858
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	6.31
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.29	-	-	3.399
Pot Cap-1 Maneuver	-	0	756	-	0	343
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	750	-	-	337
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	20.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	337	-	750	-
HCM Lane V/C Ratio	0.32	-	0.076	-
HCM Control Delay (s)	20.6	-	10.2	-
HCM Lane LOS	C	-	B	-
HCM 95th %tile Q(veh)	1.3	-	0.2	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	640	25	5	210	25	5
Future Vol, veh/h	640	25	5	210	25	5
Conflicting Peds, #/hr	0	10	10	0	10	10
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	77	77	89	89	75	75
Heavy Vehicles, %	1	1	10	10	4	4
Mvmt Flow	831	32	6	236	33	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	873	0	1115	867
Stage 1	-	-	-	-	857	-
Stage 2	-	-	-	-	258	-
Critical Hdwy	-	-	4.2	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.29	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	740	-	228	349
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	780	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	734	-	222	343
Mov Cap-2 Maneuver	-	-	-	-	222	-
Stage 1	-	-	-	-	409	-
Stage 2	-	-	-	-	767	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	23.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	236	-	-	734	-
HCM Lane V/C Ratio	0.169	-	-	0.008	-
HCM Control Delay (s)	23.3	-	-	9.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	260	60	55	105	75	40	630	280	105	470	115
Future Volume (veh/h)	110	260	60	55	105	75	40	630	280	105	470	115
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	129	306	71	66	127	90	43	685	304	124	553	135
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	1	3	1
Peak Hour Factor	0.85	0.85	0.85	0.83	0.83	0.83	0.92	0.92	0.92	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	184	467	392	101	362	304	73	1580	484	176	1836	564
Arrive On Green	0.11	0.26	0.26	0.06	0.22	0.22	0.04	0.33	0.33	0.11	0.39	0.39
Sat Flow, veh/h	1681	1765	1483	1573	1651	1384	1681	4818	1477	1633	4680	1439
Grp Volume(v), veh/h	129	306	71	66	127	90	43	685	304	124	553	135
Grp Sat Flow(s),veh/h/ln	1681	1765	1483	1573	1651	1384	1681	1606	1477	1633	1560	1439
Q Serve(g_s), s	6.0	12.4	3.0	3.3	5.2	4.4	2.0	9.0	14.1	5.9	6.6	5.1
Cycle Q Clear(g_c), s	6.0	12.4	3.0	3.3	5.2	4.4	2.0	9.0	14.1	5.9	6.6	5.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	467	392	101	362	304	73	1580	484	176	1836	564
V/C Ratio(X)	0.70	0.66	0.18	0.65	0.35	0.30	0.59	0.43	0.63	0.70	0.30	0.24
Avail Cap(c_a), veh/h	646	1312	1103	370	982	824	312	3045	934	627	3886	1195
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.7	26.4	22.9	36.9	26.6	26.3	37.9	21.2	22.9	34.7	16.9	16.4
Incr Delay (d2), s/veh	4.8	1.6	0.2	7.0	0.6	0.5	7.3	0.2	1.3	5.1	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	6.2	1.2	1.6	2.5	1.7	1.1	4.0	5.9	2.9	2.8	2.0
LnGrp Delay(d),s/veh	39.5	28.0	23.1	43.9	27.2	26.8	45.1	21.4	24.3	39.8	17.0	16.7
LnGrp LOS	D	C	C	D	C	C	D	C	C	D	B	B
Approach Vol, veh/h		506			283			1032			812	
Approach Delay, s/veh		30.2			31.0			23.3			20.4	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.7	29.5	10.2	27.3	8.5	34.6	13.8	23.7
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	30.0	47.0	18.0	59.0	14.0	63.0	30.0	47.0
Max Q Clear Time (g_c+I1), s	7.9	16.1	5.3	14.4	4.0	8.6	8.0	7.2
Green Ext Time (p_c), s	0.3	6.4	0.1	2.1	0.0	4.7	0.3	1.0

Intersection Summary	
HCM 2010 Ctrl Delay	24.5
HCM 2010 LOS	C

Notes

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	425	5	15	245	5	5
Future Vol, veh/h	425	5	15	245	5	5
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	88	88	63	63
Heavy Vehicles, %	2	2	5	5	20	20
Mvmt Flow	457	5	17	278	8	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	472	0	653	251
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	183	-
Critical Hdwy	-	-	4.2	-	7.2	7.3
Critical Hdwy Stg 1	-	-	-	-	6.2	-
Critical Hdwy Stg 2	-	-	-	-	6.2	-
Follow-up Hdwy	-	-	2.25	-	3.7	3.5
Pot Cap-1 Maneuver	-	-	1065	-	362	697
Stage 1	-	-	-	-	546	-
Stage 2	-	-	-	-	779	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1056	-	350	685
Mov Cap-2 Maneuver	-	-	-	-	439	-
Stage 1	-	-	-	-	542	-
Stage 2	-	-	-	-	760	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	11.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	439	685	-	-	1056	-
HCM Lane V/C Ratio	0.018	0.012	-	-	0.016	-
HCM Control Delay (s)	13.4	10.3	-	-	8.5	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	220	240	145	220	45	280	65	165	25	35	40
Future Volume (veh/h)	120	220	240	145	220	45	280	65	165	25	35	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1800	1748	1748	1748	1800	1800	1800	1782	1782	1782
Adj Flow Rate, veh/h	141	259	282	177	268	55	333	77	196	29	41	47
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.85	0.85	0.85	0.82	0.82	0.82	0.84	0.84	0.84	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	3	3	3	0	0	0	1	1	1
Cap, veh/h	459	631	558	239	1275	566	539	628	508	453	621	503
Arrive On Green	0.14	0.38	0.38	0.14	0.38	0.38	0.35	0.35	0.33	0.35	0.35	0.33
Sat Flow, veh/h	3198	1644	1452	1664	3320	1474	1320	1800	1516	1106	1782	1501
Grp Volume(v), veh/h	141	259	282	177	268	55	333	77	196	29	41	47
Grp Sat Flow(s),veh/h/ln	1599	1644	1452	1664	1660	1474	1320	1800	1516	1106	1782	1501
Q Serve(g_s), s	2.9	8.4	10.8	7.4	3.9	1.7	16.3	2.1	7.2	1.3	1.1	1.6
Cycle Q Clear(g_c), s	2.9	8.4	10.8	7.4	3.9	1.7	17.5	2.1	7.2	3.4	1.1	1.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	459	631	558	239	1275	566	539	628	508	453	621	503
V/C Ratio(X)	0.31	0.41	0.51	0.74	0.21	0.10	0.62	0.12	0.39	0.06	0.07	0.09
Avail Cap(c_a), veh/h	528	1018	899	435	2376	1055	842	1040	856	706	1030	847
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.9	16.4	17.1	29.8	15.0	14.3	21.6	16.1	18.5	17.3	15.8	16.6
Incr Delay (d2), s/veh	0.4	0.4	0.7	4.5	0.1	0.1	1.2	0.1	0.5	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	3.8	4.4	3.7	1.8	0.7	6.1	1.1	3.1	0.4	0.6	0.7
LnGrp Delay(d),s/veh	28.3	16.8	17.8	34.3	15.1	14.4	22.8	16.2	18.9	17.3	15.8	16.7
LnGrp LOS	C	B	B	C	B	B	C	B	B	B	B	B
Approach Vol, veh/h		682			500			606			117	
Approach Delay, s/veh		19.6			21.8			20.7			16.5	
Approach LOS		B			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		28.3	13.4	30.9		28.3	13.4	30.9
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		41.0	18.0	41.0		41.0	11.0	48.0
Max Q Clear Time (g_c+I1), s		19.5	9.4	12.8		5.4	4.9	5.9
Green Ext Time (p_c), s		2.2	0.3	3.6		0.5	0.2	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	20.3
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	225	110	50	290	280	195	435	75	295	735	800
Future Volume (veh/h)	320	225	110	50	290	280	195	435	75	295	735	800
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1731	1765	1765	1765	1731	1731	1731	1748	1748	1748
Adj Flow Rate, veh/h	390	274	0	52	302	292	229	512	0	343	762	992
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	1	2
Peak Hour Factor	0.82	0.82	0.82	0.96	0.96	0.96	0.85	0.85	0.85	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	2	2	2	4	4	4	3	3	3
Cap, veh/h	472	994	445	90	697	541	283	1394	624	439	816	1373
Arrive On Green	0.15	0.30	0.00	0.05	0.21	0.21	0.09	0.42	0.00	0.13	0.47	0.47
Sat Flow, veh/h	3198	3288	1471	1681	3353	2602	3198	3288	1471	3329	1748	2939
Grp Volume(v), veh/h	390	274	0	52	302	292	229	512	0	343	762	992
Grp Sat Flow(s),veh/h/ln	1599	1644	1471	1681	1676	1301	1599	1644	1471	1664	1748	1470
Q Serve(g_s), s	16.0	8.6	0.0	4.1	10.6	13.6	9.5	14.4	0.0	13.5	55.8	36.8
Cycle Q Clear(g_c), s	16.0	8.6	0.0	4.1	10.6	13.6	9.5	14.4	0.0	13.5	55.8	36.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	472	994	445	90	697	541	283	1394	624	439	816	1373
V/C Ratio(X)	0.83	0.28	0.00	0.58	0.43	0.54	0.81	0.37	0.00	0.78	0.93	0.72
Avail Cap(c_a), veh/h	472	1214	543	149	1040	807	283	1394	624	565	826	1389
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.0	36.0	0.0	62.6	46.7	47.8	60.6	26.6	0.0	56.9	34.1	29.0
Incr Delay (d2), s/veh	10.8	0.1	0.0	2.2	0.4	0.8	14.8	0.2	0.0	3.9	17.2	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	3.9	0.0	2.0	4.9	4.9	4.8	6.6	0.0	6.4	30.8	15.3
LnGrp Delay(d),s/veh	66.8	36.1	0.0	64.8	47.1	48.7	75.3	26.8	0.0	60.8	51.3	30.9
LnGrp LOS	E	D		E	D	D	E	C		E	D	C
Approach Vol, veh/h		664			646			741			2097	
Approach Delay, s/veh		54.1			49.2			41.8			43.2	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.8	60.4	10.2	43.9	15.0	66.3	23.0	31.2
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	21.0	50.0	10.0	47.0	10.0	61.0	18.0	39.0
Max Q Clear Time (g_c+I1), s	15.5	16.4	6.1	10.6	11.5	57.8	18.0	15.6
Green Ext Time (p_c), s	0.3	3.5	0.0	1.8	0.0	2.5	0.0	3.1

Intersection Summary	
HCM 2010 Ctrl Delay	45.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	440	0	0	300	5	0	0	5	0
Future Volume (veh/h)	0	0	0	440	0	0	300	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				478	0	0	326	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				896	0	400	523	980	0	0	275	0
Arrive On Green				0.27	0.00	0.00	0.31	0.56	0.00	0.00	0.16	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				478	0	0	326	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				5.5	0.0	0.0	7.5	0.1	0.0	0.0	0.1	0.0
Cycle Q Clear(g_c), s				5.5	0.0	0.0	7.5	0.1	0.0	0.0	0.1	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				896	0	400	523	980	0	0	275	0
V/C Ratio(X)				0.53	0.00	0.00	0.62	0.01	0.00	0.00	0.02	0.00
Avail Cap(c_a), veh/h				896	0	400	523	980	0	0	275	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				14.1	0.0	0.0	13.2	4.5	0.0	0.0	16.1	0.0
Incr Delay (d2), s/veh				2.3	0.0	0.0	5.5	0.0	0.0	0.0	0.1	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.8	0.0	0.0	4.2	0.0	0.0	0.0	0.1	0.0
LnGrp Delay(d),s/veh				16.4	0.0	0.0	18.8	4.5	0.0	0.0	16.2	0.0
LnGrp LOS				B			B	A			B	
Approach Vol, veh/h					478			331			5	
Approach Delay, s/veh					16.4			18.6			16.2	
Approach LOS					B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		29.0			18.0	11.0		16.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		25.0			14.0	7.0		12.0
Max Q Clear Time (g_c+I1), s		2.1			9.5	2.1		7.5
Green Ext Time (p_c), s		0.0			0.4	0.0		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	17.3
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	250	0	0	0	0	300	515	5	440	0
Future Volume (veh/h)	5	0	250	0	0	0	0	300	515	5	440	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	326	0	5	478	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	448	0	400				0	1118	880	224	1863	0
Arrive On Green	0.27	0.00	0.00				0.00	0.33	0.00	0.27	1.00	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	326	0	5	478	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.1	0.0	0.0				0.0	3.2	0.0	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0				0.0	3.2	0.0	0.1	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	448	0	400				0	1118	880	224	1863	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.29	0.00	0.02	0.26	0.00
Avail Cap(c_a), veh/h	448	0	400				0	1118	880	224	1863	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	12.1	0.0	0.0				0.0	11.1	0.0	14.3	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	0.7	0.0	0.2	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	1.6	0.0	0.1	0.1	0.0
LnGrp Delay(d),s/veh	12.2	0.0	0.0				0.0	11.7	0.0	14.5	0.3	0.0
LnGrp LOS	B							B		B	A	
Approach Vol, veh/h		5						326			483	
Approach Delay, s/veh		12.2						11.7			0.5	
Approach LOS		B						B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	19.0		16.0		29.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	15.0		12.0		25.0		
Max Q Clear Time (g_c+I1), s	2.1	5.2		2.1		2.0		
Green Ext Time (p_c), s	0.0	1.4		0.0		3.2		

Intersection Summary	
HCM 2010 Ctrl Delay	5.1
HCM 2010 LOS	A

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↖	↑		↗
Traffic Vol, veh/h	325	0	195	375	0	45
Future Vol, veh/h	325	0	195	375	0	45
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	96	96	75	75
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	411	0	203	391	0	60

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	421	0	-	431
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.15	-	-	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.245	-	-	3.345
Pot Cap-1 Maneuver	-	0	1122	-	0	618
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	1113	-	-	608
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.1	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	608	-	1113	-
HCM Lane V/C Ratio	0.099	-	0.183	-
HCM Control Delay (s)	11.6	-	9	-
HCM Lane LOS	B	-	A	-
HCM 95th %tile Q(veh)	0.3	-	0.7	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	315	30	5	370	30	10
Future Vol, veh/h	315	30	5	370	30	10
Conflicting Peds, #/hr	0	10	10	0	10	10
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	78	78	97	97	65	65
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	404	38	5	381	46	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	452	0	834	443
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	401	-
Critical Hdwy	-	-	4.12	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.218	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1109	-	337	613
Stage 1	-	-	-	-	652	-
Stage 2	-	-	-	-	674	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1100	-	330	603
Mov Cap-2 Maneuver	-	-	-	-	330	-
Stage 1	-	-	-	-	647	-
Stage 2	-	-	-	-	665	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	16.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	372	-	-	1100	-
HCM Lane V/C Ratio	0.165	-	-	0.005	-
HCM Control Delay (s)	16.6	-	-	8.3	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	195	130	100	135	200	65	60	955	130	25	895	325
Future Volume (veh/h)	195	130	100	135	200	65	60	955	130	25	895	325
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	212	141	109	153	227	74	62	995	135	26	942	342
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	1	3	1
Peak Hour Factor	0.92	0.92	0.92	0.88	0.88	0.88	0.96	0.96	0.96	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	268	447	375	206	383	321	96	1829	562	54	1740	534
Arrive On Green	0.16	0.26	0.26	0.12	0.22	0.22	0.06	0.38	0.38	0.03	0.36	0.36
Sat Flow, veh/h	1664	1748	1468	1681	1765	1479	1664	4771	1466	1697	4865	1494
Grp Volume(v), veh/h	212	141	109	153	227	74	62	995	135	26	942	342
Grp Sat Flow(s),veh/h/ln	1664	1748	1468	1681	1765	1479	1664	1590	1466	1697	1622	1494
Q Serve(g_s), s	11.3	6.0	5.5	8.1	10.6	3.8	3.4	14.9	5.7	1.4	14.2	17.5
Cycle Q Clear(g_c), s	11.3	6.0	5.5	8.1	10.6	3.8	3.4	14.9	5.7	1.4	14.2	17.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	268	447	375	206	383	321	96	1829	562	54	1740	534
V/C Ratio(X)	0.79	0.32	0.29	0.74	0.59	0.23	0.64	0.54	0.24	0.48	0.54	0.64
Avail Cap(c_a), veh/h	779	1027	862	603	845	708	308	3374	1037	166	3017	926
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.1	27.7	27.5	38.9	32.3	29.7	42.4	22.1	19.2	43.7	23.5	24.6
Incr Delay (d2), s/veh	5.2	0.4	0.4	5.3	1.5	0.4	7.0	0.3	0.2	6.4	0.3	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	2.9	2.3	4.0	5.3	1.6	1.7	6.6	2.3	0.7	6.4	7.4
LnGrp Delay(d),s/veh	42.3	28.1	27.9	44.2	33.8	30.0	49.4	22.3	19.5	50.1	23.8	25.9
LnGrp LOS	D	C	C	D	C	C	D	C	B	D	C	C
Approach Vol, veh/h		462			454			1192			1310	
Approach Delay, s/veh		34.6			36.7			23.4			24.9	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.9	38.2	16.2	29.5	10.3	35.9	19.8	25.9
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	8.0	61.0	32.0	53.0	16.0	53.0	42.0	43.0
Max Q Clear Time (g_c+I1), s	3.4	16.9	10.1	8.0	5.4	19.5	13.3	12.6
Green Ext Time (p_c), s	0.0	9.2	0.4	1.2	0.1	9.3	0.6	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	27.2
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	345	5	10	575	10	15
Future Vol, veh/h	345	5	10	575	10	15
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	95	95	68	68
Heavy Vehicles, %	3	3	1	1	0	0
Mvmt Flow	416	6	11	605	15	22

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	432	0	764	231
Stage 1	-	-	-	-	429	-
Stage 2	-	-	-	-	335	-
Critical Hdwy	-	-	4.12	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.21	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1131	-	344	777
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	702	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1122	-	335	764
Mov Cap-2 Maneuver	-	-	-	-	451	-
Stage 1	-	-	-	-	625	-
Stage 2	-	-	-	-	689	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	451	764	-	-	1122	-
HCM Lane V/C Ratio	0.033	0.029	-	-	0.009	-
HCM Control Delay (s)	13.3	9.9	-	-	8.2	-
HCM Lane LOS	B	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	230	205	255	200	240	80	290	130	160	55	110	115
Future Volume (veh/h)	230	205	255	200	240	80	290	130	160	55	110	115
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1765	1765	1765	1800	1800	1800
Adj Flow Rate, veh/h	256	228	283	215	258	86	322	144	178	60	121	126
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.93	0.93	0.93	0.90	0.90	0.90	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	0	0
Cap, veh/h	527	573	508	271	1146	508	473	685	560	444	699	571
Arrive On Green	0.16	0.34	0.34	0.16	0.34	0.34	0.39	0.39	0.38	0.39	0.39	0.38
Sat Flow, veh/h	3261	1676	1487	1681	3353	1487	1122	1765	1488	1070	1800	1518
Grp Volume(v), veh/h	256	228	283	215	258	86	322	144	178	60	121	126
Grp Sat Flow(s),veh/h/ln	1630	1676	1487	1681	1676	1487	1122	1765	1488	1070	1800	1518
Q Serve(g_s), s	5.9	8.6	12.9	10.2	4.6	3.4	21.9	4.5	7.0	3.3	3.7	4.7
Cycle Q Clear(g_c), s	5.9	8.6	12.9	10.2	4.6	3.4	25.6	4.5	7.0	7.8	3.7	4.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	527	573	508	271	1146	508	473	685	560	444	699	571
V/C Ratio(X)	0.49	0.40	0.56	0.79	0.23	0.17	0.68	0.21	0.32	0.14	0.17	0.22
Avail Cap(c_a), veh/h	588	908	805	384	1977	877	604	892	734	569	910	749
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.7	20.8	22.2	33.5	19.5	19.1	25.1	16.9	18.4	19.5	16.7	17.6
Incr Delay (d2), s/veh	0.7	0.4	1.0	7.3	0.1	0.2	2.1	0.2	0.3	0.1	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	4.1	5.4	5.3	2.1	1.4	7.1	2.2	2.9	1.0	1.8	2.0
LnGrp Delay(d),s/veh	32.4	21.3	23.2	40.8	19.6	19.3	27.2	17.1	18.7	19.7	16.8	17.8
LnGrp LOS	C	C	C	D	B	B	C	B	B	B	B	B
Approach Vol, veh/h		767			559			644			307	
Approach Delay, s/veh		25.7			27.7			22.6			17.8	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		35.3	16.4	31.4		35.3	16.4	31.4
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		41.0	18.0	41.0		41.0	14.0	45.0
Max Q Clear Time (g_c+I1), s		27.6	12.2	14.9		9.8	7.9	6.6
Green Ext Time (p_c), s		2.4	0.3	3.3		1.4	0.4	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	24.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	815	380	250	60	295	445	115	630	55	275	590	630
Future Volume (veh/h)	815	380	250	60	295	445	115	630	55	275	590	630
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1782	1782	1782	1765	1765	1765	1782	1782	1782
Adj Flow Rate, veh/h	896	418	0	71	347	524	124	677	0	293	551	721
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	1	2
Peak Hour Factor	0.91	0.91	0.91	0.85	0.85	0.85	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	1	1	1
Cap, veh/h	917	1595	713	112	881	686	212	949	424	310	551	922
Arrive On Green	0.28	0.48	0.00	0.07	0.26	0.26	0.07	0.28	0.00	0.09	0.31	0.31
Sat Flow, veh/h	3261	3353	1500	1697	3386	2635	3261	3353	1500	3395	1782	2981
Grp Volume(v), veh/h	896	418	0	71	347	524	124	677	0	293	551	721
Grp Sat Flow(s),veh/h/ln	1630	1676	1500	1697	1693	1318	1630	1676	1500	1697	1782	1490
Q Serve(g_s), s	38.7	10.6	0.0	5.8	12.0	26.1	5.3	25.8	0.0	12.2	44.0	31.3
Cycle Q Clear(g_c), s	38.7	10.6	0.0	5.8	12.0	26.1	5.3	25.8	0.0	12.2	44.0	31.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	917	1595	713	112	881	686	212	949	424	310	551	922
V/C Ratio(X)	0.98	0.26	0.00	0.64	0.39	0.76	0.58	0.71	0.00	0.94	1.00	0.78
Avail Cap(c_a), veh/h	917	1626	728	155	1000	778	275	1014	453	310	551	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.7	22.3	0.0	64.8	43.4	48.6	64.6	45.8	0.0	64.3	49.1	44.8
Incr Delay (d2), s/veh	24.1	0.1	0.0	2.2	0.3	4.0	1.0	2.2	0.0	36.2	38.2	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.5	5.0	0.0	2.8	5.7	9.9	2.4	12.2	0.0	7.3	27.4	13.5
LnGrp Delay(d),s/veh	74.8	22.4	0.0	67.0	43.7	52.6	65.6	48.1	0.0	100.5	87.3	49.2
LnGrp LOS	E	C		E	D	D	E	D		F	F	D
Approach Vol, veh/h		1314			942			801			1565	
Approach Delay, s/veh		58.1			50.4			50.8			72.2	
Approach LOS		E			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	43.2	12.3	70.7	12.2	47.0	43.0	40.0
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	11.0	40.0	11.0	66.0	10.0	41.0	38.0	39.0
Max Q Clear Time (g_c+I1), s	14.2	27.8	7.8	12.6	7.3	46.0	40.7	28.1
Green Ext Time (p_c), s	0.0	3.4	0.0	3.0	0.0	0.0	0.0	3.4

Intersection Summary	
HCM 2010 Ctrl Delay	60.0
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1015	0	0	395	5	0	0	5	0
Future Volume (veh/h)	0	0	0	1015	0	0	395	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				1103	0	0	429	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1471	0	656	546	816	0	0	154	0
Arrive On Green				0.44	0.00	0.00	0.32	0.46	0.00	0.00	0.09	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				1103	0	0	429	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				22.0	0.0	0.0	18.5	0.1	0.0	0.0	0.2	0.0
Cycle Q Clear(g_c), s				22.0	0.0	0.0	18.5	0.1	0.0	0.0	0.2	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1471	0	656	546	816	0	0	154	0
V/C Ratio(X)				0.75	0.00	0.00	0.79	0.01	0.00	0.00	0.03	0.00
Avail Cap(c_a), veh/h				1471	0	656	546	816	0	0	154	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				18.8	0.0	0.0	24.5	11.6	0.0	0.0	33.4	0.0
Incr Delay (d2), s/veh				3.6	0.0	0.0	10.8	0.0	0.0	0.0	0.4	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.8	0.0	0.0	10.2	0.1	0.0	0.0	0.1	0.0
LnGrp Delay(d),s/veh				22.4	0.0	0.0	35.3	11.6	0.0	0.0	33.8	0.0
LnGrp LOS				C			D	B			C	
Approach Vol, veh/h					1103			434			5	
Approach Delay, s/veh					22.4			35.0			33.8	
Approach LOS					C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		41.0			30.0	11.0		39.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		37.0			26.0	7.0		35.0
Max Q Clear Time (g_c+I1), s		2.1			20.5	2.2		24.0
Green Ext Time (p_c), s		0.0			0.7	0.0		3.7

Intersection Summary	
HCM 2010 Ctrl Delay	26.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	230	0	0	0	0	395	820	5	1015	0
Future Volume (veh/h)	5	0	230	0	0	0	0	395	820	5	1015	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	429	0	5	1103	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	483	0	431				0	1635	1287	126	2054	0
Arrive On Green	0.29	0.00	0.00				0.00	0.49	0.00	0.15	1.00	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	429	0	5	1103	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.2	0.0	0.0				0.0	6.0	0.0	0.2	0.0	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0				0.0	6.0	0.0	0.2	0.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	483	0	431				0	1635	1287	126	2054	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.26	0.00	0.04	0.54	0.00
Avail Cap(c_a), veh/h	483	0	431				0	1635	1287	126	2054	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	2.00	2.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	20.4	0.0	0.0				0.0	12.0	0.0	31.5	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	0.4	0.0	0.6	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	2.8	0.0	0.1	0.3	0.0
LnGrp Delay(d),s/veh	20.4	0.0	0.0				0.0	12.4	0.0	32.1	1.0	0.0
LnGrp LOS	C							B		C	A	
Approach Vol, veh/h		5						429			1108	
Approach Delay, s/veh		20.4						12.4			1.2	
Approach LOS		C						B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	43.0		27.0		53.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	39.0		23.0		49.0		
Max Q Clear Time (g_c+I1), s	2.2	8.0		2.2		2.0		
Green Ext Time (p_c), s	0.0	2.9		0.0		10.8		

Intersection Summary	
HCM 2010 Ctrl Delay	4.4
HCM 2010 LOS	A

Appendix C

Intersection, Queue, and Segment Analysis Detail

Farrington Highway - Synchro Traffic Analysis Results
April 2020

			Existing Conditions			Year (2028) No Build			Year (2028) Build			Year (2028) Build Mitigated			Year (2028) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2018			2028 With Developments			2028 With Developments			2028 With Developments			2028 With Developments		
	Channelization Scenario -->		Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade with double left-turn lanes			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade, double left-turn lanes, SB signal priority		
	ID	Intersection	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS
AM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)	Stop	20.6	C	Stop	24.1	C	Stop	14.3	B	Stop	14.3	B			
		Farrington Hwy - Eastbound Left															
		Farrington Hwy - Eastbound Through															
		Farrington Hwy - Westbound Left		10.2	B		11.0	B		11.2	B		11.2	B			
		Farrington Hwy - Westbound Through															
		Farrington Hwy - Westbound Right															
		Old Fort Weaver Rd - Northbound Through															
		Old Fort Weaver Rd - Northbound Right		20.6	C		24.1	C		14.3	B		14.3	B			
		Old Fort Weaver Rd - Southbound Left															
		Old Fort Weaver Rd - Southbound Through															
		Old Fort Weaver Rd - Southbound Right															
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)	Stop	23.3	C	Stop	48.3	E	Stop	29.7	D	Stop	29.7	D			
		Farrington Hwy - Eastbound Through															
		Farrington Hwy - Eastbound Right															
		Farrington Hwy - Westbound Left		9.9	A		10.6	B		10.8	B		10.8	B			
		Farrington Hwy - Westbound Through								0.4	A		0.4	A			
		Old Fort Weaver Rd - Northbound Left/Right		23.3	C		48.3	E		29.7	D		29.7	D			
	3	Farrington Hwy/Kualakai Pkwy	Signal	24.5	C	Signal	114.6	F	Signal	87.0	F	Signal	48.8	D			
		Farrington Hwy - Eastbound Left		39.5	D		152.5	F		97.3	F		67.5	E			
		Farrington Hwy - Eastbound Through		28.0	C		106.5	F		73.5	E		55.7	E			
		Farrington Hwy - Eastbound Right		23.1	C		41.1	D		92.2	F		64.2	E			
		Farrington Hwy - Westbound Left		43.9	D		173.7	F		100.0	F		67.5	E			
		Farrington Hwy - Westbound Through		27.2	C		73.2	E		67.0	E		52.8	D			
		Farrington Hwy - Westbound Right		26.8	C		36.6	D		64.5	E		51.0	D			
		Kualakai Pkwy - Northbound Left		45.1	D		154.0	F		93.0	F		68.2	E			
		Kualakai Pkwy - Northbound Through		21.4	C		87.7	F		67.0	E		34.9	C			
		Kualakai Pkwy - Northbound Right		24.3	C		295.7	F		209.4	F		60.8	E			
		Kualakai Pkwy - Southbound Left		39.8	D		167.3	F		95.4	F		70.4	E			
		Kualakai Pkwy - Southbound Through		17.0	B		49.5	D		55.4	E		31.8	C			
		Kualakai Pkwy - Southbound Right		16.7	B		107.2	F		75.4	E		36.0	D			
	4	Farrington Hwy/Kapolei Golf Course Rd	Stop	13.4	B	Stop	21.6	C	Stop	21.6	C	Stop	21.6	C			
		Farrington Hwy - Westbound Left		8.5	A		10.3	B		10.3	B		10.3	B			
		Kapolei Golf Course Rd - Northbound Left		13.4	B		21.6	C		21.6	C		21.6	C			
		Kapolei Golf Course Rd - Northbound Right		10.3	B		12.7	B		12.7	B		12.7	B			
	5	Farrington Hwy/Kealanani Ave	Signal	20.3	C	Signal	34.0	C	Signal	34.0	C	Signal	34.0	C			
		Farrington Hwy - Eastbound Left		28.3	C		32.8	C		32.8	C		32.8	C			
		Farrington Hwy - Eastbound Through		16.8	B		33.1	C		33.1	C		33.1	C			
		Farrington Hwy - Eastbound Right		17.8	B		33.6	C		33.6	C		33.6	C			
		Farrington Hwy - Westbound Left		34.3	C		63.6	E		63.6	E		63.6	E			
		Farrington Hwy - Westbound Through		15.1	B		32.1	C		32.1	C		32.1	C			
		Farrington Hwy - Westbound Right		14.4	B		29.5	C		29.5	C		29.5	C			
		Kealanani Ave - Northbound Left		22.8	C		39.4	D		39.4	D		39.4	D			
		Kealanani Ave - Northbound Through		16.2	B		19.7	B		19.7	B		19.7	B			
		Kealanani Ave - Northbound Right		18.9	B		24.0	C		24.0	C		24.0	C			
		Kealanani Ave - Southbound Left		17.3	B		22.8	C		22.8	C		22.8	C			
		Kealanani Ave - Southbound Through		15.8	B		19.2	B		19.2	B		19.2	B			
		Kealanani Ave - Southbound Right		16.7	B		20.1	C		20.1	C		20.1	C			
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr	Signal	45.6	D	Signal	64.3	E	Signal	64.3	E	Signal	64.3	E			
		Farrington Hwy - Eastbound Left		66.8	E		122.7	F		122.7	F		122.7	F			
		Farrington Hwy - Eastbound Through		36.1	D		50.4	D		50.4	D		50.4	D			
		Farrington Hwy - Eastbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Farrington Hwy - Westbound Left		64.8	E		73.8	E		73.8	E		73.8	E			
		Farrington Hwy - Westbound Through		47.1	D		48.2	D		48.2	D		48.2	D			
		Farrington Hwy - Westbound Right		48.7	D		49.7	D		49.7	D		49.7	D			
		Ft Barrette Ave - Northbound Left		75.3	E		131.7	F		131.7	F		131.7	F			
		Ft Barrette Ave - Northbound Through		26.8	C		30.6	C		30.6	C		30.6	C			
		Ft Barrette Ave - Northbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Makakilo Dr - Southbound Left		60.8	E		63.1	E		63.1	E		63.1	E			
		Makakilo Dr - Southbound Through		51.3	D		92.0	F		92.0	F		92.0	F			
		Makakilo Dr - Southbound Right		30.9	C		38.7	D		38.7	D		38.7	D			
	7	Kualakai Pkwy/H-1 Westbound Ramp	Signal	17.3	B	Signal	45.1	D	Signal	45.1	D	Signal	45.1	D			
		Kualakai Pkwy - Northbound Left		18.8	B		51.8	D		51.8	D		51.8	D			
		Kualakai Pkwy - Northbound Through		4.5	A		8.9	A		8.9	A		8.9	A			
		Kualakai Pkwy - Southbound Through		16.2	B		40.0	D		40.0	D		40.0	D			
		Kualakai Pkwy - Southbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Left		16.4	B		40.8	D		40.8	D		40.8	D			
		H-1 Westbound Ramp - Westbound Through		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
	8	Kualakai Pkwy/H-1 Eastbound Ramp	Signal	5.1	A	Signal	31.7	C	Signal	31.7	C	Signal	31.7	C			
		Kualakai Pkwy - Northbound Through		11.7	B		34.4	C		34.4	C		34.4	C			
		Kualakai Pkwy - Northbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Kualakai Pkwy - Southbound Left		14.5	B		40.1	D		40.1	D		40.1	D			
		Kualakai Pkwy - Southbound Through		0.3	A		29.9	C		29.9	C		29.9	C			
		H-1 Eastbound Ramp - Eastbound Left		12.2	B		10.8	B		10.8	B		10.8	B			
		H-1 Eastbound Ramp - Eastbound Through		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Eastbound Ramp - Eastbound Right		0.0	A		0.0	A		0.0	A		0.0	A			

Notes:

Orange shaded cells represent LOS 'E', red shaded cells represent LOS 'F'.

Analysis conducted using Synchro 10 (HCM 2010 methodology). Delay is measured in seconds.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Results are reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections).

Year 2028 No Build includes existing channelization on Farrington Highway.

Year 2028 Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Year 2028 Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turn lanes on all approaches.

Year 2028 Build Mitigated with Signal Priority assumes priority at the intersection of Kualakai Parkway and Farrington Highway is given to the southbound left, through, and right-turn movements.

Farrington Highway - Synchro Traffic Analysis Results
April 2020

			Existing Conditions			Year (2028) No Build			Year (2028) Build			Year (2028) Build Mitigated			Year (2028) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2018			2028 With Developments			2028 With Developments			2028 With Developments			2028 With Developments		
	Channelization Scenario -->		Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade with double left-turn lanes			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade, double left-turn lanes, SB signal priority		
	ID	Intersection	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS
PM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)	Stop	11.6	B	Stop	18.1	C	Stop	12.6	B	Stop	12.6	B			
		Farrington Hwy - Eastbound Left															
		Farrington Hwy - Eastbound Through															
		Farrington Hwy - Westbound Left		9.0	A		11.4	B		11.5	B		11.5	B			
		Farrington Hwy - Westbound Through															
		Farrington Hwy - Westbound Right															
		Old Fort Weaver Rd - Northbound Through															
		Old Fort Weaver Rd - Northbound Right		11.6	B		18.1	C		12.6	B		12.6	B			
		Old Fort Weaver Rd - Southbound Left															
		Old Fort Weaver Rd - Southbound Through															
		Old Fort Weaver Rd - Southbound Right															
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)	Stop	16.6	C	Stop	47.2	E	Stop	30.0	D	Stop	30.0	D			
		Farrington Hwy - Eastbound Through															
		Farrington Hwy - Eastbound Right															
		Farrington Hwy - Westbound Left		8.3	A		9.7	A		9.7	A		9.7	A			
		Farrington Hwy - Westbound Through								0.2	A		0.2	A			
		Old Fort Weaver Rd - Northbound Left/Right		16.6	C		47.2	E		30.0	D		30.0	D			
	3	Farrington Hwy/Kualakai Pkwy	Signal	27.2	C	Signal	212.6	F	Signal	144.4	F	Signal	78.6	E	Signal	81.7	F
		Farrington Hwy - Eastbound Left		42.3	D		482.2	F		124.6	F		93.1	F		100.2	F
		Farrington Hwy - Eastbound Through		28.1	C		210.6	F		132.5	F		96.5	F		87.4	F
		Farrington Hwy - Eastbound Right		27.9	C		59.9	E		234.8	F		177.0	F		160.2	F
		Farrington Hwy - Westbound Left		44.2	D		459.0	F		250.7	F		103.9	F		193.3	F
		Farrington Hwy - Westbound Through		33.8	C		67.2	E		83.7	F		63.2	E		68.9	E
		Farrington Hwy - Westbound Right		30.0	C		45.4	D		236.3	F		121.4	F		161.3	F
		Kualakai Pkwy - Northbound Left		49.4	D		399.8	F		285.8	F		119.4	F		103.4	F
		Kualakai Pkwy - Northbound Through		22.3	C		149.6	F		91.2	F		53.1	D		47.8	D
		Kualakai Pkwy - Northbound Right		19.5	B		93.5	F		67.8	E		48.2	D		43.7	D
		Kualakai Pkwy - Southbound Left		50.1	D		438.3	F		280.2	F		108.3	F		85.2	F
		Kualakai Pkwy - Southbound Through		23.8	C		216.1	F		136.0	F		59.9	E		52.1	D
		Kualakai Pkwy - Southbound Right		25.9	C		201.3	F		128.0	F		63.7	E		54.7	D
	4	Farrington Hwy/Kapolei Golf Course Rd	Stop	13.3	B	Stop	25.9	D	Stop	25.9	D	Stop	25.9	D			
		Farrington Hwy - Westbound Left		8.2	A		10.7	B		10.7	B		10.7	B			
		Kapolei Golf Course Rd - Northbound Left		13.3	B		25.9	D		25.9	D		25.9	D			
		Kapolei Golf Course Rd - Northbound Right		9.9	A		13.1	B		13.1	B		13.1	B			
	5	Farrington Hwy/Kealanani Ave	Signal	24.2	C	Signal	50.5	D	Signal	50.5	D	Signal	50.5	D			
		Farrington Hwy - Eastbound Left		32.4	C		35.5	D		35.5	D		35.5	D			
		Farrington Hwy - Eastbound Through		21.3	C		36.6	D		36.6	D		36.6	D			
		Farrington Hwy - Eastbound Right		23.2	C		37.3	D		37.3	D		37.3	D			
		Farrington Hwy - Westbound Left		40.8	D		150.6	F		150.6	F		150.6	F			
		Farrington Hwy - Westbound Through		19.6	B		33.8	C		33.8	C		33.8	C			
		Farrington Hwy - Westbound Right		19.3	B		31.2	C		31.2	C		31.2	C			
		Kealanani Ave - Northbound Left		27.2	C		93.3	F		93.3	F		93.3	F			
		Kealanani Ave - Northbound Through		17.1	B		23.6	C		23.6	C		23.6	C			
		Kealanani Ave - Northbound Right		18.7	B		28.4	C		28.4	C		28.4	C			
		Kealanani Ave - Southbound Left		19.7	B		30.9	C		30.9	C		30.9	C			
		Kealanani Ave - Southbound Through		16.8	B		23.1	C		23.1	C		23.1	C			
		Kealanani Ave - Southbound Right		17.8	B		24.4	C		24.4	C		24.4	C			
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr	Signal	60.0	E	Signal	83.1	F	Signal	83.1	F	Signal	83.1	F			
		Farrington Hwy - Eastbound Left		74.8	E		157.5	F		157.5	F		157.5	F			
		Farrington Hwy - Eastbound Through		22.4	C		35.8	D		35.8	D		35.8	D			
		Farrington Hwy - Eastbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Farrington Hwy - Westbound Left		67.0	E		68.7	E		68.7	E		68.7	E			
		Farrington Hwy - Westbound Through		43.7	D		47.1	D		47.1	D		47.1	D			
		Farrington Hwy - Westbound Right		52.6	D		40.0	D		40.0	D		40.0	D			
		Ft Barrette Ave - Northbound Left		65.6	E		97.4	F		97.4	F		97.4	F			
		Ft Barrette Ave - Northbound Through		48.1	D		56.9	E		56.9	E		56.9	E			
		Ft Barrette Ave - Northbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Makakilo Dr - Southbound Left		100.5	F		158.1	F		158.1	F		158.1	F			
		Makakilo Dr - Southbound Through		87.3	F		75.0	F		75.0	F		75.0	F			
		Makakilo Dr - Southbound Right		49.2	D		73.7	F		73.7	F		73.7	F			
	7	Kualakai Pkwy/H-1 Westbound Ramp	Signal	26.0	C	Signal	185.1	F	Signal	185.1	F	Signal	185.1	F			
		Kualakai Pkwy - Northbound Left		35.3	D		208.7	F		208.7	F		208.7	F			
		Kualakai Pkwy - Northbound Through		11.6	B		21.4	C		21.4	C		21.4	C			
		Kualakai Pkwy - Southbound Through		33.8	C		69.8	E		69.8	E		69.8	E			
		Kualakai Pkwy - Southbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Left		22.4	C		175.8	F		175.8	F		175.8	F			
		H-1 Westbound Ramp - Westbound Through		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
	8	Kualakai Pkwy/H-1 Eastbound Ramp	Signal	4.4	A	Signal	22.7	C	Signal	22.7	C	Signal	22.7	C			
		Kualakai Pkwy - Northbound Through		12.4	B		19.4	B		19.4	B		19.4	B			
		Kualakai Pkwy - Northbound Right		0.0	A		0.0	A		0.0	A		0.0	A			
		Kualakai Pkwy - Southbound Left		32.1	C		70.5	E		70.5	E		70.5	E			
		Kualakai Pkwy - Southbound Through		1.0	A		24.0	C		24.0	C		24.0	C			
		H-1 Eastbound Ramp - Eastbound Left		20.4	C		36.2	D		36.2	D		36.2	D			
		H-1 Eastbound Ramp - Eastbound Through		0.0	A		0.0	A		0.0	A		0.0	A			
		H-1 Eastbound Ramp - Eastbound Right		0.0	A		0.0	A		0.0	A		0.0	A			

Notes:

Orange shaded cells represent LOS 'E', red shaded cells represent LOS 'F'.

Analysis conducted using Synchro 10 (HCM 2010 methodology). Delay is measured in seconds.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Results are reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections).

Year 2028 No Build includes existing channelization on Farrington Highway.

Year 2028 Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Year 2028 Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turn lanes on all approaches.

Year 2028 Build Mitigated with Signal Priority assumes priority at the intersection of Kualakai Parkway and Farrington Highway is given to the southbound left, through, and right-turn movements.

Farrington Highway - Synchro Traffic Analysis Results

April 2020

			Future Phase (2035) No Build			Future Phase (2035) Build			Future Phase (2035) Build Mitigated			Future Phase (2035) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2035 With Developments			2035 With Developments			2035 With Developments			2035 With Developments		
	Channelization Scenario -->		Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (6-lanes to Golf Course Rd, 4-lanes to Makakilo), Kualakai at-grade, WB double right-turn lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes, SB signal priority		
	ID	Intersection	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS
AM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)	Signal	35.7	D	Signal	22.5	C	Signal	22.5	C			
		Farrington Hwy - Eastbound Left		75.1	E		51.9	D		51.9	D			
		Farrington Hwy - Eastbound Through		36.2	D		22.2	C		22.2	C			
		Farrington Hwy - Westbound Left		92.9	F		59.5	E		59.5	E			
		Farrington Hwy - Westbound Through		15.3	B		13.5	B		13.5	B			
		Farrington Hwy - Westbound Right		9.7	A		10.6	B		10.6	B			
		Old Fort Weaver Rd - Northbound Through		44.5	D		28.3	C		28.3	C			
		Old Fort Weaver Rd - Northbound Right		52.1	D		32.6	C		32.6	C			
		Old Fort Weaver Rd - Southbound Left		75.6	E		37.9	D		37.9	D			
		Old Fort Weaver Rd - Southbound Through		0.0	A		0.0	A		0.0	A			
		Old Fort Weaver Rd - Southbound Right		28.5	C		15.9	B		15.9	B			
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)	Signal	5.6	A	Signal	4.5	A	Signal	4.5	A			
		Farrington Hwy - Eastbound Through		6.5	A		4.6	A		4.6	A			
		Farrington Hwy - Eastbound Right		6.5	A		5.0	A		5.0	A			
		Farrington Hwy - Westbound Left												
		Farrington Hwy - Westbound Through		3.4	A		3.7	A		3.7	A			
		Old Fort Weaver Rd - Northbound Left/Right		19.7	B		12.4	B		12.4	B			
	3	Farrington Hwy/Kualakai Pkwy	Signal	196.6	F	Signal	160.9	F	Signal	67.8	E	Signal	81.2	F
		Farrington Hwy - Eastbound Left		377.1	F		377.1	F		69.4	E		303.1	F
		Farrington Hwy - Eastbound Through		54.1	D		46.0	D		40.4	D		40.4	D
		Farrington Hwy - Eastbound Right		46.8	D		46.8	D		40.8	D		40.8	D
		Farrington Hwy - Westbound Left		397.2	F		397.2	F		117.5	F		504.3	F
		Farrington Hwy - Westbound Through		53.1	D		43.7	D		41.7	D		41.7	D
		Farrington Hwy - Westbound Right		483.5	F		116.3	F		124.7	F		124.7	F
		Kualakai Pkwy - Northbound Left		125.8	F		125.8	F		67.3	E		67.3	E
		Kualakai Pkwy - Northbound Through		187.5	F		187.5	F		67.2	F		40.8	D
		Kualakai Pkwy - Northbound Right		209.5	F		209.5	F		89.3	F		53.1	D
		Kualakai Pkwy - Southbound Left		438.4	F		438.4	F		98.8	F		98.8	F
		Kualakai Pkwy - Southbound Through		68.5	E		68.5	E		40.0	D		32.3	C
		Kualakai Pkwy - Southbound Right		71.0	E		71.0	E		41.8	D		32.8	C
	4	Farrington Hwy/Kapolei Golf Course Rd	Stop	28.2	D	Stop	28.2	D	Stop	28.2	D			
		Farrington Hwy - Westbound Left		11.4	B		11.4	B		11.4	B			
		Kapolei GolF Course Rd - Northbound Left		28.2	D		28.2	D		28.2	D			
		Kapolei GolF Course Rd - Northbound Right		15.2	C		15.2	C		15.2	C			
	5	Farrington Hwy/Kealanani Ave	Signal	40.2	D	Signal	40.2	D	Signal	40.2	D			
		Farrington Hwy - Eastbound Left		31.5	C		31.5	C		31.5	C			
		Farrington Hwy - Eastbound Through		29.4	C		29.4	C		29.4	C			
		Farrington Hwy - Eastbound Right		29.8	C		29.8	C		29.8	C			
		Farrington Hwy - Westbound Left		154.9	F		154.9	F		154.9	F			
		Farrington Hwy - Westbound Through		29.1	C		29.1	C		29.1	C			
		Farrington Hwy - Westbound Right		25.9	C		25.9	C		25.9	C			
		Kealanani Ave - Northbound Left		38.7	D		38.7	D		38.7	D			
		Kealanani Ave - Northbound Through		19.6	B		19.6	B		19.6	B			
		Kealanani Ave - Northbound Right		24.5	C		24.5	C		24.5	C			
		Kealanani Ave - Southbound Left		22.4	C		22.4	C		22.4	C			
		Kealanani Ave - Southbound Through		19.1	B		19.1	B		19.1	B			
		Kealanani Ave - Southbound Right		20.0	C		20.0	C		20.0	C			
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr	Signal	53.4	D	Signal	53.4	D	Signal	53.4	D			
		Farrington Hwy - Eastbound Left		88.6	F		88.6	F		88.6	F			
		Farrington Hwy - Eastbound Through		48.5	D		48.5	D		48.5	D			
		Farrington Hwy - Eastbound Right		0.0	A		0.0	A		0.0	A			
		Farrington Hwy - Westbound Left		72.4	E		72.4	E		72.4	E			
		Farrington Hwy - Westbound Through		46.3	D		46.3	D		46.3	D			
		Farrington Hwy - Westbound Right		47.1	D		47.1	D		47.1	D			
		Ft Barrette Ave - Northbound Left		92.1	F		92.1	F		92.1	F			
		Ft Barrette Ave - Northbound Through		31.4	C		31.4	C		31.4	C			
		Ft Barrette Ave - Northbound Right		0.0	A		0.0	A		0.0	A			
		Makakilo Dr - Southbound Left		61.0	E		61.0	E		61.0	E			
		Makakilo Dr - Southbound Through		43.2	D		43.2	D		43.2	D			
		Makakilo Dr - Southbound Right		63.4	E		63.4	E		63.4	E			
	7	Kualakai Pkwy/H-1 Westbound Ramp	Signal	73.5	E	Signal	73.5	E	Signal	73.5	E			
		Kualakai Pkwy - Northbound Left		110.1	F		110.1	F		110.1	F			
		Kualakai Pkwy - Northbound Through		22.2	C		22.2	C		22.2	C			
		Kualakai Pkwy - Southbound Through		91.0	F		91.0	F		91.0	F			
		Kualakai Pkwy - Southbound Right		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Left		60.2	F		60.2	F		60.2	F			
		H-1 Westbound Ramp - Westbound Through		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Right		0.0	A		0.0	A		0.0	A			
	8	Kualakai Pkwy/H-1 Eastbound Ramp	Signal	11.0	B	Signal	11.0	B	Signal	11.0	B			
		Kualakai Pkwy - Northbound Through		11.3	B		11.3	B		11.3	B			
		Kualakai Pkwy - Northbound Right		0.0	A		0.0	A		0.0	A			
		Kualakai Pkwy - Southbound Left		50.4	D		50.4	D		50.4	D			
		Kualakai Pkwy - Southbound Through		2.7	A		2.7	A		2.7	A			
		H-1 Eastbound Ramp - Eastbound Left		80.5	F		80.5	F		80.5	F			
		H-1 Eastbound Ramp - Eastbound Through		0.0	A		0.0	A		0.0	A			
		H-1 Eastbound Ramp - Eastbound Right		0.0	A		0.0	A		0.0	A			

Notes:

Orange shaded cells represent LOS 'E', red shaded cells represent LOS 'F'.

Analysis conducted using Synchro 10 (HCM 2010 methodology). Delay is measured in seconds.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Results are reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections).

Future Phase Year is 2035.

Future Phase No Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Future Phase Build includes six lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road, with double right-turn lanes on the westbound approach.

Future Phase Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turns on the northbound, eastbound, and westbound approaches and triple left-turns on the southbound approach.

Farrington Highway - Synchro Traffic Analysis Results

April 2020

			Future Phase (2035) No Build			Future Phase (2035) Build			Future Phase (2035) Build Mitigated			Future Phase (2035) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2035 With Developments			2035 With Developments			2035 With Developments			2035 With Developments		
	Channelization Scenario -->		Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (6-lanes to Golf Course Rd, 4-lanes to Makakilo), Kualakai at-grade, WB double right-turn lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes, SB signal priority		
	ID	Intersection	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS	Control	Delay	LOS
PM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)	Signal	88.1	F	Signal	51.7	D	Signal	51.7	D			
		Farrington Hwy - Eastbound Left		183.3	F		115.4	F		115.4	F			
		Farrington Hwy - Eastbound Through		51.7	D		37.7	D		37.7	D			
		Farrington Hwy - Westbound Left		124.0	F		84.5	F		84.5	F			
		Farrington Hwy - Westbound Through		93.9	F		50.4	F		50.4	F			
		Farrington Hwy - Westbound Right		26.1	C		39.7	D		39.7	D			
		Old Fort Weaver Rd - Northbound Through		178.1	F		67.0	E		67.0	E			
		Old Fort Weaver Rd - Northbound Right		191.0	F		70.3	D		70.3	D			
		Old Fort Weaver Rd - Southbound Left		133.8	F		65.2	E		65.2	E			
		Old Fort Weaver Rd - Southbound Through		0.0	A		0.0	A		0.0	A			
		Old Fort Weaver Rd - Southbound Right		72.6	E		39.8	D		39.8	D			
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)	Signal	7.3	A	Signal	4.4	A	Signal	4.4	A			
		Farrington Hwy - Eastbound Through		4.2	A		3.4	A		3.4	A			
		Farrington Hwy - Eastbound Right		4.2	A		3.5	A		3.5	A			
		Farrington Hwy - Westbound Left												
		Farrington Hwy - Westbound Through		8.6	A		4.5	A		4.5	A			
		Old Fort Weaver Rd - Northbound Left/Right		32.0	C		18.6	B		18.6	B			
	3	Farrington Hwy/Kualakai Pkwy	Signal	266.6	F	Signal	222.3	F	Signal	94.5	F	Signal	117.5	F
		Farrington Hwy - Eastbound Left		442.2	F		405.0	F		189.2	F		612.8	F
		Farrington Hwy - Eastbound Through		116.8	F		58.6	E		60.8	E		60.8	E
		Farrington Hwy - Eastbound Right		113.2	F		144.9	F		157.7	F		157.7	F
		Farrington Hwy - Westbound Left		474.9	F		434.4	F		184.4	F		603.3	F
		Farrington Hwy - Westbound Through		165.6	F		67.5	E		67.5	E		675.0	E
		Farrington Hwy - Westbound Right		363.9	F		98.9	F		98.9	F		98.9	F
		Kualakai Pkwy - Northbound Left		477.5	F		444.3	F		159.1	F		159.1	F
		Kualakai Pkwy - Northbound Through		210.1	F		210.1	F		49.1	D		40.0	D
		Kualakai Pkwy - Northbound Right		369.8	F		369.8	F		108.7	F		68.1	E
		Kualakai Pkwy - Southbound Left		477.7	F		431.4	F		88.6	F		88.6	F
		Kualakai Pkwy - Southbound Through		226.1	F		212.5	F		96.8	F		55.8	E
		Kualakai Pkwy - Southbound Right		115.9	F		107.6	F		53.7	D		41.1	D
	4	Farrington Hwy/Kapolei Golf Course Rd	Stop	48.1	E	Stop	48.1	E	Stop	48.1	E			
		Farrington Hwy - Westbound Left		15.1	C		15.1	C		15.1	C			
		Kapolei GolF Course Rd - Northbound Left		48.1	E		48.1	E		48.1	E			
		Kapolei GolF Course Rd - Northbound Right		19.5	C		19.5	C		19.5	C			
	5	Farrington Hwy/Kealanani Ave	Signal	69.8	E	Signal	69.8	E	Signal	69.8	E			
		Farrington Hwy - Eastbound Left		39.0	D		39.0	D		39.0	D			
		Farrington Hwy - Eastbound Through		88.1	F		88.1	F		88.1	F			
		Farrington Hwy - Eastbound Right		92.1	F		92.1	F		92.1	F			
		Farrington Hwy - Westbound Left		137.7	F		137.7	F		137.7	F			
		Farrington Hwy - Westbound Through		38.8	D		38.8	D		38.8	D			
		Farrington Hwy - Westbound Right		35.2	D		35.2	D		35.2	D			
		Kealanani Ave - Northbound Left		127.0	F		127.0	F		127.0	F			
		Kealanani Ave - Northbound Through		28.4	C		28.4	C		28.4	C			
		Kealanani Ave - Northbound Right		40.1	D		40.1	D		40.1	D			
		Kealanani Ave - Southbound Left		42.1	D		42.1	D		42.1	D			
		Kealanani Ave - Southbound Through		28.0	C		28.0	C		28.0	C			
		Kealanani Ave - Southbound Right		29.3	C		29.3	C		29.3	C			
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr	Signal	93.8	F	Signal	93.8	F	Signal	93.8	F			
		Farrington Hwy - Eastbound Left		221.6	F		221.6	F		221.6	F			
		Farrington Hwy - Eastbound Through		46.3	D		46.3	D		46.3	D			
		Farrington Hwy - Eastbound Right		0.0	A		0.0	A		0.0	A			
		Farrington Hwy - Westbound Left		72.5	E		72.5	E		72.5	E			
		Farrington Hwy - Westbound Through		45.8	D		45.8	D		45.8	D			
		Farrington Hwy - Westbound Right		34.9	C		34.9	C		34.9	C			
		Ft Barrette Ave - Northbound Left		151.0	F		151.0	F		151.0	F			
		Ft Barrette Ave - Northbound Through		83.1	F		83.1	F		83.1	F			
		Ft Barrette Ave - Northbound Right		0.0	A		0.0	A		0.0	A			
		Makakilo Dr - Southbound Left		143.3	F		143.3	F		143.3	F			
		Makakilo Dr - Southbound Through		61.8	E		61.8	E		61.8	E			
		Makakilo Dr - Southbound Right		68.8	F		68.8	F		68.8	F			
	7	Kualakai Pkwy/H-1 Westbound Ramp	Signal	78.7	E	Signal	78.7	E	Signal	78.7	E			
		Kualakai Pkwy - Northbound Left		128.1	F		128.1	F		128.1	F			
		Kualakai Pkwy - Northbound Through		64.4	E		64.4	E		64.4	E			
		Kualakai Pkwy - Southbound Through		123.6	F		123.6	F		123.6	F			
		Kualakai Pkwy - Southbound Right		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Left		61.6	F		61.6	F		61.6	F			
		H-1 Westbound Ramp - Westbound Through		0.0	A		0.0	A		0.0	A			
		H-1 Westbound Ramp - Westbound Right		0.0	A		0.0	A		0.0	A			
	8	Kualakai Pkwy/H-1 Eastbound Ramp	Signal	6.9	A	Signal	6.9	A	Signal	6.9	A			
		Kualakai Pkwy - Northbound Through		3.6	A		3.6	A		3.6	A			
		Kualakai Pkwy - Northbound Right		0.0	A		0.0	A		0.0	A			
		Kualakai Pkwy - Southbound Left		43.7	D		43.7	D		43.7	D			
		Kualakai Pkwy - Southbound Through		6.5	A		6.5	A		6.5	A			
		H-1 Eastbound Ramp - Eastbound Left		82.8	F		82.8	F		82.8	F			
		H-1 Eastbound Ramp - Eastbound Through		0.0	A		0.0	A		0.0	A			
		H-1 Eastbound Ramp - Eastbound Right		0.0	A		0.0	A		0.0	A			

Notes:

Orange shaded cells represent LOS 'E', red shaded cells represent LOS 'F'.

Analysis conducted using Synchro 10 (HCM 2010 methodology). Delay is measured in seconds.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Results are reported for the worst approach (stop-controlled intersections) or for overall conditions (signalized intersections).

Future Phase Year is 2035.

Future Phase No Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Future Phase Build includes six lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road, with double right-turn lanes on the westbound approach.

Future Phase Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turns on the northbound, eastbound, and westbound approaches and triple left-turns on the southbound approach.

Farrington Highway - Segment Traffic Analysis Results

April 2020

	Roadway Segment	Direction of Travel	Existing Condtions (2018)						No Build With Developments (2028), Farrington Highway (2-lanes)						Year (2028) With Developments, Farrington Highway (4-lanes)						No Build With Developments (2035), Farrington Highway (4-lanes)						Future Phase With Developments (2035), Farrington Highway (6-lanes)					
			AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak			AM Peak			PM Peak		
			Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS	Volume	V/C	LOS
1	Farrington Hwy Between Ft Barrette Road and Kealanani Ave	EB	590	0.20	A	700	0.23	A	945	0.32	B	1,130	0.38	B	945	0.32	B	1,130	0.38	B	1,020	0.34	B	1,420	0.47	C	1,020	0.34	B	1,420	0.47	C
		WB	580	0.19	A	725	0.24	A	910	0.30	B	1,120	0.37	B	910	0.30	B	1,120	0.37	B	1,045	0.35	B	1,285	0.43	B	1,045	0.35	B	1,285	0.43	B
2	Farrington Hwy Between Kealanani Ave and Kapolei Golf Course Road	EB	420	0.14	A	385	0.13	A	820	0.27	B	940	0.31	B	820	0.27	B	940	0.31	B	965	0.32	B	1,335	0.45	C	965	0.32	B	1,335	0.45	C
		WB	330	0.11	A	555	0.19	A	705	0.24	A	1,205	0.40	B	705	0.24	A	1,205	0.40	B	945	0.32	B	1,525	0.51	C	945	0.32	B	1,525	0.51	C
3	Farrington Hwy Between Kapolei Golf Course Road and Kualakai Parkway	EB	430	0.29	B	395	0.26	B	945	0.63	D	1,255	0.84	E	945	0.32	B	1,255	0.42	B	1,165	0.39	B	1,655	0.55	C	1,165	0.26	A	1,655	0.37	B
		WB	260	0.17	A	585	0.39	B	905	0.60	C	1,315	0.88	E	905	0.30	B	1,315	0.44	C	1,285	0.43	B	1,930	0.64	D	1,285	0.29	B	1,930	0.43	B
4	Farrington Hwy Between Kualakai Parkway and Fort Weaver Road (West Loop)	EB	655	0.44	C	315	0.21	A	1,140	0.76	D	1,020	0.68	D	1,140	0.38	B	1,020	0.34	B	1,910	0.64	D	1,960	0.65	D	1,910	0.42	B	1,960	0.44	C
		WB	235	0.16	A	400	0.27	B	675	0.45	C	1,120	0.75	D	675	0.23	A	1,120	0.37	B	1,595	0.53	C	2,215	0.74	D	1,595	0.35	B	2,215	0.49	C
5	Farrington Hwy Between Fort Weaver Road West Loop and East Loop	EB	645	0.43	B	325	0.22	A	935	0.62	D	720	0.48	C	935	0.31	B	720	0.24	A	1,790	0.60	C	1,575	0.53	C	1,790	0.40	B	1,575	0.35	B
		WB	215	0.14	A	375	0.25	A	520	0.35	B	715	0.48	C	520	0.17	A	715	0.24	A	1,225	0.41	B	2,225	0.74	D	1,225	0.27	B	2,225	0.49	C
6	Kualakai Parkway Between H-1 Eastbound Ramps and Farrington Hwy	NB	815	0.18	A	1,215	0.27	B	1,635	0.36	B	2,440	0.54	C	1,635	0.36	B	2,440	0.54	C	2,975	0.66	D	2,535	0.56	C	2,975	0.66	D	2,535	0.56	C
		SB	690	0.15	A	1,245	0.28	B	1,630	0.36	B	2,365	0.53	C	1,630	0.36	B	2,365	0.53	C	2,580	0.57	C	3,330	0.74	D	2,580	0.57	C	3,330	0.74	D
7	Kualakai Parkway south of Farrington Hwy	NB	950	0.21	A	1,145	0.25	A	2,090	0.46	C	2,310	0.51	C	2,090	0.46	C	2,310	0.51	C	2,885	0.64	D	2,570	0.57	C	2,885	0.64	D	2,570	0.57	C
		SB	585	0.13	A	1,130	0.25	A	1,445	0.32	B	2,620	0.58	C	1,445	0.32	B	2,620	0.58	C	2,025	0.45	C	2,885	0.64	D	2,025	0.45	C	2,885	0.64	D

Notes:

Farrington Highway capacity is assumed to be 1,500 vehicles per hour per lane.

Midblock access roads/driveways are assumed between Kualakai Parkway and Fort Weaver Road to provide access to developments mauka/makai of Farrington Highway.

Existing Conditions and Year (2028) No Build channelization represents current lane configuration along Farrington in 2018 with one travel lane in each direction.

Year (2028) Build and Future Phase (2035) No Build channelization on Farrington Highway assumes 4-lanes (2 lanes in each direction) from Fort Barette Rd to Old Fort Weaver Rd. Future Phase (2035) Build channelization on Farrington Highway assumes 6-lanes (3 lanes in each direction) from Fort Barette Rd to Old Fort Weaver Rd.

Farrington Highway - Synchro Analysis - Queue Results
April 2020

			Existing Conditions			Year (2028) No Build			Year (2028) Build			Year (2028) Build Mitigated			Year (2028) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2018			2028 With Developments			2028 With Developments			2028 With Developments			2028 With Developments		
	Channelization Scenario -->		Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade with double left-turn lanes			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade, double left-turn lanes, SB signal priority		
	ID	Intersection	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)
AM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)															
		Farrington Hwy - Eastbound Left															
		Farrington Hwy - Eastbound Through	1700	0	0	1700	0	0	1700	0	0						
		Farrington Hwy - Westbound Left	600	25	25	600	25	25	600	25	25						
		Farrington Hwy - Westbound Through	800	0	0	800	0	0	800	0	0						
		Farrington Hwy - Westbound Right															
		Old Fort Weaver Rd - Northbound Through															
		Old Fort Weaver Rd - Northbound Right	900	35	35	900	35	35	900	25	25						
		Old Fort Weaver Rd - Southbound Left															
		Old Fort Weaver Rd - Southbound Through/Right															
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)															
		Farrington Hwy - Eastbound Through/Right	500	0	0	500	0	0	500	0	0						
		Farrington Hwy - Westbound Left/Through	1700	25	25	1700	25	25	1700	25	25						
		Farrington Hwy - Westbound Through															
		Old Fort Weaver Rd - Northbound Left/Right	1200	25	25	1200	80	80	1200	50	50						
	3	Farrington Hwy/Kualakai Pkwy															
		Farrington Hwy - Eastbound Left	350	95	170	350	245	415	350	300	455	350	135	190	350	120	190
		Farrington Hwy - Eastbound Through	1400	185	320	1400	495	715	1400	330	405	1400	280	365	1400	240	375
		Farrington Hwy - Eastbound Right	350	0	0	350	0	65	350	0	90	350	0	85	350	0	85
		Farrington Hwy - Westbound Left	120	50	100	120	250	420	500	295	465	500	130	185	500	115	190
		Farrington Hwy - Westbound Through	800	75	145	800	360	570	800	270	335	800	225	300	800	195	305
		Farrington Hwy - Westbound Right	140	0	0	140	25	70	140	50	130	140	45	120	140	25	100
		Kualakai Pkwy - Northbound Left	500	35	80	500	315	500	500	375	545	500	170	230	500	150	235
		Kualakai Pkwy - Northbound Through	1800	165	240	1800	420	520	1800	555	640	1800	415	505	1800	405	535
		Kualakai Pkwy - Northbound Right	500	0	80	500	255	500	500	235	430	500	105	270	500	120	310
		Kualakai Pkwy - Southbound Left	500	90	165	500	320	505	500	380	570	500	170	235	500	150	230
		Kualakai Pkwy - Southbound Through	1700	120	165	1700	285	340	1700	400	460	1700	295	380	1700	290	380
		Kualakai Pkwy - Southbound Right	500	0	40	500	40	145	500	0	95	500	0	85	500	0	80
	4	Farrington Hwy/Kapolei Golf Course Rd															
		Farrington Hwy - Westbound Left	215	25	25	215	25	25	215	25	25						
		Kapolei Golf Course Rd - Northbound Left	300	25	25	300	25	25	300	25	25						
		Kapolei Golf Course Rd - Northbound Right	300	25	25	300	25	25	300	25	25						
	5	Farrington Hwy/Kealanani Ave															
		Farrington Hwy - Eastbound Left	300	45	75	300	55	85	300	55	85						
		Farrington Hwy - Eastbound Through/Right	1100	60	100	1100	210	280	1100	210	280						
		Farrington Hwy - Westbound Left	500	120	180	500	155	290	500	155	290						
		Farrington Hwy - Westbound Through	1100	65	90	1100	125	170	1100	125	170						
		Farrington Hwy - Westbound Right	250	0	25	250	0	35	250	0	35						
		Kealanani Ave - Northbound Left	450	205	290	450	330	490	450	330	490						
		Kealanani Ave - Northbound Through	500	40	70	500	45	75	500	45	75						
		Kealanani Ave - Northbound Right	500	0	40	500	0	45	500	0	45						
		Kealanani Ave - Southbound Left	150	25	35	150	45	75	150	45	75						
		Kealanani Ave - Southbound Through	350	25	45	350	25	45	350	25	45						
		Kealanani Ave - Southbound Right	350	0	25	350	0	25	350	0	25						
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr															
		Farrington Hwy - Eastbound Left	250	200	250	250	225	335	250	225	335						
		Farrington Hwy - Eastbound Through	600	105	130	600	180	235	600	180	235						
		Farrington Hwy - Eastbound Right	335	0	35	335	25	80	335	25	80						
		Farrington Hwy - Westbound Left	450	50	100	450	170	295	450	170	295						
		Farrington Hwy - Westbound Through	600	125	170	600	180	235	600	180	235						
		Farrington Hwy - Westbound Right	470	0	40	470	0	45	470	0	45						
		Ft Barrette Ave - Northbound Left	300	120	180	300	205	280	300	205	280						
		Ft Barrette Ave - Northbound Through	1000	200	240	1000	285	325	1000	285	325						
		Ft Barrette Ave - Northbound Right	150	0	0	150	0	45	150	0	45						
		Makakilo Dr - Southbound Left	350	170	210	350	215	260	350	215	260						
		Makakilo Dr - Southbound Through	1000	610	675	1000	895	960	1000	895	960						
		Makakilo Dr - Southbound Right	350	145	265	350	365	535	350	365	535						
	7	Kualakai Pkwy/H-1 Westbound Ramp															
		H-1 Westbound Ramp - Westbound Left	1800	55	115	1800	320	545	1800	320	545						
		H-1 Westbound Ramp - Westbound Right	475	0	0	475	0	0	475	0	0						
		Kualakai Pkwy - Northbound Left	590	105	170	590	455	670	590	455	670						
		Kualakai Pkwy - Northbound Through	590	25	25	590	25	25	590	25	25						
		Kualakai Pkwy - Southbound Through	1000	25	25	1000	25	25	1000	25	25						
		Kualakai Pkwy - Southbound Right	25	0	0	25	0	0	25	0	0						
	8	Kualakai Pkwy/H-1 Eastbound Ramp															
		H-1 Eastbound Ramp - Eastbound Left	200	25	25	200	25	25	200	25	25						
		H-1 Eastbound Ramp - Eastbound Right	1500	0	45	1500	285	515	1500	285	515						
		Kualakai Pkwy - Northbound Through	1700	35	55	1700	200	265	1700	200	265						
		Kualakai Pkwy - Northbound Right	1700	0	30	1700	0	50	1700	0	50						
		Kualakai Pkwy - Southbound Left	500	25	25	500	25	25	500	25	25						
		Kualakai Pkwy - Southbound Through	590	75	120	590	335	345	590	335	345						

Notes:

Results are reported from the Synchro software. Red shaded cells represent queues that could exceed the storage length.

Average queues at signalized intersections represent the expected length on a typical traffic cycle. The 95th percentile queue is the expected length with 95th percentile traffic volumes.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Year (2028) No Build includes existing channelization on Farrington Highway.

Year (2028) Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Year (2028) Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turn lanes on all approaches.

Year (2028) Build Mitigated with Signal Priority assumes priority at the intersection of Kualakai Parkway and Farrington Highway is given to the southbound left, through, and right-turn movements.

Farrington Highway - Synchro Analysis - Queue Results
April 2020

			Existing Conditions			Year (2028) No Build			Year (2028) Build			Year (2028) Build Mitigated			Year (2028) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2018			2028 With Developments			2028 With Developments			2028 With Developments			2028 With Developments		
	Channelization Scenario -->		Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Existing, Farrington Hwy (2-lanes to Golf Course Road, 4-lanes to Makakilo)			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade with double left-turn lanes			Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade, double left-turn lanes, SB signal priority		
	ID	Intersection	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)
PM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)															
		Farrington Hwy - Eastbound Left															
		Farrington Hwy - Eastbound Through	1700	0	0	1700	0	0	1700	0	0						
		Farrington Hwy - Westbound Left	600	25	25	600	35	35	600	35	35						
		Farrington Hwy - Westbound Through	800	0	0	800	0	0	800	0	0						
		Farrington Hwy - Westbound Right															
		Old Fort Weaver Rd - Northbound Through															
		Old Fort Weaver Rd - Northbound Right	900	25	25	900	25	25	900	25	25						
		Old Fort Weaver Rd - Southbound Left															
		Old Fort Weaver Rd - Southbound Through/Right															
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)															
		Farrington Hwy - Eastbound Through/Right	500	0	0	500	0	0	500	0	0						
		Farrington Hwy - Westbound Left/Through	1700	25	25	1700	25	25	1700	25	25						
		Farrington Hwy - Westbound Through															
		Old Fort Weaver Rd - Northbound Left/Right	1200	25	25	1200	45	45	1200	30	30						
	3	Farrington Hwy/Kualakai Pkwy															
		Farrington Hwy - Eastbound Left	350	175	300	350	665	885	350	590	825	350	280	375	350	280	395
		Farrington Hwy - Eastbound Through	1400	90	190	1400	885	1130	1400	500	640	1400	455	590	1400	450	580
		Farrington Hwy - Eastbound Right	350	0	35	350	185	310	350	285	495	350	320	530	350	270	450
		Farrington Hwy - Westbound Left	120	175	225	120	870	1105	500	945	1195	500	375	505	500	455	585
		Farrington Hwy - Westbound Through	800	165	305	800	545	785	800	365	465	800	345	415	800	355	430
		Farrington Hwy - Westbound Right	140	0	0	140	185	300	140	260	460	140	310	495	140	275	455
		Kualakai Pkwy - Northbound Left	500	55	120	500	375	560	500	430	630	500	170	265	500	170	255
		Kualakai Pkwy - Northbound Through	1800	260	345	1800	715	810	1800	790	885	1800	675	740	1800	665	765
		Kualakai Pkwy - Northbound Right	500	0	50	500	75	200	500	0	90	500	30	120	500	45	155
		Kualakai Pkwy - Southbound Left	500	25	65	500	290	455	500	320	500	500	130	205	500	125	165
		Kualakai Pkwy - Southbound Through	1700	255	350	1700	800	895	1700	895	985	1700	730	795	1700	695	760
		Kualakai Pkwy - Southbound Right	500	0	80	500	140	305	500	25	145	500	95	230	500	140	275
	4	Farrington Hwy/Kapolei Golf Course Rd															
		Farrington Hwy - Westbound Left	215	25	25	215	25	25	215	25	25						
		Kapolei Golf Course Rd - Northbound Left	300	25	25	300	25	25	300	25	25						
		Kapolei Golf Course Rd - Northbound Right	300	25	25	300	25	25	300	25	25						
	5	Farrington Hwy/Kealanani Ave															
		Farrington Hwy - Eastbound Left	300	90	135	300	100	145	300	100	145						
		Farrington Hwy - Eastbound Through/Right	1100	60	100	1100	225	300	1100	225	300						
		Farrington Hwy - Westbound Left	500	155	275	500	310	490	500	310	490						
		Farrington Hwy - Westbound Through	1100	65	95	1100	185	240	1100	185	240						
		Farrington Hwy - Westbound Right	250	0	35	250	0	45	250	0	45						
		Kealanani Ave - Northbound Left	450	210	360	450	365	565	450	365	565						
		Kealanani Ave - Northbound Through	500	75	125	500	90	140	500	90	140						
		Kealanani Ave - Northbound Right	500	0	50	500	0	60	500	0	60						
		Kealanani Ave - Southbound Left	150	30	65	150	75	130	150	75	130						
		Kealanani Ave - Southbound Through	350	60	105	350	75	125	350	75	125						
		Kealanani Ave - Southbound Right	350	0	40	350	0	45	350	0	45						
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr															
		Farrington Hwy - Eastbound Left	250	485	620	250	615	750	250	615	750						
		Farrington Hwy - Eastbound Through	600	130	170	600	215	285	600	215	285						
		Farrington Hwy - Eastbound Right	335	25	60	335	105	220	335	105	220						
		Farrington Hwy - Westbound Left	450	70	115	450	190	275	450	190	275						
		Farrington Hwy - Westbound Through	600	145	180	600	170	225	600	170	225						
		Farrington Hwy - Westbound Right	470	120	165	470	165	235	470	165	235						
		Ft Barrette Ave - Northbound Left	300	60	100	300	130	220	300	130	220						
		Ft Barrette Ave - Northbound Through	1000	315	390	1000	465	595	1000	465	595						
		Ft Barrette Ave - Northbound Right	150	0	0	150	45	125	150	45	125						
		Makakilo Dr - Southbound Left	350	160	260	350	250	360	350	250	360						
		Makakilo Dr - Southbound Through	1000	460	610	1000	670	815	1000	670	815						
		Makakilo Dr - Southbound Right	350	0	105	350	30	165	350	30	165						
	7	Kualakai Pkwy/H-1 Westbound Ramp															
		H-1 Westbound Ramp - Westbound Left	1800	240	425	1800	1410	1690	1800	1410	1690						
		H-1 Westbound Ramp - Westbound Right	475	0	0	475	0	0	475	0	0						
		Kualakai Pkwy - Northbound Left	590	240	355	590	1160	1430	590	1160	1430						
		Kualakai Pkwy - Northbound Through	590	25	25	590	25	25	590	25	25						
		Kualakai Pkwy - Southbound Through	1000	25	25	1000	25	25	1000	25	25						
		Kualakai Pkwy - Southbound Right	25	0	0	25	0	0	25	0	0						
	8	Kualakai Pkwy/H-1 Eastbound Ramp															
		H-1 Eastbound Ramp - Eastbound Left	200	25	25	200	25	25	200	25	25						
		H-1 Eastbound Ramp - Eastbound Right	1500	60	130	1500	450	695	1500	450	695						
		Kualakai Pkwy - Northbound Through	1700	65	95	1700	255	310	1700	255	310						
		Kualakai Pkwy - Northbound Right	1700	0	35	1700	0	35	1700	0	35						
		Kualakai Pkwy - Southbound Left	500	25	25	500	25	25	500	25	25						
		Kualakai Pkwy - Southbound Through	590	155	225	590	395	125	590	395	125						

Notes:

Results are reported from the Synchro software. Red shaded cells represent queues that could exceed the storage length.

Average queues at signalized intersections represent the expected length on a typical traffic cycle. The 95th percentile queue is the expected length with 95th percentile traffic volumes.

Existing channelization scenario represents current lane configuration along Farrington in 2018.

Year (2028) No Build includes existing channelization on Farrington Highway.

Year (2028) Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Year (2028) Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turn lanes on all approaches.

Year (2028) Build Mitigated with Signal Priority assumes priority at the intersection of Kualakai Parkway and Farrington Highway is given to the southbound left, through, and right-turn movements.

Farrington Highway - Synchro Analysis - Queue Results

April 2020

			Future Phase (2035) No Build			Future Phase (2035) Build			Future Phase (2035) Build Mitigated			Future Phase (2035) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2035 With Developments			2035 With Developments			2035 With Developments			2035 With Developments		
	Channelization Scenario -->		Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (6-lanes to Golf Course Rd, 4-lanes to Makakilo), Kualakai at-grade, WB double right-turn lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes, SB signal priority		
	ID	Intersection	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)
AM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)												
		Farrington Hwy - Eastbound Left	200	25	65	200	25	50						
		Farrington Hwy - Eastbound Through	1700	535	770	1700	240	335						
		Farrington Hwy - Westbound Left	600	70	180	600	45	130						
		Farrington Hwy - Westbound Through	800	275	380	800	145	200						
		Farrington Hwy - Westbound Right	200	25	25	200	0	25						
		Old Fort Weaver Rd - Northbound Through	900	30	65	900	25	50						
		Old Fort Weaver Rd - Northbound Right	200	0	50	200	0	25						
		Old Fort Weaver Rd - Southbound Left	200	145	250	200	90	170						
		Old Fort Weaver Rd - Southbound Through/Right	500	0	0	500	0	0						
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)												
		Farrington Hwy - Eastbound Through/Right	500	150	295	500	70	125						
		Farrington Hwy - Westbound Left/Through												
		Farrington Hwy - Westbound Through	1700	75	145	1700	40	75						
		Old Fort Weaver Rd - Northbound Left/Right	1200	25	45	1200	25	35						
	3	Farrington Hwy/Kualakai Pkwy												
		Farrington Hwy - Eastbound Left	350	390	580	350	390	580	350	130	195	350	180	270
		Farrington Hwy - Eastbound Through	1400	335	410	1400	215	260	1400	195	235	1400	195	235
		Farrington Hwy - Eastbound Right	350	0	65	350	0	65	350	0	65	350	0	65
		Farrington Hwy - Westbound Left	500	485	690	500	485	690	500	170	275	500	245	345
		Farrington Hwy - Westbound Through	800	355	435	800	225	270	800	210	255	800	210	255
		Farrington Hwy - Westbound Right	500	605	860	500	35	105	500	170	265	500	175	270
		Kualakai Pkwy - Northbound Left	500	425	635	500	425	635	500	180	255	500	180	255
		Kualakai Pkwy - Northbound Through	1800	835	925	1800	835	925	1800	645	740	1800	555	630
		Kualakai Pkwy - Northbound Right	500	470	715	500	470	715	500	320	555	500	375	605
		Kualakai Pkwy - Southbound Left	500	1000	1245	500	1000	1245	500	235	320	500	235	320
		Kualakai Pkwy - Southbound Through	1700	505	615	1700	505	615	1700	415	480	1700	380	435
		Kualakai Pkwy - Southbound Right	500	175	310	500	175	310	500	135	250	500	195	310
	4	Farrington Hwy/Kapolei Golf Course Rd												
		Farrington Hwy - Westbound Left	215	25	25	215	25	25						
		Kapolei GolF Course Rd - Northbound Left	300	25	25	300	25	25						
		Kapolei GolF Course Rd - Northbound Right	300	25	25	300	25	25						
	5	Farrington Hwy/Kealanani Ave												
		Farrington Hwy - Eastbound Left	300	50	85	300	50	85						
		Farrington Hwy - Eastbound Through/Right	1100	195	265	1100	195	265						
		Farrington Hwy - Westbound Left	500	220	380	500	220	380						
		Farrington Hwy - Westbound Through	1100	145	190	1100	145	190						
		Farrington Hwy - Westbound Right	250	0	35	250	0	35						
		Kealanani Ave - Northbound Left	450	295	500	450	295	500						
		Kealanani Ave - Northbound Through	500	40	75	500	40	75						
		Kealanani Ave - Northbound Right	500	0	60	500	0	60						
		Kealanani Ave - Southbound Left	150	40	75	150	40	75						
		Kealanani Ave - Southbound Through	350	25	45	350	25	45						
		Kealanani Ave - Southbound Right	350	0	25	350	0	25						
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr												
		Farrington Hwy - Eastbound Left	250	195	305	250	195	305						
		Farrington Hwy - Eastbound Through	600	175	230	600	175	230						
		Farrington Hwy - Eastbound Right	335	25	75	335	25	75						
		Farrington Hwy - Westbound Left	450	195	330	450	195	330						
		Farrington Hwy - Westbound Through	600	190	245	600	190	245						
		Farrington Hwy - Westbound Right	470	0	45	470	0	45						
		Ft Barrette Ave - Northbound Left	300	155	260	300	155	260						
		Ft Barrette Ave - Northbound Through	1000	310	380	1000	310	380						
		Ft Barrette Ave - Northbound Right	150	0	60	150	0	60						
		Makakilo Dr - Southbound Left	350	185	245	350	185	245						
		Makakilo Dr - Southbound Through	1000	725	875	1000	725	875						
		Makakilo Dr - Southbound Right	350	245	445	350	245	445						
	7	Kualakai Pkwy/H-1 Westbound Ramp												
		H-1 Westbound Ramp - Westbound Left	1800	700	950	1800	700	950						
		H-1 Westbound Ramp - Westbound Right	475	0	0	475	0	0						
		Kualakai Pkwy - Northbound Left	590	290	410	590	290	410						
		Kualakai Pkwy - Northbound Through	590	195	275	590	195	275						
		Kualakai Pkwy - Southbound Through	1000	425	555	1000	425	555						
		Kualakai Pkwy - Southbound Right	25	0	0	25	0	0						
	8	Kualakai Pkwy/H-1 Eastbound Ramp												
		H-1 Eastbound Ramp - Eastbound Left	200	25	35	200	25	35						
		H-1 Eastbound Ramp - Eastbound Right	1500	525	745	1500	525	745						
		Kualakai Pkwy - Northbound Through	1700	300	380	1700	300	380						
		Kualakai Pkwy - Northbound Right	1700	640	790	1700	640	790						
		Kualakai Pkwy - Southbound Left	250	350	540	250	350	540						
		Kualakai Pkwy - Southbound Through	590	630	860	590	630	860						

Notes:

Results are reported from the Synchro software. Red shaded cells represent queues that could exceed the storage length.

Average queues at signalized intersections represent the expected length on a typical traffic cycle. The 95th percentile queue is the expected length with 95th percentile traffic volumes.

Future Phase Year is 2035.

Future Phase No Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Future Phase Build includes six lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road, with double right-turn lanes on the westbound approach.

Future Phase Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turns on the northbound, eastbound, and westbound approaches and triple left-turns on the southbound approach.

Farrington Highway - Synchro Analysis - Queue Results

April 2020

			Future Phase (2035) No Build			Future Phase (2035) Build			Future Phase (2035) Build Mitigated			Future Phase (2035) Build Mitigated with Signal Priority		
Peak	Year, Land Use Scenario -->		2035 With Developments			2035 With Developments			2035 With Developments			2035 With Developments		
	Channelization Scenario -->		Farrington Hwy (4-lanes to Makakilo), Kualakai at-grade			Farrington Hwy (6-lanes to Golf Course Rd, 4-lanes to Makakilo), Kualakai at-grade, WB double right-turn lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes			Farrington Hwy (6-lanes to Kualakai, 4-lanes to Makakilo), Kualakai at-grade, multiple turn-lanes, SB signal priority		
	ID	Intersection	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)	Storage Length (ft)	Average Queue (ft)	95th % Queue (ft)
PM Peak	1	Farrington Hwy/Old Fort Weaver Rd (East Loop)												
		Farrington Hwy - Eastbound Left	200	155	300	200	85	205						
		Farrington Hwy - Eastbound Through	1700	655	825	1700	285	380						
		Farrington Hwy - Westbound Left	600	260	440	600	155	305						
		Farrington Hwy - Westbound Through	800	1075	1210	800	410	530						
		Farrington Hwy - Westbound Right	200	160	270	200	30	115						
		Old Fort Weaver Rd - Northbound Through	900	110	235	900	60	150						
		Old Fort Weaver Rd - Northbound Right	200	0	45	200	0	25						
		Old Fort Weaver Rd - Southbound Left	200	435	565	200	235	360						
		Old Fort Weaver Rd - Southbound Through/Right	500	30	120	500	0	30						
	2	Farrington Hwy/Old Fort Weaver Rd (West Loop)												
		Farrington Hwy - Eastbound Through/Right	500	140	260	500	65	115						
		Farrington Hwy - Westbound Left/Through												
		Farrington Hwy - Westbound Through	1700	295	715	1700	110	195						
		Old Fort Weaver Rd - Northbound Left/Right	1200	40	80	1200	25	50						
	3	Farrington Hwy/Kualakai Pkwy												
		Farrington Hwy - Eastbound Left	350	620	835	350	605	825	350	260	375	350	340	450
		Farrington Hwy - Eastbound Through	1400	570	710	1400	335	395	1400	340	395	1400	340	395
		Farrington Hwy - Eastbound Right	350	60	185	350	60	190	350	145	285	350	145	285
		Farrington Hwy - Westbound Left	500	625	845	500	615	835	500	260	370	500	340	450
		Farrington Hwy - Westbound Through	800	675	810	800	375	460	800	375	460	800	375	460
		Farrington Hwy - Westbound Right	500	545	790	500	0	55	500	90	170	500	90	165
		Kualakai Pkwy - Northbound Left	500	785	1020	500	775	1005	500	315	435	500	315	435
		Kualakai Pkwy - Northbound Through	1800	685	780	1800	685	780	1800	490	555	1800	450	515
		Kualakai Pkwy - Northbound Right	500	430	665	500	410	650	500	330	560	500	400	630
		Kualakai Pkwy - Southbound Left	500	1170	1425	500	1150	1405	500	275	365	500	275	365
		Kualakai Pkwy - Southbound Through	1700	975	1065	1700	960	1055	1700	830	920	1700	715	835
		Kualakai Pkwy - Southbound Right	500	225	385	500	205	360	500	220	365	500	285	430
	4	Farrington Hwy/Kapolei Golf Course Rd												
		Farrington Hwy - Westbound Left	215	25	25	215	25	25						
		Kapolei GolF Course Rd - Northbound Left	300	25	30	300	25	30						
		Kapolei GolF Course Rd - Northbound Right	300	25	30	300	25	30						
	5	Farrington Hwy/Kealanani Ave												
		Farrington Hwy - Eastbound Left	300	105	160	300	105	160						
		Farrington Hwy - Eastbound Through/Right	1100	485	645	1100	485	645						
		Farrington Hwy - Westbound Left	500	375	570	500	375	570						
		Farrington Hwy - Westbound Through	1100	275	320	1100	275	320						
		Farrington Hwy - Westbound Right	250	0	55	250	0	55						
		Kealanani Ave - Northbound Left	450	405	610	450	405	610						
		Kealanani Ave - Northbound Through	500	95	150	500	95	150						
		Kealanani Ave - Northbound Right	500	25	75	500	25	75						
		Kealanani Ave - Southbound Left	150	115	195	150	115	195						
		Kealanani Ave - Southbound Through	350	80	130	350	80	130						
		Kealanani Ave - Southbound Right	350	0	45	350	0	45						
	6	Farrington Hwy/Ft Barrette Ave/Makakilo Dr												
		Farrington Hwy - Eastbound Left	250	625	760	250	625	760						
		Farrington Hwy - Eastbound Through	600	320	395	600	320	395						
		Farrington Hwy - Eastbound Right	335	145	265	335	145	265						
		Farrington Hwy - Westbound Left	450	240	385	450	240	385						
		Farrington Hwy - Westbound Through	600	190	245	600	190	245						
		Farrington Hwy - Westbound Right	470	145	215	470	145	215						
		Ft Barrette Ave - Northbound Left	300	185	285	300	185	285						
		Ft Barrette Ave - Northbound Through	1000	645	785	1000	645	785						
		Ft Barrette Ave - Northbound Right	150	70	160	150	70	160						
		Makakilo Dr - Southbound Left	350	245	355	350	245	355						
		Makakilo Dr - Southbound Through	1000	690	835	1000	690	835						
		Makakilo Dr - Southbound Right	350	80	245	350	80	245						
	7	Kualakai Pkwy/H-1 Westbound Ramp												
		H-1 Westbound Ramp - Westbound Left	1800	1345	1625	1800	1345	1625						
		H-1 Westbound Ramp - Westbound Right	475	0	0	475	0	0						
		Kualakai Pkwy - Northbound Left	250	290	410	250	290	410						
		Kualakai Pkwy - Northbound Through	590	415	590	590	415	590						
		Kualakai Pkwy - Southbound Through	1000	250	365	1000	250	365						
		Kualakai Pkwy - Southbound Right	25	0	0	25	0	0						
	8	Kualakai Pkwy/H-1 Eastbound Ramp												
		H-1 Eastbound Ramp - Eastbound Left	200	25	30	200	25	30						
		H-1 Eastbound Ramp - Eastbound Right	1500	0	0	1500	0	0						
		Kualakai Pkwy - Northbound Through	1700	60	145	1700	60	145						
		Kualakai Pkwy - Northbound Right	1700	0	0	1700	0	0						
		Kualakai Pkwy - Southbound Left	250	45	100	250	45	100						
		Kualakai Pkwy - Southbound Through	590	0	835	590	0	835						

Notes:

Results are reported from the Synchro software. Red shaded cells represent queues that could exceed the storage length.

Average queues at signalized intersections represent the expected length on a typical traffic cycle. The 95th percentile queue is the expected length with 95th percentile traffic volumes.

Future Phase Year is 2035.

Future Phase No Build includes four lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road.

Future Phase Build includes six lanes on Farrington Highway from Kapolei Golf Course Road to Old Fort Weaver Road, with double right-turn lanes on the westbound approach.

Future Phase Build Mitigated assumes the intersection of Kualakai Parkway and Farrington Highway is at-grade, with double left-turns on the northbound, eastbound, and westbound approaches and triple left-turns on the southbound approach.

Appendix D

Forecasting and Trip Generation/Distribution

Table D.1 - Farrington Highway Trip Generation (ITE 8th Edition) - 2028

UH West Oahu	ID#	1,2,3	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			666	**1025**	**1691**	**1923**	**1605**	**3528**
Transit trip reduction (8%)		0.92	613	943	1556	1769	1477	3246
Trips in Analysis =		0.75	460	707	1167	1327	1107	2434
Internal Zone Trip Reduction =		0.20	368	566	934	1062	886	1948
			Net Trips 370	565		Net Trips 1060	885	

Hoopili	ID#	4	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
Updated Land Use, May 30, 2014			**3556**	**5013**	**8569**	**6070**	**5362**	**11434**
Table 5.5 Project Trip Generation with Rail Transit, Phase 1 and 2								
			3556	**5013**	**8569**	**6070**	**5362**	**11434**
Percent complete by 2028 (30%)		0.30	1067	1504	2571	1821	1609	3430
Trips in Analysis =		0.70	747	1053	1799	1275	1126	2401
			Net Trips 745	1055		Net Trips 1275	1125	

Royal Kunia II	ID#	7	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			137	**523**	**660**	**540**	**292**	**832**
Transit trip reduction (8%)		0.92	126	481	607	497	268	765
Trips in Analysis =		0.10	13	48	61	50	27	77
			Net Trips 15	50		Net Trips 50	25	

East Kapolei I - Kanehili	ID#	9	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			39	**44**	**83**	**119**	**112**	**231**
Transit trip reduction (8%)		0.92	36	41	76	110	103	212
Trips in Analysis =		0.60	21	24	46	66	62	127
			Net Trips 20	25		Net Trips 65	60	

East Kapolei Phase II - Kauluokahai	ID#	10	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			239	**815**	**1054**	**877**	**492**	**1370**
Transit trip reduction (8%)		0.92	220	750	970	807	453	1260
Trips in Analysis =		0.60	132	450	582	484	272	756
			312	**255**	**567**	**82**	**86**	**168**
Transit trip reduction (0%)		1.00	312	255	567	82	86	168
Trips in Analysis =		0.20	62	51	113	16	17	34
			Net Trips 195	500		Net Trips 500	290	

Ka Makana Alii	ID#	12	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			478	**297**	**775**	**1135**	**1109**	**2244**
Transit trip reduction (8%)		0.92	439	273	713	1044	1020	2064
Trips in Analysis =		0.60	264	164	428	626	612	1238
			Net Trips 265	165		Net Trips 625	610	

Kalaeloa Master Plan	ID#	13	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			2281	**1899**	**4180**	**2050**	**2826**	**4876**
Transit trip reduction (8%)		0.92	2099	1747	3846	1886	2600	4486
Trips in Analysis =		0.20	420	349	769	377	520	897
			Net Trips 420	350		Net Trips 375	520	

North Kapolei	ID#	19	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			135	**405**	**540**	**458**	**269**	**727**
Transit trip reduction (8%)		0.92	124	373	497	421	248	669
Trips in Analysis =		0.10	12	37	50	42	25	67
			Net Trips 10	35		Net Trips 40	25	

DNLR D	ID#	20	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			223	**59**	**282**	**162**	**311**	**473**
Transit trip reduction (8%)		0.92	205	54	259	149	286	435
Trips in Analysis =		1.00	205	54	259	149	286	435
			Net Trips 205	55		Net Trips 150	285	

DNLR C	ID#	21	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			372	**115**	**486**	**375**	**603**	**977**
Transit trip reduction (8%)		0.92	342	106	448	345	555	899
Trips in Analysis =		1.00	342	106	448	345	555	899
			Net Trips 340	105		Net Trips 345	555	

DNLR A, B	ID#	22, 23	AM Peak			PM Peak		
			In	Out	Total	In	Out	Total
			540	**99**	**639**	**206**	**653**	**859**
Transit trip reduction (8%)		0.92	497	91	588	189	601	790
Trips in Analysis =		1.00	497	91	588	189	601	790
			Net Trips 495	90		Net Trips 190	600	

Appendix E

Hoopili Trigger Study (August 2018)

ROADWAY IMPROVEMENTS

This section provides estimates for the timing of future critical roadway improvements related to and within the vicinity of the Hoopili Project. These estimates were determined via traffic analysis based on traffic projections of the Project, ambient traffic growth, and developments in the area that will likely contribute to traffic within the vicinity of the Project. The traffic projections utilized in this report were based on those contained within the Hoopili Traffic Impact Analysis Report (TIAR), completed by ATA in May 2014 and updated with recent traffic count data conducted in 2017.

The timing of the following critical roadway improvements was estimated:

- Road E construction (extension of Campus Drive)
- Road H construction and connection to Kualakai Parkway
- Signalization of Kualakai Parkway/Road H intersection
- Farrington Highway widening
- Kualakai Parkway widening
- Keahumoa Parkway extension to Fort Weaver Road

General Discussion

For the purpose of this analysis, the project has been broken up into eight (8) initial phases anticipated to span from years 2018 - 2024. The sequence of each phase was determined based on necessary infrastructure.

In this analysis, not all internal roadways were considered. However, the major internal roadways providing connectivity between phases and to the major roadways were listed when triggered.

On average the project blocks generate approximately 190 trips during the AM(PM) combined. Each block trip generation ranges from approximately 100 to 350 trips.

Assumptions:

- When triggered, internal roadway and connections to major roads are assumed to be built to their full cross-section.
- Smaller internal roadways assumed to be constructed concurrently with subject phase.
- Background project assumptions are based on the TIAR's assumptions. However, where known, background project trips were modified as necessary.

Methodology

Phases 1 through 6, Phase 10A, and Phase 13 provide general information on the land use and build-out years of each phase. Traffic generated by the land uses in each phase was added to the project roadways to determine when critical roadway improvements would be triggered. Background project traffic was also taken into account for each of the phases. Beyond Year 2024 (Phase 13), the development schedule is less certain and as such, further analyses were not conducted for the purpose of this report.

Findings:

Due to the uncertainty regarding surrounding regional projects, the variability of the development schedule, and the periodic updates to the Traffic Impact Analysis Report (TIAR) from which these projections were based, it is important to note that these projections reflect "best-guess" estimates at the time of this study. Future updates to the TIAR will provide updated information thereby providing more accurate determinations of the improvements required in and around the Hoopili project area. Likewise, it is recommended to update this study as updated traffic projections are available to yield more accurate determinations of the timing of critical roadway improvements in and around the Hoopili project area.

See below for a summary of the timeline for major roadway improvement triggers:

Phase 1 (2018)

DU:	**291**
Commercial SF:	**15,000 approx.**
Overall Percent Complete (by DU):	**3%**

<u>Recommended roadways:</u>

1. **Extend Keahumoa Parkway along Phase 1 frontage.**
2. **Construct Road 4 from Keahumoa Parkway to Maunakapu Street.**
3. **Construct Road K from Road 4 to the edge of Phase 1 development.**

Phase 1 will include single-family and AMX land uses and is the first phase of the Hoopili development.

Phase 3 (2019)

DU:	**282**
Commercial SF:	**0**
Overall Percent Complete (by DU):	**5%**

<u>Recommended roadways:</u>

1. **Extend Road 4 northward along project frontage.**

Phase 3 will include single-family and apartment uses, and will extend northward from Phase 1.

Phase 2 (2021)

DU:	**716**
Commercial SF:	**64,000 approx.**
Overall Percent Complete (by DU):	**11%**

<u>Recommended roadways:</u>

1. **Construct Road E from Kualakai Parkway to Road 3.**
2. **Construct additional turning lanes at the Kualakai Parkway/Road E intersection.**

Phase 2 will include AMX, BMX, and commercial uses and will be constructed near the proposed Park 'n Ride for the rail; access will be provided via Kualakai Parkway.

Road E – Road E is expected to be constructed during this phase to provide access to the proposed Park 'n Ride for the rail via its intersection with Kualakai Parkway. The Kualakai Parkway/Road E intersection has an existing traffic signal, which will ultimately need to be modified to accommodate the UHWO driveway and conversion of the existing Hoopili driveway to Road E.

Phase 4 (2021)

DU:	**407**
Commercial SF:	**0**
Overall Percent Complete (by DU):	**15%**

Recommended roadways:

1. **Extend Road 4 northward to Road F.**
2. **Construct Road H from Road 3 to the edge of Phase 4 development.**
3. **Construct additional turning lanes at the Kualakai Parkway/Keahumoa Parkway intersection.**

Phase 4 will include single-family and apartment uses, and will extend northward from Phase 3. Road 4 and Road H will connect and a contiguous roadway network will be forged between Kualakai Parkway and Keahumoa Parkway via Road 4.

Phase 5 (2021)

DU:	**288**
Commercial SF:	**16,000 approx.**
Overall Percent Complete (by DU):	**18%**

Recommended roadways:

1. **Extend Road E eastward from Road 3 to Road 5.**
2. **Extend Road 4 northward from Road F to Road D.**

Phase 5 will include AMX land uses.

Phase 6 (2022)

DU:	**410**
Commercial SF:	**272,250 approx.**
Overall Percent Complete (by DU):	**21%**

Recommended roadways:

1. **Construct Road H from Kualakai Parkway to Road 3.**
2. **Construct additional turning lanes at the Kualakai Parkway/Road H intersection.**
3. **Construct RIRO access on Kualakai Parkway for the Gateway Development.**

4. **Construct Road K from Road A to Farrington Highway and construct traffic signal at Farrington Highway/Road K intersection for the IMX Development.**

Phase 6 will be developed to the south of Phase 2, and will include single-family, AMX, BMX, IMX, and commercial land uses.

Road H – The initial segment of Road H is assumed to be necessary for the full build-out of the DHHL East Kapolei development and is expected to serve as a right-in, right-out (RIRO) intersection at Kualakai Parkway by Phase 6. It is assumed that this intersection will eventually become a full-access signalized intersection to accommodate projected traffic volumes.

Gateway Development Access – Access to the Gateway Development on the northwest corner of the Kualakai Parkway/Farrington Highway intersection is expected to be provided via a right-in, right-out (RIRO) driveway along Kualakai Parkway by Phase 6. It is assumed that this driveway connection and any intersection improvements associated with the Gateway Development are expected to be constructed in conjunction with the initial development of the Gateway Development itself. Should the Gateway Development be developed at an earlier or later timeframe, the associated connections and intersection improvements are expected to be developed at that same timeframe.

IMX Development Access – Similarly, access to the IMX Development north of Farrington Highway is expected to be provided via a signalized intersection at Farrington Highway/Road K. It is assumed that this driveway connection, traffic signal, and any other intersection improvements associated with the IMX Development is expected to be constructed in conjunction with the initial development of the IMX Development itself. Should the IMX Development be developed at an earlier or later timeframe, the associated connections and intersection improvements are expected to be developed at that same timeframe.

Phase 10A (2023)

DU:	**238**
Commercial SF:	**244,250 approx.**
Overall Percent Complete (by DU):	**23%**

Recommended roadways:

1. **Construct Road 6 from Road J to Road K.**
2. **Extend Road K eastward from the edge of Phase 1 development to Road J.**

Phase 10A will include single-family, AMX, IMX and commercial land uses, and will extend eastward from Phase 1 and Phase 3.

Phase 13 (2024)

DU:	**343**
Commercial SF:	**244,250 approx.**
Overall Percent Complete (by DU):	**26%**

Recommended roadways:

1. **Extend Road K northward from Road J to Road 7.**
2. **Extend Road 6 northward from Road J to Road H.**
3. **Extend Road H eastward from the edge of Phase 4 development to Road 7.**
4. **Construct a traffic signal at the Kualakai Parkway/Gateway Development intersection.**
5. **Construct Road A from the IMX Development to Farrington Highway and construct a RIRO access at the Farrington Highway/Road A intersection.**

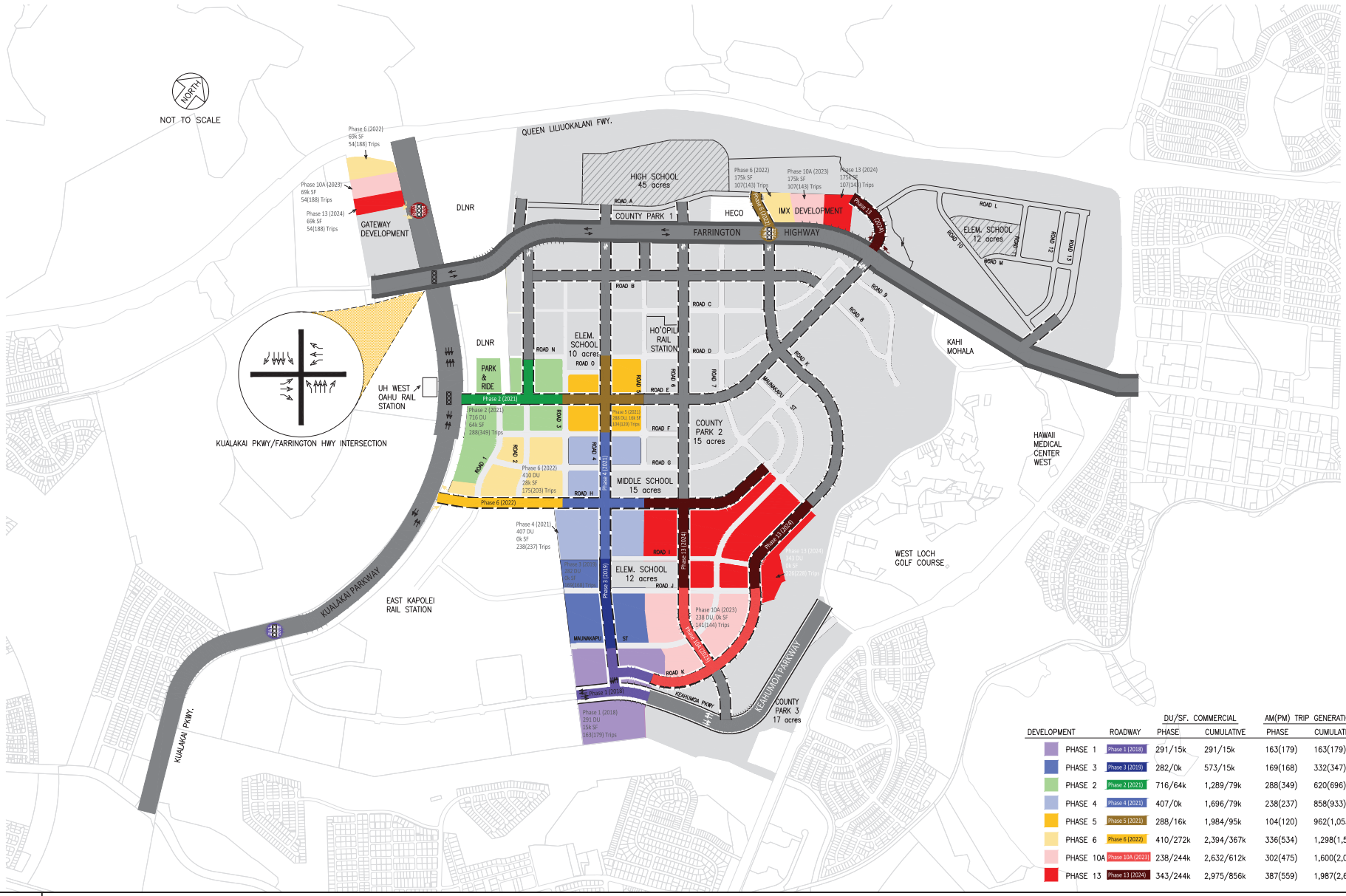
Phase 13 will include single-family, apartment, IMX and commercial land uses, and will extend northward from Phase 10A.

Gateway Development Access – By Year 2024, access to the Gateway Development is expected to be upgraded from a RIRO intersection to a signalized intersection based on projections of the parcel's development. However, this improvement assumes that the rate of the parcel's development generally occurs according to Figure D.1. Should the Gateway Development be developed at an earlier or later timeframe, the associated connections and intersection improvements are expected to be developed at that same timeframe.

IMX Development Access – By Year 2024, a secondary access to the IMX Development is expected to be provided via a RIRO intersection at Farrington Highway/Road A. However, this improvement assumes that the rate of the parcel's development generally occurs according to Figure D.1. Should the IMX Development be developed at an earlier or later timeframe, the associated connections and intersection improvements are expected to be developed at that same timeframe.

Beyond Year 2024, the remaining phases of Hoopili were not studied due to the uncertainty in the development schedule, as well as their long lead time. However, roadway improvements for these remaining phases are expected to be restudied in a future TIAR after the development of the first 2,500 units of the Project (prior to Phase 10A).

See the attached Figure D.1 for the Hoopili roadway improvement timeline map.



DEVELOPMENT	ROADWAY	DU/SF. COMMERCIAL PHASE	DU/SF. COMMERCIAL CUMULATIVE	AM(PM) TRIP GENERATION PHASE	AM(PM) TRIP GENERATION CUMULATIVE
PHASE 1	Phase 1 (2018)	291/15k	291/15k	163(179)	163(179)
PHASE 3	Phase 3 (2019)	282/0k	573/15k	169(168)	332(347)
PHASE 2	Phase 2 (2021)	716/64k	1,289/79k	288(349)	620(696)
PHASE 4	Phase 4 (2021)	407/0k	1,696/79k	238(237)	858(933)
PHASE 5	Phase 5 (2021)	288/16k	1,984/95k	104(120)	962(1,053)
PHASE 6	Phase 6 (2022)	410/272k	2,394/367k	336(534)	1,298(1,587)
PHASE 10A	Phase 10A (2023)	238/244k	2,632/612k	302(475)	1,600(2,062)
PHASE 13	Phase 13 (2024)	343/244k	2,975/856k	387(559)	1,987(2,621)

HOOPILI ROADWAY MASTER PLAN

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

ROADWAY IMPROVEMENT TIMELINE MAP

FIGURE
D.1

Hoopili Phase 1 Improvements Analysis

Kualakai/Farrington

N		306	844	27		Intersection	
		126	454	134		LOS	Delay
						C/C	32.1/29.1
219	156					57	101
110	351		1			74	188
104	43					37	112
						Critical Movement	
		38	610	284		LOS	v/c
		76	654	98		E/E	0.86/0.88

Kualakai/Keahumoa Pkwy*

N		30	871	231		Intersection	
		15	388	134		LOS	Delay
						C/C	22.1/23.2
25	19					215	222
2	2		4			0	2
26	15					111	159
						Critical Movement	
		17	734	90		LOS	v/c
		23	608	166		E/E	0.84/0.89

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Hoopili Phase 3 Improvements Analysis

Kualakai/Farrington

N		309	937	30		Intersection	
		131	519	141		LOS	Delay
						C/C	31.9/31.2
226	164					58	101
114	361		1			77	195
114	46					41	122
						Critical Movement	
		49	718	294		LOS	v/c
		80	699	106		E/E	0.86/0.89

Kualakai/Keahumoa Pkwy*

N		60	848	384		Intersection	
		29	387	189		LOS	Delay
						C/C	28.7/31.9
51	38					378	308
17	18		4			12	22
52	31					144	181
						Critical Movement	
		34	724	100		LOS	v/c
		46	576	214		E/E	0.87/0.94

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Hoopili Phases 2, 4, and 5 Improvements Analysis

Kualakai/Farrington

N		317	1,356	34		Intersection	
		142	873	154		LOS	Delay
						D/C	35.5/34.3
239	180					58	100
122	381		1			85	209
154	65					78	166
						Critical Movement	
		96	1,217	358		LOS	v/c
		108	1,021	154		E/E	0.87/0.90

Kualakai/Road E*

N		148	1,136	442		Intersection	
		214	603	228		LOS	Delay
						D/D	42.6/40.0
177	93					479	314
54	24		2			26	8
228	99					136	125
						Critical Movement	
		149	1,144	113		LOS	v/c
		128	823	127		E/E	0.86/0.91

Kualakai/Keahumoa Pkwy*

N		120	978	505		Intersection	
		58	539	251		LOS	Delay
						D/D	35.5/35.1
102	76					552	374
60	86		4			65	79
104	62					156	197
						Critical Movement	
		67	877	105		LOS	v/c
		93	656	257		E/E	0.80/0.92

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Hoopili Phase 6 Improvements Analysis

Kualakai/Farrington

N		330	1,496	106		Intersection	
		149	953	190		LOS	Delay
						D/D	40.5/39.4
246	188					61	147
128	394		1			89	224
165	70					85	184
						Critical Movement	
		108	1,335	373		LOS	v/c
		114	1,084	167		E/E	0.91/0.91

Kualakai/Road E*

N		179	1,240	490		Intersection	
		246	648	246		LOS	Delay
						D/D	38.5/42.3
204	111					278	218
62	29		2			26	8
273	120					139	131
						Critical Movement	
		171	1,484	98		LOS	v/c
		156	981	83		E/E	0.88/0.92

Kualakai/Road H*

N		48	1,666	0		Intersection	
		57	876	0		LOS	Delay
						A/A	0.1/0.3
0	0					506	279
0	0		3			0	0
45	18					0	0
						Critical Movement	
		0	1,319	27		LOS	v/c
		0	983	116		B/C	0.04/0.18

Kualakai/Keahumoa Pkwy*

N		150	998	634		Intersection	
		73	549	298		LOS	Delay
						D/D	36.6/43.1
127	95					421	297
78	105		4			80	102
130	77					185	218
						Critical Movement	
		84	882	105		LOS	v/c
		116	698	238		E/E	0.87/0.94

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Hoopili Phase 10A Improvements Analysis

Kualakai/Farrington

N		343	1,554	176		Intersection	
		156	1,007	225		LOS	Delay
						D/D	43.1/42.5
253	195					67	193
133	406		1			93	240
171	72					89	198
						Critical Movement	
		115	1,389	378		LOS	v/c
		117	1,105	172		E/E	0.91/0.91

Kualakai/Road E*

N		209	1,253	535		Intersection	
		279	666	262		LOS	Delay
						D/D	38.8/44.0
230	128					278	218
70	33		2			26	8
317	141					139	131
						Critical Movement	
		194	1,543	98		LOS	v/c
		183	991	83		E/E	0.89/0.92

Kualakai/Road H*

N		57	1,724	0		Intersection	
		68	907	0		LOS	Delay
						A/A	0.1/0.4
0	0					568	318
0	0		3			0	0
55	22					0	0
						Critical Movement	
		0	1,354	31		LOS	v/c
		0	989	137		B/C	0.05/0.24

Kualakai/Keahumoa Pkwy*

N		180	1,011	672		Intersection	
		87	555	316		LOS	Delay
						D/D	36.6/44.9
153	115					455	313
79	107		4			80	104
155	93					207	233
						Critical Movement	
		101	878	108		LOS	v/c
		139	687	256		E/E	0.83/0.94

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Hoopili Phase 13 Improvements Analysis

Kualakai/Farrington

N		350	1,676	104		Intersection	
		165	1,078	235		LOS	Delay
						D/D	48.0/46.5
289	221					78	264
147	427		1			103	264
175	76					101	222
						Critical Movement	
		135	1,530	395		LOS	v/c
		118	1,234	198		E/E	0.92/0.92

Kualakai/Road E*

N		222	1,299	629		Intersection	
		292	703	298		LOS	Delay
						D/D	43.3/46.4
241	135					278	218
73	35		2			26	8
336	150					139	131
						Critical Movement	
		203	1,722	98		LOS	v/c
		195	1,128	83		E/E	0.89/0.94

Kualakai/Road H*

N		61	1,779	0		Intersection	
		73	947	0		LOS	Delay
						A/A	0.1/0.5
0	0					704	384
0	0		3			0	0
59	24					0	0
						Critical Movement	
		0	1,399	40		LOS	v/c
		0	1,068	166		B/D	0.06/0.27

Kualakai/Keahumoa Pkwy*

N		193	1,021	701		Intersection	
		93	577	327		LOS	Delay
						D/D	38.8/49.0
164	123					472	312
90	121		4			91	119
166	99					268	256
						Critical Movement	
		108	898	112		LOS	v/c
		149	776	284		E/E	0.84/0.94

*Note: Laneage on the University of Hawaii West Oahu (UHWO) campus side of the intersection will not be constructed until UHWO builds the associated roadways to/from that development.

Appendix F

Year (2028) Intersection Reports

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↖	↑		↗
Traffic Vol, veh/h	935	0	60	520	0	85
Future Vol, veh/h	935	0	60	520	0	85
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	1	1	10	10	11	11
Mvmt Flow	984	0	63	547	0	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	994	0	-	1004
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	6.31
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.29	-	-	3.399
Pot Cap-1 Maneuver	-	0	665	-	0	282
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	659	-	-	277
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	24.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	277	-	659	-
HCM Lane V/C Ratio	0.323	-	0.096	-
HCM Control Delay (s)	24.1	-	11	-
HCM Lane LOS	C	-	B	-
HCM 95th %tile Q(veh)	1.4	-	0.3	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	870	30	35	485	40	65
Future Vol, veh/h	870	30	35	485	40	65
Conflicting Peds, #/hr	0	10	10	0	10	10
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	95	95	95	95	95	95
Heavy Vehicles, %	1	1	10	10	4	4
Mvmt Flow	916	32	37	511	42	68

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	958	0	1537	952
Stage 1	-	-	-	-	942	-
Stage 2	-	-	-	-	595	-
Critical Hdwy	-	-	4.2	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.29	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	687	-	126	312
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	547	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	681	-	115	307
Mov Cap-2 Maneuver	-	-	-	-	115	-
Stage 1	-	-	-	-	373	-
Stage 2	-	-	-	-	501	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	48.3
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	188	-	-	681	-
HCM Lane V/C Ratio	0.588	-	-	0.054	-
HCM Control Delay (s)	48.3	-	-	10.6	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	3.2	-	-	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Future Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	229	508	427	214	476	400	282	1233	376	274	1198	366
Arrive On Green	0.14	0.29	0.29	0.14	0.29	0.29	0.17	0.26	0.26	0.17	0.26	0.26
Sat Flow, veh/h	1681	1765	1484	1573	1651	1389	1681	4818	1471	1633	4680	1429
Grp Volume(v), veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Grp Sat Flow(s),veh/h/ln	1681	1765	1484	1573	1651	1389	1681	1606	1471	1633	1560	1429
Q Serve(g_s), s	17.0	36.0	19.2	17.0	33.6	11.8	21.0	32.0	32.0	21.0	25.4	32.0
Cycle Q Clear(g_c), s	17.0	36.0	19.2	17.0	33.6	11.8	21.0	32.0	32.0	21.0	25.4	32.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	229	508	427	214	476	400	282	1233	377	274	1198	366
V/C Ratio(X)	1.13	1.08	0.62	1.18	0.95	0.41	1.15	1.05	1.52	1.19	0.84	1.05
Avail Cap(c_a), veh/h	229	508	427	214	476	400	282	1233	377	274	1198	366
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.0	44.5	38.5	54.0	43.7	35.9	52.0	46.5	46.5	52.0	44.1	46.5
Incr Delay (d2), s/veh	98.5	62.0	2.6	119.7	29.5	0.7	102.0	41.2	249.2	115.3	5.4	60.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.1	26.3	8.1	14.5	19.2	4.6	17.7	18.9	39.0	18.2	11.6	18.8
LnGrp Delay(d),s/veh	152.5	106.5	41.1	173.7	73.2	36.6	154.0	87.7	295.7	167.3	49.5	107.2
LnGrp LOS	F	F	D	F	E	D	F	F	F	F	D	F
Approach Vol, veh/h		1068			869			2200			1715	
Approach Delay, s/veh		101.5			95.6			151.8			84.8	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.0	35.0	22.0	42.0	26.0	35.0	22.0	42.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	20.0	28.0	16.0	35.0	20.0	28.0	16.0	35.0
Max Q Clear Time (g_c+I1), s	23.0	34.0	19.0	38.0	23.0	34.0	19.0	35.6
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	114.6
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	860	10	25	675	10	10
Future Vol, veh/h	860	10	25	675	10	10
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	5	5	20	20
Mvmt Flow	905	11	26	711	11	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	926	0	1339	478
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	418	-
Critical Hdwy	-	-	4.2	-	7.2	7.3
Critical Hdwy Stg 1	-	-	-	-	6.2	-
Critical Hdwy Stg 2	-	-	-	-	6.2	-
Follow-up Hdwy	-	-	2.25	-	3.7	3.5
Pot Cap-1 Maneuver	-	-	715	-	123	488
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	583	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	709	-	117	480
Mov Cap-2 Maneuver	-	-	-	-	227	-
Stage 1	-	-	-	-	306	-
Stage 2	-	-	-	-	557	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	17.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	227	480	-	-	709	-
HCM Lane V/C Ratio	0.046	0.022	-	-	0.037	-
HCM Control Delay (s)	21.6	12.7	-	-	10.3	-
HCM Lane LOS	C	B	-	-	B	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	465	340	195	440	90	400	75	230	75	40	50
Future Volume (veh/h)	140	465	340	195	440	90	400	75	230	75	40	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1800	1748	1748	1748	1800	1800	1800	1782	1782	1782
Adj Flow Rate, veh/h	147	489	358	205	463	95	471	88	271	87	47	58
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.85	0.85	0.85	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	3	3	3	0	0	0	1	1	1
Cap, veh/h	738	653	477	246	928	411	573	728	599	451	720	593
Arrive On Green	0.23	0.36	0.36	0.15	0.28	0.28	0.40	0.40	0.39	0.40	0.40	0.39
Sat Flow, veh/h	3198	1803	1317	1664	3320	1469	1301	1800	1518	1024	1782	1503
Grp Volume(v), veh/h	147	446	401	205	463	95	471	88	271	87	47	58
Grp Sat Flow(s),veh/h/ln	1599	1644	1477	1664	1660	1469	1301	1800	1518	1024	1782	1503
Q Serve(g_s), s	3.9	25.0	25.0	12.6	12.3	5.2	36.5	3.2	13.8	6.1	1.7	2.6
Cycle Q Clear(g_c), s	3.9	25.0	25.0	12.6	12.3	5.2	38.2	3.2	13.8	9.3	1.7	2.6
Prop In Lane	1.00		0.89	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	738	596	535	246	928	411	573	728	599	451	720	593
V/C Ratio(X)	0.20	0.75	0.75	0.83	0.50	0.23	0.82	0.12	0.45	0.19	0.07	0.10
Avail Cap(c_a), veh/h	738	703	632	253	1546	684	604	770	635	475	762	629
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.6	29.4	29.4	43.5	31.7	29.2	30.9	19.6	23.5	22.6	19.2	20.1
Incr Delay (d2), s/veh	0.1	3.7	4.2	20.1	0.4	0.3	8.5	0.1	0.5	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	11.9	10.8	7.2	5.7	2.2	14.4	1.6	5.9	1.8	0.8	1.1
LnGrp Delay(d),s/veh	32.8	33.1	33.6	63.6	32.1	29.5	39.4	19.7	24.0	22.8	19.2	20.1
LnGrp LOS	C	C	C	E	C	C	D	B	C	C	B	C
Approach Vol, veh/h		994			763			830			192	
Approach Delay, s/veh		33.2			40.3			32.3			21.1	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		45.5	18.6	41.1		45.5	27.3	32.4
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		44.0	15.0	41.0		44.0	11.0	45.0
Max Q Clear Time (g_c+I1), s		40.2	14.6	27.0		11.3	5.9	14.3
Green Ext Time (p_c), s		1.3	0.0	4.7		0.8	0.2	3.5

Intersection Summary	
HCM 2010 Ctrl Delay	34.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	365	385	205	170	400	355	290	575	185	375	935	915
Future Volume (veh/h)	365	385	205	170	400	355	290	575	185	375	935	915
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1731	1765	1765	1765	1731	1731	1731	1748	1748	1748
Adj Flow Rate, veh/h	384	405	0	177	417	370	341	676	0	436	890	1195
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	1	2
Peak Hour Factor	0.95	0.95	0.95	0.96	0.96	0.96	0.85	0.85	0.85	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	2	2	2	4	4	4	3	3	3
Cap, veh/h	366	695	311	220	764	594	320	1359	608	528	824	1387
Arrive On Green	0.11	0.21	0.00	0.13	0.23	0.23	0.10	0.41	0.00	0.16	0.47	0.47
Sat Flow, veh/h	3198	3288	1471	1681	3353	2605	3198	3288	1471	3329	1748	2939
Grp Volume(v), veh/h	384	405	0	177	417	370	341	676	0	436	890	1195
Grp Sat Flow(s),veh/h/ln	1599	1644	1471	1681	1676	1303	1599	1644	1471	1664	1748	1470
Q Serve(g_s), s	16.0	15.5	0.0	14.3	15.3	17.9	14.0	21.2	0.0	17.7	66.0	50.6
Cycle Q Clear(g_c), s	16.0	15.5	0.0	14.3	15.3	17.9	14.0	21.2	0.0	17.7	66.0	50.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	366	695	311	220	764	594	320	1359	608	528	824	1387
V/C Ratio(X)	1.05	0.58	0.00	0.80	0.55	0.62	1.07	0.50	0.00	0.83	1.08	0.86
Avail Cap(c_a), veh/h	366	893	400	240	1007	782	320	1359	608	642	824	1387
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.9	49.6	0.0	59.0	47.6	48.6	62.9	30.3	0.0	57.0	36.9	32.9
Incr Delay (d2), s/veh	60.7	0.8	0.0	14.8	0.6	1.1	68.7	0.3	0.0	6.1	55.0	5.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.1	7.1	0.0	7.5	7.2	6.5	9.2	9.7	0.0	8.6	44.2	21.5
LnGrp Delay(d),s/veh	122.7	50.4	0.0	73.8	48.2	49.7	131.7	30.6	0.0	63.1	92.0	38.7
LnGrp LOS	F	D		E	D	D	F	C		E	F	D
Approach Vol, veh/h		789			964			1017			2521	
Approach Delay, s/veh		85.6			53.5			64.5			61.7	
Approach LOS		F			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	25.2	60.8	21.3	32.6	17.0	69.0	19.0	34.9
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	25.0	50.0	18.0	35.0	12.0	63.0	14.0	39.0
Max Q Clear Time (g_c+I1), s	19.7	23.2	16.3	17.5	16.0	68.0	18.0	19.9
Green Ext Time (p_c), s	0.5	4.6	0.0	2.3	0.0	0.0	0.0	4.1

Intersection Summary	
HCM 2010 Ctrl Delay	64.3
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1015	0	0	670	5	0	0	5	0
Future Volume (veh/h)	0	0	0	1015	0	0	670	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				1103	0	0	728	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1195	0	533	747	980	0	0	118	0
Arrive On Green				0.36	0.00	0.00	0.44	0.56	0.00	0.00	0.07	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				1103	0	0	728	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				28.3	0.0	0.0	38.2	0.1	0.0	0.0	0.2	0.0
Cycle Q Clear(g_c), s				28.3	0.0	0.0	38.2	0.1	0.0	0.0	0.2	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1195	0	533	747	980	0	0	118	0
V/C Ratio(X)				0.92	0.00	0.00	0.97	0.01	0.00	0.00	0.04	0.00
Avail Cap(c_a), veh/h				1195	0	533	747	980	0	0	118	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				27.8	0.0	0.0	24.5	8.9	0.0	0.0	39.3	0.0
Incr Delay (d2), s/veh				13.1	0.0	0.0	27.3	0.0	0.0	0.0	0.7	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.2	0.0	0.0	23.3	0.1	0.0	0.0	0.1	0.0
LnGrp Delay(d),s/veh				40.9	0.0	0.0	51.8	8.9	0.0	0.0	40.0	0.0
LnGrp LOS				D			D	A			D	
Approach Vol, veh/h					1103			733			5	
Approach Delay, s/veh					40.9			51.5			40.0	
Approach LOS					D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		54.0			44.0	10.0		36.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		50.0			40.0	6.0		32.0
Max Q Clear Time (g_c+I1), s		2.1			40.2	2.2		30.3
Green Ext Time (p_c), s		0.0			0.0	0.0		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	45.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	615	0	0	0	0	670	965	5	1015	0
Future Volume (veh/h)	5	0	615	0	0	0	0	670	965	5	1015	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	728	0	5	1103	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	859	0	767				0	969	763	112	1341	0
Arrive On Green	0.51	0.00	0.00				0.00	0.29	0.00	0.07	0.40	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	728	0	5	1103	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.1	0.0	0.0				0.0	17.7	0.0	0.3	26.5	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0				0.0	17.7	0.0	0.3	26.5	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	859	0	767				0	969	763	112	1341	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.75	0.00	0.04	0.82	0.00
Avail Cap(c_a), veh/h	859	0	767				0	969	763	112	1341	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	10.8	0.0	0.0				0.0	29.1	0.0	39.3	24.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	5.4	0.0	0.7	5.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	8.9	0.0	0.1	13.2	0.0
LnGrp Delay(d),s/veh	10.8	0.0	0.0				0.0	34.4	0.0	40.1	29.9	0.0
LnGrp LOS	B							C		D	C	
Approach Vol, veh/h		5						728			1108	
Approach Delay, s/veh		10.8						34.4			30.0	
Approach LOS		B						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	30.0		50.0		40.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	26.0		46.0		36.0		
Max Q Clear Time (g_c+I1), s	2.3	19.7		2.1		28.5		
Green Ext Time (p_c), s	0.0	2.5		0.0		4.3		

Intersection Summary	
HCM 2010 Ctrl Delay	31.7
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑		↗
Traffic Vol, veh/h	935	0	60	520	0	85
Future Vol, veh/h	935	0	60	520	0	85
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	1	1	10	10	11	11
Mvmt Flow	984	0	63	547	0	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	994	0	-	512
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.3	-	-	7.12
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.3	-	-	3.41
Pot Cap-1 Maneuver	-	0	645	-	0	484
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	640	-	-	476
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	14.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	476	-	640	-
HCM Lane V/C Ratio	0.188	-	0.099	-
HCM Control Delay (s)	14.3	-	11.2	-
HCM Lane LOS	B	-	B	-
HCM 95th %tile Q(veh)	0.7	-	0.3	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	870	30	35	485	40	65
Future Vol, veh/h	870	30	35	485	40	65
Conflicting Peds, #/hr	0	10	10	0	10	10
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	95	95	95	95	95	95
Heavy Vehicles, %	1	1	10	10	4	4
Mvmt Flow	916	32	37	511	42	68

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	958	0	1282	494
Stage 1	-	-	-	-	942	-
Stage 2	-	-	-	-	340	-
Critical Hdwy	-	-	4.3	-	6.88	6.98
Critical Hdwy Stg 1	-	-	-	-	5.88	-
Critical Hdwy Stg 2	-	-	-	-	5.88	-
Follow-up Hdwy	-	-	2.3	-	3.54	3.34
Pot Cap-1 Maneuver	-	-	666	-	154	516
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	687	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	660	-	140	507
Mov Cap-2 Maneuver	-	-	-	-	140	-
Stage 1	-	-	-	-	332	-
Stage 2	-	-	-	-	628	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	29.7
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	254	-	-	660	-
HCM Lane V/C Ratio	0.435	-	-	0.056	-
HCM Control Delay (s)	29.7	-	-	10.8	0.4
HCM Lane LOS	D	-	-	B	A
HCM 95th %tile Q(veh)	2.1	-	-	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Future Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Adj No. of Lanes	1	2	1	1	2	1	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	285	674	297	277	653	288	353	1439	443	351	1421	438
Arrive On Green	0.17	0.20	0.20	0.18	0.21	0.21	0.21	0.30	0.30	0.21	0.30	0.30
Sat Flow, veh/h	1681	3353	1478	1573	3138	1383	1681	4818	1485	1633	4680	1443
Grp Volume(v), veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Grp Sat Flow(s),veh/h/ln	1681	1676	1478	1573	1569	1383	1681	1606	1485	1633	1560	1443
Q Serve(g_s), s	26.2	27.1	30.1	27.5	23.3	18.4	33.1	45.1	52.0	34.1	33.2	44.0
Cycle Q Clear(g_c), s	26.2	27.1	30.1	27.5	23.3	18.4	33.1	45.1	52.0	34.1	33.2	44.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	285	674	297	277	653	288	353	1439	443	351	1421	438
V/C Ratio(X)	0.91	0.81	0.88	0.91	0.69	0.57	0.92	0.90	1.29	0.93	0.71	0.88
Avail Cap(c_a), veh/h	319	693	306	298	653	288	396	1439	443	375	1421	438
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	71.0	66.4	67.6	70.4	63.8	61.9	67.4	58.6	61.1	67.1	53.8	57.5
Incr Delay (d2), s/veh	26.4	7.1	24.7	29.6	3.2	2.6	25.6	8.3	148.4	28.4	1.6	17.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.3	13.3	14.3	14.2	10.4	7.3	17.9	21.1	39.6	18.2	14.5	19.7
LnGrp Delay(d),s/veh	97.3	73.5	92.2	100.0	67.0	64.5	93.0	67.0	209.4	95.4	55.4	75.4
LnGrp LOS	F	E	F	F	E	E	F	E	F	F	E	E
Approach Vol, veh/h		1068			869			2200			1715	
Approach Delay, s/veh		83.9			76.1			108.0			67.5	
Approach LOS		F			E			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	42.4	55.0	35.7	41.0	41.6	55.9	34.5	42.2
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	39.0	48.0	32.0	35.0	40.0	47.0	32.0	35.0
Max Q Clear Time (g_c+I1), s	36.1	54.0	29.5	32.1	35.1	46.0	28.2	25.3
Green Ext Time (p_c), s	0.3	0.0	0.2	1.3	0.5	0.8	0.3	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	87.0
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	860	10	25	675	10	10
Future Vol, veh/h	860	10	25	675	10	10
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	5	5	20	20
Mvmt Flow	905	11	26	711	11	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	926	0	1339	478
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	418	-
Critical Hdwy	-	-	4.2	-	7.2	7.3
Critical Hdwy Stg 1	-	-	-	-	6.2	-
Critical Hdwy Stg 2	-	-	-	-	6.2	-
Follow-up Hdwy	-	-	2.25	-	3.7	3.5
Pot Cap-1 Maneuver	-	-	715	-	123	488
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	583	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	709	-	117	480
Mov Cap-2 Maneuver	-	-	-	-	227	-
Stage 1	-	-	-	-	306	-
Stage 2	-	-	-	-	557	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	17.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	227	480	-	-	709	-
HCM Lane V/C Ratio	0.046	0.022	-	-	0.037	-
HCM Control Delay (s)	21.6	12.7	-	-	10.3	-
HCM Lane LOS	C	B	-	-	B	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	465	340	195	440	90	400	75	230	75	40	50
Future Volume (veh/h)	140	465	340	195	440	90	400	75	230	75	40	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1800	1748	1748	1748	1800	1800	1800	1782	1782	1782
Adj Flow Rate, veh/h	147	489	358	205	463	95	471	88	271	87	47	58
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.85	0.85	0.85	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	3	3	3	0	0	0	1	1	1
Cap, veh/h	738	653	477	246	928	411	573	728	599	451	720	593
Arrive On Green	0.23	0.36	0.36	0.15	0.28	0.28	0.40	0.40	0.39	0.40	0.40	0.39
Sat Flow, veh/h	3198	1803	1317	1664	3320	1469	1301	1800	1518	1024	1782	1503
Grp Volume(v), veh/h	147	446	401	205	463	95	471	88	271	87	47	58
Grp Sat Flow(s),veh/h/ln	1599	1644	1477	1664	1660	1469	1301	1800	1518	1024	1782	1503
Q Serve(g_s), s	3.9	25.0	25.0	12.6	12.3	5.2	36.5	3.2	13.8	6.1	1.7	2.6
Cycle Q Clear(g_c), s	3.9	25.0	25.0	12.6	12.3	5.2	38.2	3.2	13.8	9.3	1.7	2.6
Prop In Lane	1.00		0.89	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	738	596	535	246	928	411	573	728	599	451	720	593
V/C Ratio(X)	0.20	0.75	0.75	0.83	0.50	0.23	0.82	0.12	0.45	0.19	0.07	0.10
Avail Cap(c_a), veh/h	738	703	632	253	1546	684	604	770	635	475	762	629
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.6	29.4	29.4	43.5	31.7	29.2	30.9	19.6	23.5	22.6	19.2	20.1
Incr Delay (d2), s/veh	0.1	3.7	4.2	20.1	0.4	0.3	8.5	0.1	0.5	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	11.9	10.8	7.2	5.7	2.2	14.4	1.6	5.9	1.8	0.8	1.1
LnGrp Delay(d),s/veh	32.8	33.1	33.6	63.6	32.1	29.5	39.4	19.7	24.0	22.8	19.2	20.1
LnGrp LOS	C	C	C	E	C	C	D	B	C	C	B	C
Approach Vol, veh/h		994			763			830			192	
Approach Delay, s/veh		33.2			40.3			32.3			21.1	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		45.5	18.6	41.1		45.5	27.3	32.4
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		44.0	15.0	41.0		44.0	11.0	45.0
Max Q Clear Time (g_c+I1), s		40.2	14.6	27.0		11.3	5.9	14.3
Green Ext Time (p_c), s		1.3	0.0	4.7		0.8	0.2	3.5

Intersection Summary	
HCM 2010 Ctrl Delay	34.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	365	385	205	170	400	355	290	575	185	375	935	915
Future Volume (veh/h)	365	385	205	170	400	355	290	575	185	375	935	915
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1731	1765	1765	1765	1731	1731	1731	1748	1748	1748
Adj Flow Rate, veh/h	384	405	0	177	417	370	341	676	0	436	890	1195
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	1	2
Peak Hour Factor	0.95	0.95	0.95	0.96	0.96	0.96	0.85	0.85	0.85	0.86	0.86	0.86
Percent Heavy Veh, %	4	4	4	2	2	2	4	4	4	3	3	3
Cap, veh/h	366	695	311	220	764	594	320	1359	608	528	824	1387
Arrive On Green	0.11	0.21	0.00	0.13	0.23	0.23	0.10	0.41	0.00	0.16	0.47	0.47
Sat Flow, veh/h	3198	3288	1471	1681	3353	2605	3198	3288	1471	3329	1748	2939
Grp Volume(v), veh/h	384	405	0	177	417	370	341	676	0	436	890	1195
Grp Sat Flow(s),veh/h/ln	1599	1644	1471	1681	1676	1303	1599	1644	1471	1664	1748	1470
Q Serve(g_s), s	16.0	15.5	0.0	14.3	15.3	17.9	14.0	21.2	0.0	17.7	66.0	50.6
Cycle Q Clear(g_c), s	16.0	15.5	0.0	14.3	15.3	17.9	14.0	21.2	0.0	17.7	66.0	50.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	366	695	311	220	764	594	320	1359	608	528	824	1387
V/C Ratio(X)	1.05	0.58	0.00	0.80	0.55	0.62	1.07	0.50	0.00	0.83	1.08	0.86
Avail Cap(c_a), veh/h	366	893	400	240	1007	782	320	1359	608	642	824	1387
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.9	49.6	0.0	59.0	47.6	48.6	62.9	30.3	0.0	57.0	36.9	32.9
Incr Delay (d2), s/veh	60.7	0.8	0.0	14.8	0.6	1.1	68.7	0.3	0.0	6.1	55.0	5.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.1	7.1	0.0	7.5	7.2	6.5	9.2	9.7	0.0	8.6	44.2	21.5
LnGrp Delay(d),s/veh	122.7	50.4	0.0	73.8	48.2	49.7	131.7	30.6	0.0	63.1	92.0	38.7
LnGrp LOS	F	D		E	D	D	F	C		E	F	D
Approach Vol, veh/h		789			964			1017			2521	
Approach Delay, s/veh		85.6			53.5			64.5			61.7	
Approach LOS		F			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	25.2	60.8	21.3	32.6	17.0	69.0	19.0	34.9
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	25.0	50.0	18.0	35.0	12.0	63.0	14.0	39.0
Max Q Clear Time (g_c+I1), s	19.7	23.2	16.3	17.5	16.0	68.0	18.0	19.9
Green Ext Time (p_c), s	0.5	4.6	0.0	2.3	0.0	0.0	0.0	4.1

Intersection Summary	
HCM 2010 Ctrl Delay	64.3
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1015	0	0	670	5	0	0	5	0
Future Volume (veh/h)	0	0	0	1015	0	0	670	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				1103	0	0	728	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1195	0	533	747	980	0	0	118	0
Arrive On Green				0.36	0.00	0.00	0.44	0.56	0.00	0.00	0.07	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				1103	0	0	728	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				28.3	0.0	0.0	38.2	0.1	0.0	0.0	0.2	0.0
Cycle Q Clear(g_c), s				28.3	0.0	0.0	38.2	0.1	0.0	0.0	0.2	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1195	0	533	747	980	0	0	118	0
V/C Ratio(X)				0.92	0.00	0.00	0.97	0.01	0.00	0.00	0.04	0.00
Avail Cap(c_a), veh/h				1195	0	533	747	980	0	0	118	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				27.8	0.0	0.0	24.5	8.9	0.0	0.0	39.3	0.0
Incr Delay (d2), s/veh				13.1	0.0	0.0	27.3	0.0	0.0	0.0	0.7	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				15.2	0.0	0.0	23.3	0.1	0.0	0.0	0.1	0.0
LnGrp Delay(d),s/veh				40.9	0.0	0.0	51.8	8.9	0.0	0.0	40.0	0.0
LnGrp LOS				D			D	A			D	
Approach Vol, veh/h					1103			733			5	
Approach Delay, s/veh					40.9			51.5			40.0	
Approach LOS					D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		54.0			44.0	10.0		36.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		50.0			40.0	6.0		32.0
Max Q Clear Time (g_c+I1), s		2.1			40.2	2.2		30.3
Green Ext Time (p_c), s		0.0			0.0	0.0		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	45.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	615	0	0	0	0	670	965	5	1015	0
Future Volume (veh/h)	5	0	615	0	0	0	0	670	965	5	1015	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	728	0	5	1103	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	859	0	767				0	969	763	112	1341	0
Arrive On Green	0.51	0.00	0.00				0.00	0.29	0.00	0.07	0.40	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	728	0	5	1103	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.1	0.0	0.0				0.0	17.7	0.0	0.3	26.5	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0				0.0	17.7	0.0	0.3	26.5	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	859	0	767				0	969	763	112	1341	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.75	0.00	0.04	0.82	0.00
Avail Cap(c_a), veh/h	859	0	767				0	969	763	112	1341	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	10.8	0.0	0.0				0.0	29.1	0.0	39.3	24.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	5.4	0.0	0.7	5.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	8.9	0.0	0.1	13.2	0.0
LnGrp Delay(d),s/veh	10.8	0.0	0.0				0.0	34.4	0.0	40.1	29.9	0.0
LnGrp LOS	B							C		D	C	
Approach Vol, veh/h		5						728			1108	
Approach Delay, s/veh		10.8						34.4			30.0	
Approach LOS		B						C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	30.0		50.0		40.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	26.0		46.0		36.0		
Max Q Clear Time (g_c+I1), s	2.3	19.7		2.1		28.5		
Green Ext Time (p_c), s	0.0	2.5		0.0		4.3		

Intersection Summary	
HCM 2010 Ctrl Delay	31.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Future Volume (veh/h)	245	520	250	240	430	155	310	1235	545	310	955	365
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Adj No. of Lanes	2	2	1	2	2	1	2	3	1	2	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	337	745	329	327	709	313	401	2003	619	396	1955	604
Arrive On Green	0.10	0.22	0.22	0.11	0.23	0.23	0.12	0.42	0.42	0.13	0.42	0.42
Sat Flow, veh/h	3261	3353	1480	3051	3138	1385	3261	4818	1489	3167	4680	1447
Grp Volume(v), veh/h	258	547	263	253	453	163	326	1300	574	326	1005	384
Grp Sat Flow(s),veh/h/ln	1630	1676	1480	1526	1569	1385	1630	1606	1489	1584	1560	1447
Q Serve(g_s), s	11.3	22.2	24.6	11.8	19.1	15.1	14.2	31.6	53.6	14.7	23.3	30.8
Cycle Q Clear(g_c), s	11.3	22.2	24.6	11.8	19.1	15.1	14.2	31.6	53.6	14.7	23.3	30.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	337	745	329	327	709	313	401	2003	619	396	1955	604
V/C Ratio(X)	0.76	0.73	0.80	0.77	0.64	0.52	0.81	0.65	0.93	0.82	0.51	0.64
Avail Cap(c_a), veh/h	892	848	374	814	772	341	580	2009	621	520	1955	604
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.8	52.9	53.8	63.6	51.2	49.7	62.5	34.2	40.6	62.4	31.6	33.8
Incr Delay (d2), s/veh	3.6	2.9	10.4	3.9	1.6	1.3	5.7	0.7	20.2	8.0	0.2	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	10.6	11.0	5.2	8.5	5.9	6.7	14.1	25.4	6.9	10.1	12.7
LnGrp Delay(d),s/veh	67.5	55.7	64.2	67.5	52.8	51.0	68.2	34.9	60.8	70.4	31.8	36.0
LnGrp LOS	E	E	E	E	D	D	E	C	E	E	C	D
Approach Vol, veh/h		1068			869			2200			1715	
Approach Delay, s/veh		60.7			56.7			46.6			40.1	
Approach LOS		E			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.3	63.8	20.7	38.5	23.0	64.1	20.1	39.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	23.0	57.0	38.0	36.0	25.0	55.0	39.0	35.0
Max Q Clear Time (g_c+I1), s	16.7	55.6	13.8	26.6	16.2	32.8	13.3	21.1
Green Ext Time (p_c), s	0.6	1.2	0.8	3.1	0.8	9.0	0.9	3.0

Intersection Summary	
HCM 2010 Ctrl Delay	48.8
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	2.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↖	↑		↗
Traffic Vol, veh/h	720	0	225	715	0	80
Future Vol, veh/h	720	0	225	715	0	80
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	96	96	90	90
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	800	0	234	745	0	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	810	0	-	820
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.15	-	-	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.245	-	-	3.345
Pot Cap-1 Maneuver	-	0	803	-	0	370
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	796	-	-	364
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	18.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	364	-	796	-
HCM Lane V/C Ratio	0.244	-	0.294	-
HCM Control Delay (s)	18.1	-	11.4	-
HCM Lane LOS	C	-	B	-
HCM 95th %tile Q(veh)	0.9	-	1.2	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	705	35	25	690	35	15
Future Vol, veh/h	705	35	25	690	35	15
Conflicting Peds, #/hr	0	10	10	0	10	10
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	90	90	97	97	90	90
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	783	39	26	711	39	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	832	0	1586	823
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	773	-
Critical Hdwy	-	-	4.12	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.218	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	801	-	118	372
Stage 1	-	-	-	-	434	-
Stage 2	-	-	-	-	454	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	794	-	110	366
Mov Cap-2 Maneuver	-	-	-	-	110	-
Stage 1	-	-	-	-	431	-
Stage 2	-	-	-	-	426	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	47.2
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	139	-	-	794	-
HCM Lane V/C Ratio	0.4	-	-	0.032	-
HCM Control Delay (s)	47.2	-	-	9.7	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	1.7	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Future Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	241	542	457	325	633	533	161	1415	433	117	1309	400
Arrive On Green	0.14	0.31	0.31	0.19	0.36	0.36	0.10	0.30	0.30	0.07	0.27	0.27
Sat Flow, veh/h	1664	1748	1471	1681	1765	1487	1664	4771	1460	1697	4865	1487
Grp Volume(v), veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Grp Sat Flow(s),veh/h/ln	1664	1748	1471	1681	1765	1487	1664	1590	1460	1697	1622	1487
Q Serve(g_s), s	21.0	45.0	35.3	28.0	47.3	32.9	14.0	43.0	42.8	10.0	39.0	39.0
Cycle Q Clear(g_c), s	21.0	45.0	35.3	28.0	47.3	32.9	14.0	43.0	42.8	10.0	39.0	39.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	241	542	457	325	633	533	161	1415	433	117	1309	400
V/C Ratio(X)	1.90	1.33	0.84	1.86	0.94	0.73	1.69	1.20	1.00	1.75	1.35	1.29
Avail Cap(c_a), veh/h	241	542	457	325	633	533	161	1415	433	117	1309	400
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	50.0	46.7	58.5	45.0	40.4	65.5	51.0	50.9	67.5	53.0	53.0
Incr Delay (d2), s/veh	420.2	160.6	13.2	400.5	22.2	5.0	334.3	98.6	42.6	370.8	163.1	148.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	37.8	45.9	16.0	49.1	26.9	14.3	21.4	31.8	22.4	16.7	37.2	32.5
LnGrp Delay(d),s/veh	482.2	210.6	59.9	459.0	67.2	45.4	399.8	149.6	93.5	438.3	216.1	201.3
LnGrp LOS	F	F	E	F	E	D	F	F	F	F	F	F
Approach Vol, veh/h		1563			1589			2406			2489	
Approach Delay, s/veh		253.2			211.0			167.7			231.3	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.0	46.0	33.0	51.0	19.0	42.0	26.0	58.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	9.0	39.0	27.0	44.0	13.0	35.0	20.0	51.0
Max Q Clear Time (g_c+I1), s	12.0	45.0	30.0	47.0	16.0	41.0	23.0	49.3
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	212.6
HCM 2010 LOS	F

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1000	10	15	1300	15	25
Future Vol, veh/h	1000	10	15	1300	15	25
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	85	85
Heavy Vehicles, %	3	3	1	1	0	0
Mvmt Flow	1053	11	16	1368	18	29

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1074	0	1795	552
Stage 1	-	-	-	-	1069	-
Stage 2	-	-	-	-	726	-
Critical Hdwy	-	-	4.12	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.21	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	651	-	73	483
Stage 1	-	-	-	-	296	-
Stage 2	-	-	-	-	445	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	646	-	70	475
Mov Cap-2 Maneuver	-	-	-	-	190	-
Stage 1	-	-	-	-	294	-
Stage 2	-	-	-	-	430	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	190	475	-	-	646	-
HCM Lane V/C Ratio	0.093	0.062	-	-	0.024	-
HCM Control Delay (s)	25.9	13.1	-	-	10.7	-
HCM Lane LOS	D	B	-	-	B	-
HCM 95th %tile Q(veh)	0.3	0.2	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	470	395	320	600	170	390	150	270	125	130	135
Future Volume (veh/h)	265	470	395	320	600	170	390	150	270	125	130	135
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1765	1765	1765	1800	1800	1800
Adj Flow Rate, veh/h	279	495	416	337	632	179	433	167	300	137	143	148
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	0	0
Cap, veh/h	771	630	529	289	1010	447	418	672	553	361	685	564
Arrive On Green	0.24	0.37	0.37	0.17	0.30	0.30	0.38	0.38	0.37	0.38	0.38	0.37
Sat Flow, veh/h	3261	1724	1448	1681	3353	1485	1079	1765	1488	937	1800	1518
Grp Volume(v), veh/h	279	481	430	337	632	179	433	167	300	137	143	148
Grp Sat Flow(s),veh/h/ln	1630	1676	1495	1681	1676	1485	1079	1765	1488	937	1800	1518
Q Serve(g_s), s	7.9	28.2	28.2	19.0	17.9	10.6	36.1	7.1	17.5	12.9	5.9	7.5
Cycle Q Clear(g_c), s	7.9	28.2	28.2	19.0	17.9	10.6	42.0	7.1	17.5	20.1	5.9	7.5
Prop In Lane	1.00		0.97	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	771	613	546	289	1010	447	418	672	553	361	685	564
V/C Ratio(X)	0.36	0.79	0.79	1.16	0.63	0.40	1.04	0.25	0.54	0.38	0.21	0.26
Avail Cap(c_a), veh/h	771	684	610	289	1459	646	418	672	553	361	685	564
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.2	31.2	31.2	45.7	33.2	30.6	39.9	23.4	27.3	30.2	23.0	24.1
Incr Delay (d2), s/veh	0.3	5.5	6.1	104.9	0.6	0.6	53.4	0.2	1.1	0.7	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	13.9	12.5	17.2	8.3	4.4	18.9	3.5	7.4	3.4	3.0	3.2
LnGrp Delay(d),s/veh	35.5	36.6	37.3	150.6	33.8	31.2	93.3	23.6	28.4	30.9	23.1	24.4
LnGrp LOS	D	D	D	F	C	C	F	C	C	C	C	C
Approach Vol, veh/h		1190			1148			900			428	
Approach Delay, s/veh		36.6			67.7			58.7			26.0	
Approach LOS		D			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		45.0	22.0	43.3		45.0	29.1	36.2
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		41.0	18.0	41.0		41.0	15.0	44.0
Max Q Clear Time (g_c+I1), s		44.0	21.0	30.2		22.1	9.9	19.9
Green Ext Time (p_c), s		0.0	0.0	4.4		1.9	0.4	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	50.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	930	515	350	190	380	540	230	865	235	380	795	720
Future Volume (veh/h)	930	515	350	190	380	540	230	865	235	380	795	720
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1782	1782	1782	1765	1765	1765	1782	1782	1782
Adj Flow Rate, veh/h	979	542	0	200	400	568	247	930	0	404	1189	537
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	1	1	1
Cap, veh/h	813	1200	537	243	829	645	271	1045	468	353	1185	499
Arrive On Green	0.25	0.36	0.00	0.14	0.24	0.24	0.08	0.31	0.00	0.10	0.33	0.33
Sat Flow, veh/h	3261	3353	1500	1697	3386	2633	3261	3353	1500	3395	3564	1501
Grp Volume(v), veh/h	979	542	0	200	400	568	247	930	0	404	1189	537
Grp Sat Flow(s),veh/h/ln	1630	1676	1500	1697	1693	1317	1630	1676	1500	1697	1782	1501
Q Serve(g_s), s	36.0	17.9	0.0	16.5	14.6	22.5	10.8	38.1	0.0	15.0	48.0	23.6
Cycle Q Clear(g_c), s	36.0	17.9	0.0	16.5	14.6	22.5	10.8	38.1	0.0	15.0	48.0	23.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	813	1200	537	243	829	645	271	1045	468	353	1185	499
V/C Ratio(X)	1.20	0.45	0.00	0.82	0.48	0.88	0.91	0.89	0.00	1.15	1.00	1.08
Avail Cap(c_a), veh/h	813	1200	537	329	985	766	271	1045	468	353	1185	499
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.2	35.5	0.0	60.0	46.7	29.7	65.6	47.3	0.0	64.7	48.2	11.6
Incr Delay (d2), s/veh	103.3	0.3	0.0	8.6	0.4	10.3	31.8	9.6	0.0	93.4	26.9	62.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.8	8.3	0.0	8.4	6.9	9.4	6.1	19.1	0.0	11.6	28.0	21.8
LnGrp Delay(d),s/veh	157.5	35.8	0.0	68.7	47.1	40.0	97.4	56.9	0.0	158.1	75.0	73.7
LnGrp LOS	F	D		E	D	D	F	E		F	F	F
Approach Vol, veh/h		1521			1168			1177			2130	
Approach Delay, s/veh		114.1			47.3			65.4			90.5	
Approach LOS		F			D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	48.0	23.7	54.7	15.0	51.0	40.0	38.3
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	13.0	42.0	26.0	47.0	10.0	45.0	34.0	* 39
Max Q Clear Time (g_c+I1), s	17.0	40.1	18.5	19.9	12.8	50.0	38.0	24.5
Green Ext Time (p_c), s	0.0	1.1	0.2	3.7	0.0	0.0	0.0	4.4

Intersection Summary	
HCM 2010 Ctrl Delay	83.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1920	0	0	815	5	0	0	5	0
Future Volume (veh/h)	0	0	0	1920	0	0	815	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				2087	0	0	886	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1613	0	720	661	824	0	0	82	0
Arrive On Green				0.48	0.00	0.00	0.39	0.47	0.00	0.00	0.05	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				2087	0	0	886	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				72.0	0.0	0.0	59.0	0.2	0.0	0.0	0.4	0.0
Cycle Q Clear(g_c), s				72.0	0.0	0.0	59.0	0.2	0.0	0.0	0.4	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1613	0	720	661	824	0	0	82	0
V/C Ratio(X)				1.29	0.00	0.00	1.34	0.01	0.00	0.00	0.06	0.00
Avail Cap(c_a), veh/h				1613	0	720	661	824	0	0	82	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				39.0	0.0	0.0	45.5	21.4	0.0	0.0	68.4	0.0
Incr Delay (d2), s/veh				136.8	0.0	0.0	163.2	0.0	0.0	0.0	1.4	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				64.1	0.0	0.0	57.3	0.1	0.0	0.0	0.2	0.0
LnGrp Delay(d),s/veh				175.8	0.0	0.0	208.7	21.4	0.0	0.0	69.8	0.0
LnGrp LOS				F			F	C			E	
Approach Vol, veh/h					2087			891			5	
Approach Delay, s/veh					175.8			207.6			69.8	
Approach LOS					F			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		74.0			63.0	11.0		76.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		70.0			59.0	7.0		72.0
Max Q Clear Time (g_c+I1), s		2.2			61.0	2.4		74.0
Green Ext Time (p_c), s		0.0			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	185.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	445	0	0	0	0	815	1625	5	1920	0
Future Volume (veh/h)	5	0	445	0	0	0	0	815	1625	5	1920	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	886	0	5	2087	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	515	0	460				0	1922	1514	67	2146	0
Arrive On Green	0.31	0.00	0.00				0.00	0.57	0.00	0.05	0.85	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	886	0	5	2087	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.3	0.0	0.0				0.0	23.0	0.0	0.4	80.7	0.0
Cycle Q Clear(g_c), s	0.3	0.0	0.0				0.0	23.0	0.0	0.4	80.7	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	515	0	460				0	1922	1514	67	2146	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.46	0.00	0.07	0.97	0.00
Avail Cap(c_a), veh/h	515	0	460				0	1922	1514	67	2146	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.33	1.33	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.2	0.0	0.0				0.0	18.6	0.0	68.4	10.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	0.8	0.0	2.1	14.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	10.8	0.0	0.2	39.5	0.0
LnGrp Delay(d),s/veh	36.2	0.0	0.0				0.0	19.4	0.0	70.5	24.0	0.0
LnGrp LOS	D							B		E	C	
Approach Vol, veh/h		5						886			2092	
Approach Delay, s/veh		36.2						19.4			24.1	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	90.0		50.0		100.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	86.0		46.0		96.0		
Max Q Clear Time (g_c+I1), s	2.4	25.0		2.3		82.7		
Green Ext Time (p_c), s	0.0	7.6		0.0		11.3		

Intersection Summary	
HCM 2010 Ctrl Delay	22.7
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	2.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑		↗
Traffic Vol, veh/h	720	0	225	715	0	80
Future Vol, veh/h	720	0	225	715	0	80
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	600	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	96	96	90	90
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	800	0	234	745	0	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	810	0	-	420
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.2	-	-	7
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.25	-	-	3.35
Pot Cap-1 Maneuver	-	0	793	-	0	574
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	786	-	-	564
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.8	12.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	564	-	786	-
HCM Lane V/C Ratio	0.158	-	0.298	-
HCM Control Delay (s)	12.6	-	11.5	-
HCM Lane LOS	B	-	B	-
HCM 95th %tile Q(veh)	0.6	-	1.3	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	705	35	25	690	35	15
Future Vol, veh/h	705	35	25	690	35	15
Conflicting Peds, #/hr	0	10	10	0	10	10
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	90	90	97	97	90	90
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	783	39	26	711	39	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	832	0	1231	431
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	418	-
Critical Hdwy	-	-	4.14	-	6.86	6.96
Critical Hdwy Stg 1	-	-	-	-	5.86	-
Critical Hdwy Stg 2	-	-	-	-	5.86	-
Follow-up Hdwy	-	-	2.22	-	3.53	3.33
Pot Cap-1 Maneuver	-	-	796	-	168	570
Stage 1	-	-	-	-	394	-
Stage 2	-	-	-	-	630	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	789	-	156	561
Mov Cap-2 Maneuver	-	-	-	-	156	-
Stage 1	-	-	-	-	391	-
Stage 2	-	-	-	-	591	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	30
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	199	-	-	789	-
HCM Lane V/C Ratio	0.279	-	-	0.033	-
HCM Control Delay (s)	30	-	-	9.7	0.2
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Future Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Adj No. of Lanes	1	2	1	1	2	1	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	435	664	293	439	671	296	194	1643	507	151	1541	475
Arrive On Green	0.26	0.20	0.20	0.26	0.20	0.20	0.12	0.34	0.34	0.09	0.32	0.32
Sat Flow, veh/h	1664	3320	1463	1681	3353	1478	1664	4771	1472	1697	4865	1501
Grp Volume(v), veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Grp Sat Flow(s),veh/h/ln	1664	1660	1463	1681	1676	1478	1664	1590	1472	1697	1622	1501
Q Serve(g_s), s	47.0	36.0	36.0	47.0	31.1	36.0	21.0	62.0	49.0	16.0	57.0	57.0
Cycle Q Clear(g_c), s	47.0	36.0	36.0	47.0	31.1	36.0	21.0	62.0	49.0	16.0	57.0	57.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	435	664	293	439	671	296	194	1643	507	151	1541	475
V/C Ratio(X)	1.05	1.09	1.31	1.38	0.89	1.32	1.40	1.04	0.85	1.36	1.15	1.09
Avail Cap(c_a), veh/h	435	664	293	439	671	296	194	1643	507	151	1541	475
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.5	72.0	72.0	66.5	70.0	72.0	79.5	59.0	54.7	82.0	61.5	61.5
Incr Delay (d2), s/veh	58.1	60.5	162.8	184.2	13.7	164.3	206.3	32.2	13.1	198.2	74.5	66.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.6	22.1	27.8	44.3	15.7	28.2	20.8	32.1	21.8	15.8	36.2	32.4
LnGrp Delay(d),s/veh	124.6	132.5	234.8	250.7	83.7	236.3	285.8	91.2	67.8	280.2	136.0	128.0
LnGrp LOS	F	F	F	F	F	F	F	F	E	F	F	F
Approach Vol, veh/h		1563			1589			2406			2489	
Approach Delay, s/veh		155.3			184.7			108.9			146.2	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	21.0	65.0	52.0	42.0	26.0	60.0	52.0	42.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	15.0	58.0	46.0	35.0	20.0	53.0	46.0	35.0
Max Q Clear Time (g_c+I1), s	18.0	64.0	49.0	38.0	23.0	59.0	49.0	38.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	144.4
HCM 2010 LOS	F

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1000	10	15	1300	15	25
Future Vol, veh/h	1000	10	15	1300	15	25
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	85	85
Heavy Vehicles, %	3	3	1	1	0	0
Mvmt Flow	1053	11	16	1368	18	29

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1074	0	1795	552
Stage 1	-	-	-	-	1069	-
Stage 2	-	-	-	-	726	-
Critical Hdwy	-	-	4.12	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.21	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	651	-	73	483
Stage 1	-	-	-	-	296	-
Stage 2	-	-	-	-	445	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	646	-	70	475
Mov Cap-2 Maneuver	-	-	-	-	190	-
Stage 1	-	-	-	-	294	-
Stage 2	-	-	-	-	430	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	190	475	-	-	646	-
HCM Lane V/C Ratio	0.093	0.062	-	-	0.024	-
HCM Control Delay (s)	25.9	13.1	-	-	10.7	-
HCM Lane LOS	D	B	-	-	B	-
HCM 95th %tile Q(veh)	0.3	0.2	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	470	395	320	600	170	390	150	270	125	130	135
Future Volume (veh/h)	265	470	395	320	600	170	390	150	270	125	130	135
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1765	1765	1765	1800	1800	1800
Adj Flow Rate, veh/h	279	495	416	337	632	179	433	167	300	137	143	148
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	0	0
Cap, veh/h	771	630	529	289	1010	447	418	672	553	361	685	564
Arrive On Green	0.24	0.37	0.37	0.17	0.30	0.30	0.38	0.38	0.37	0.38	0.38	0.37
Sat Flow, veh/h	3261	1724	1448	1681	3353	1485	1079	1765	1488	937	1800	1518
Grp Volume(v), veh/h	279	481	430	337	632	179	433	167	300	137	143	148
Grp Sat Flow(s),veh/h/ln	1630	1676	1495	1681	1676	1485	1079	1765	1488	937	1800	1518
Q Serve(g_s), s	7.9	28.2	28.2	19.0	17.9	10.6	36.1	7.1	17.5	12.9	5.9	7.5
Cycle Q Clear(g_c), s	7.9	28.2	28.2	19.0	17.9	10.6	42.0	7.1	17.5	20.1	5.9	7.5
Prop In Lane	1.00		0.97	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	771	613	546	289	1010	447	418	672	553	361	685	564
V/C Ratio(X)	0.36	0.79	0.79	1.16	0.63	0.40	1.04	0.25	0.54	0.38	0.21	0.26
Avail Cap(c_a), veh/h	771	684	610	289	1459	646	418	672	553	361	685	564
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.2	31.2	31.2	45.7	33.2	30.6	39.9	23.4	27.3	30.2	23.0	24.1
Incr Delay (d2), s/veh	0.3	5.5	6.1	104.9	0.6	0.6	53.4	0.2	1.1	0.7	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	13.9	12.5	17.2	8.3	4.4	18.9	3.5	7.4	3.4	3.0	3.2
LnGrp Delay(d),s/veh	35.5	36.6	37.3	150.6	33.8	31.2	93.3	23.6	28.4	30.9	23.1	24.4
LnGrp LOS	D	D	D	F	C	C	F	C	C	C	C	C
Approach Vol, veh/h		1190			1148			900			428	
Approach Delay, s/veh		36.6			67.7			58.7			26.0	
Approach LOS		D			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		45.0	22.0	43.3		45.0	29.1	36.2
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		41.0	18.0	41.0		41.0	15.0	44.0
Max Q Clear Time (g_c+I1), s		44.0	21.0	30.2		22.1	9.9	19.9
Green Ext Time (p_c), s		0.0	0.0	4.4		1.9	0.4	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	50.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	930	515	350	190	380	540	230	865	235	380	795	720
Future Volume (veh/h)	930	515	350	190	380	540	230	865	235	380	795	720
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1782	1782	1782	1765	1765	1765	1782	1782	1782
Adj Flow Rate, veh/h	979	542	0	200	400	568	247	930	0	404	1189	537
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.93	0.93	0.93	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	1	1	1
Cap, veh/h	813	1200	537	243	829	645	271	1045	468	353	1185	499
Arrive On Green	0.25	0.36	0.00	0.14	0.24	0.24	0.08	0.31	0.00	0.10	0.33	0.33
Sat Flow, veh/h	3261	3353	1500	1697	3386	2633	3261	3353	1500	3395	3564	1501
Grp Volume(v), veh/h	979	542	0	200	400	568	247	930	0	404	1189	537
Grp Sat Flow(s),veh/h/ln	1630	1676	1500	1697	1693	1317	1630	1676	1500	1697	1782	1501
Q Serve(g_s), s	36.0	17.9	0.0	16.5	14.6	22.5	10.8	38.1	0.0	15.0	48.0	23.6
Cycle Q Clear(g_c), s	36.0	17.9	0.0	16.5	14.6	22.5	10.8	38.1	0.0	15.0	48.0	23.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	813	1200	537	243	829	645	271	1045	468	353	1185	499
V/C Ratio(X)	1.20	0.45	0.00	0.82	0.48	0.88	0.91	0.89	0.00	1.15	1.00	1.08
Avail Cap(c_a), veh/h	813	1200	537	329	985	766	271	1045	468	353	1185	499
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.2	35.5	0.0	60.0	46.7	29.7	65.6	47.3	0.0	64.7	48.2	11.6
Incr Delay (d2), s/veh	103.3	0.3	0.0	8.6	0.4	10.3	31.8	9.6	0.0	93.4	26.9	62.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.8	8.3	0.0	8.4	6.9	9.4	6.1	19.1	0.0	11.6	28.0	21.8
LnGrp Delay(d),s/veh	157.5	35.8	0.0	68.7	47.1	40.0	97.4	56.9	0.0	158.1	75.0	73.7
LnGrp LOS	F	D		E	D	D	F	E		F	F	F
Approach Vol, veh/h		1521			1168			1177			2130	
Approach Delay, s/veh		114.1			47.3			65.4			90.5	
Approach LOS		F			D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	48.0	23.7	54.7	15.0	51.0	40.0	38.3
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	13.0	42.0	26.0	47.0	10.0	45.0	34.0	* 39
Max Q Clear Time (g_c+I1), s	17.0	40.1	18.5	19.9	12.8	50.0	38.0	24.5
Green Ext Time (p_c), s	0.0	1.1	0.2	3.7	0.0	0.0	0.0	4.4

Intersection Summary	
HCM 2010 Ctrl Delay	83.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1920	0	0	815	5	0	0	5	0
Future Volume (veh/h)	0	0	0	1920	0	0	815	5	0	0	5	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				2087	0	0	886	5	0	0	5	0
Adj No. of Lanes				2	0	1	1	1	0	0	1	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1613	0	720	661	824	0	0	82	0
Arrive On Green				0.48	0.00	0.00	0.39	0.47	0.00	0.00	0.05	0.00
Sat Flow, veh/h				3361	0	1500	1681	1765	0	0	1765	0
Grp Volume(v), veh/h				2087	0	0	886	5	0	0	5	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1681	1765	0	0	1765	0
Q Serve(g_s), s				72.0	0.0	0.0	59.0	0.2	0.0	0.0	0.4	0.0
Cycle Q Clear(g_c), s				72.0	0.0	0.0	59.0	0.2	0.0	0.0	0.4	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1613	0	720	661	824	0	0	82	0
V/C Ratio(X)				1.29	0.00	0.00	1.34	0.01	0.00	0.00	0.06	0.00
Avail Cap(c_a), veh/h				1613	0	720	661	824	0	0	82	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				39.0	0.0	0.0	45.5	21.4	0.0	0.0	68.4	0.0
Incr Delay (d2), s/veh				136.8	0.0	0.0	163.2	0.0	0.0	0.0	1.4	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				64.1	0.0	0.0	57.3	0.1	0.0	0.0	0.2	0.0
LnGrp Delay(d),s/veh				175.8	0.0	0.0	208.7	21.4	0.0	0.0	69.8	0.0
LnGrp LOS				F			F	C			E	
Approach Vol, veh/h					2087			891			5	
Approach Delay, s/veh					175.8			207.6			69.8	
Approach LOS					F			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		74.0			63.0	11.0		76.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		70.0			59.0	7.0		72.0
Max Q Clear Time (g_c+I1), s		2.2			61.0	2.4		74.0
Green Ext Time (p_c), s		0.0			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	185.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	445	0	0	0	0	815	1625	5	1920	0
Future Volume (veh/h)	5	0	445	0	0	0	0	815	1625	5	1920	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	886	0	5	2087	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	515	0	460				0	1922	1514	67	2146	0
Arrive On Green	0.31	0.00	0.00				0.00	0.57	0.00	0.05	0.85	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	886	0	5	2087	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.3	0.0	0.0				0.0	23.0	0.0	0.4	80.7	0.0
Cycle Q Clear(g_c), s	0.3	0.0	0.0				0.0	23.0	0.0	0.4	80.7	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	515	0	460				0	1922	1514	67	2146	0
V/C Ratio(X)	0.01	0.00	0.00				0.00	0.46	0.00	0.07	0.97	0.00
Avail Cap(c_a), veh/h	515	0	460				0	1922	1514	67	2146	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.33	1.33	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.2	0.0	0.0				0.0	18.6	0.0	68.4	10.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0				0.0	0.8	0.0	2.1	14.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0				0.0	10.8	0.0	0.2	39.5	0.0
LnGrp Delay(d),s/veh	36.2	0.0	0.0				0.0	19.4	0.0	70.5	24.0	0.0
LnGrp LOS	D							B		E	C	
Approach Vol, veh/h		5						886			2092	
Approach Delay, s/veh		36.2						19.4			24.1	
Approach LOS		D						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	10.0	90.0		50.0		100.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	6.0	86.0		46.0		96.0		
Max Q Clear Time (g_c+I1), s	2.4	25.0		2.3		82.7		
Green Ext Time (p_c), s	0.0	7.6		0.0		11.3		

Intersection Summary	
HCM 2010 Ctrl Delay	22.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Future Volume (veh/h)	435	685	365	575	565	370	260	1635	415	195	1680	490
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Adj No. of Lanes	2	2	1	2	2	1	2	3	1	2	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	507	739	326	617	854	377	287	1957	605	238	1915	592
Arrive On Green	0.16	0.22	0.22	0.19	0.25	0.25	0.09	0.41	0.41	0.07	0.39	0.39
Sat Flow, veh/h	3229	3320	1465	3261	3353	1482	3229	4771	1475	3293	4865	1503
Grp Volume(v), veh/h	458	721	384	605	595	389	271	1703	432	205	1768	516
Grp Sat Flow(s),veh/h/ln	1614	1660	1465	1630	1676	1482	1614	1590	1475	1646	1622	1503
Q Serve(g_s), s	25.0	38.8	40.0	33.2	28.9	45.8	15.0	58.8	43.9	11.1	62.2	57.0
Cycle Q Clear(g_c), s	25.0	38.8	40.0	33.2	28.9	45.8	15.0	58.8	43.9	11.1	62.2	57.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	507	739	326	617	854	377	287	1957	605	238	1915	592
V/C Ratio(X)	0.90	0.98	1.18	0.98	0.70	1.03	0.94	0.87	0.71	0.86	0.92	0.87
Avail Cap(c_a), veh/h	521	739	326	617	854	377	287	1964	607	238	1922	594
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	74.4	69.4	69.9	72.5	60.7	67.0	81.4	48.6	44.2	82.5	51.9	50.3
Incr Delay (d2), s/veh	18.7	27.1	107.2	31.3	2.5	54.4	38.0	4.5	4.0	25.9	8.0	13.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.5	20.6	25.9	17.6	13.7	24.5	8.2	26.7	18.5	5.9	29.3	25.8
LnGrp Delay(d),s/veh	93.1	96.5	177.0	103.9	63.2	121.4	119.4	53.1	48.2	108.3	59.9	63.7
LnGrp LOS	F	F	F	F	E	F	F	D	D	F	E	E
Approach Vol, veh/h		1563			1589			2406			2489	
Approach Delay, s/veh		115.3			92.9			59.7			64.7	
Approach LOS		F			F			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	76.7	39.0	46.0	21.0	73.7	33.2	51.8
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	12.0	70.0	33.0	39.0	15.0	67.0	28.0	44.0
Max Q Clear Time (g_c+I1), s	13.1	60.8	35.2	42.0	17.0	64.2	27.0	47.8
Green Ext Time (p_c), s	0.0	7.4	0.0	0.0	0.0	2.5	0.2	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	78.6
HCM 2010 LOS	E

Appendix G

VISSIM Analysis Summary Technical Memorandum

Farrington Highway – VISSIM Analysis Summary Technical Memorandum

PREPARED FOR: Steven Doo/G70

PREPARED BY: Erica Tran/Jacobs
Terry Yuen/Jacobs

DATE: August 14, 2019

This memorandum describes the VISSIM microsimulation of three study intersections within the Farrington Highway Widening Study analysis area. The VISSIM analysis was conducted to evaluate the vehicle interaction between three study intersections along Kualakai Parkway including the Interstate H-1 (H-1) interchange ramp terminals and the intersection with Farrington Highway. Figure 1 shows the entire VISSIM model network.

Figure 1. VISSIM Model Network Extents

VISSIM (version 10.00-16) was used to analyze potential vehicle queuing impacts as a result of future development. Analysis scenarios were modeled for the PM peak hour only. The PM peak hour analysis volumes are higher than the AM peak hour volumes, therefore the analysis describes the worst of the two peaks.

The existing (2018) PM peak hour was modeled with a 15-minute seeding period using turning movement volumes and segment volumes documented in Section 3 of the *Farrington Highway Widening Study*. Future 2028 Build condition volumes were developed from travel demand model forecasts, based on future planned land use developments along the corridor, and are documented in Section 5 of the *Farrington Highway Widening Study*.

Existing Conditions (2018)

During the existing PM peak, there is little queueing at all three study intersections. All H-1 interchange off-ramp queues are contained on the ramp and do not extend to the freeway mainline. Figure 2 shows the typical queue lengths under existing PM peak operating conditions at the H-1 interchange. Figure 3 shows existing typical queues at the Farrington Highway and Kualakai Parkway intersection.

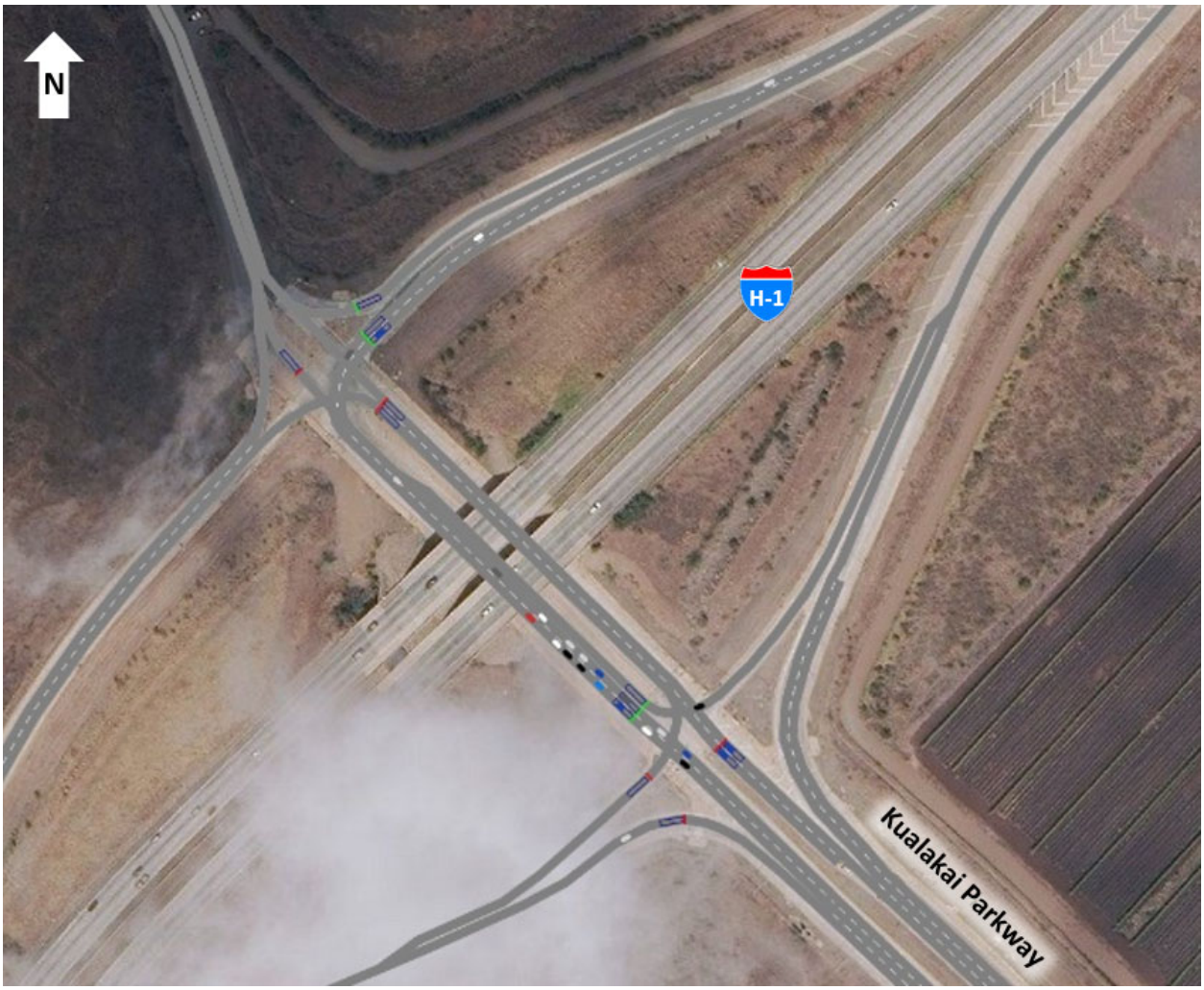


Figure 2. Existing (2018) PM Peak Hour Queues – H-1 Interchange

Figure 3. Existing (2018) PM Peak Hour Queues – Farrington Highway at Kualakai Parkway

A summary of the 95th percentile queue lengths at each intersection are shown in Table 1 below. The 95th percentile queue length generally refers to the maximum queue that occurs during 95 percent of the peak hour of travel. The length of the queue is likely to be less than the length reported 95 percent of the time. Although the vehicle queue could be greater than the length reported, it is unlikely and if it were to occur would do so for approximately 5 percent of the peak hour.

Future Build Conditions (2018)

Future planned developments are expected to result in an increase in traffic along Farrington Highway. The intersection of Farrington Highway and Kualakai Parkway will facilitate vehicle trips traveling between the local, neighborhood roads and the regional freeway system (the H-1 interchange).

Although additional capacity (one full eastbound and westbound travel lane) is provided on Farrington Highway, there is substantial growth in vehicular and pedestrian demand generated by the planned developments. Eastbound through movement queues could extend back beyond the UH West Oahu driveway, and westbound queues may affect access to the Hoopili development.

The traffic signal timing and phasing at the intersection was optimized to accommodate the high vehicle turning movements from Farrington Highway to the H-1 interchange. Pedestrian traffic is expected to be high at this intersection, but without pedestrian model-specific forecasts, approximately 100

pedestrians were assumed to be crossing each leg of the intersection during the PM peak hour. This generally equates to approximately 4 pedestrians waiting to cross any leg of the intersection per traffic signal cycle.

At the H-1 interchange westbound ramp terminal, congestion and queues are expected on the northbound left-turn and westbound left-turn movements. The northbound left-turn queue from Kualakai Parkway to westbound H-1, on average, does not extend back to the eastbound ramp terminal. The 95th percentile queue (longer than 500 feet) could be expected to extend back past eastbound ramp terminal.

The westbound left-turn movement queue (from the off-ramp to southbound Kualakai Parkway) is expected to be significantly longer than the existing queue length. However, the westbound off-ramp queue would still be contained on the ramp and would not be expected to spill back onto the mainline.

At the H-1 interchange eastbound ramp terminal, the northbound through movement would be affected occasionally from queues spilling back from the westbound ramp terminal intersection. The intersection itself, when not affected by the upstream signal, would be expected to have little congestion.

Table 1 compares the existing (2018) and future (2028) Build condition anticipated queues, by movement.

Table 1. PM Peak Hour Queue Results

					2018 Existing		2028 Build	
Int. #	Int. Name	Control Type	Approach Direction	Lane Group	95th Percentile Queue (ft)	Average Queue (ft)	95th Percentile Queue (ft)	Average Queue (ft)
1	Kualakai Pkwy and H-1 WB Ramps	Signal	SB	TH	0	0	0	0
				RT	0	0	0	0
			NB	LT	120	45	530	325
				TH	120	45	530	325
			WB	RT	0	0	0	0
				LT	80	35	1085	735
2	Kualakai Pkwy and H-1 EB Ramps	Signal	SB	LT	5	0	5	0
				TH	95	25	260	125
			NB	TH	55	20	520	205
				RT	25	10	105	30
			EB	LT	0	0	0	0
				RT	0	0	5	0
3	Kualakai Pkwy and Farrington Hwy	Signal	SB	LT	15	5	575	340
				TH	115	65	1245	840
				RT	50	20	210	85
			NB	LT	35	20	995	725
				TH	95	55	1275	1030
				RT	10	5	340	150
			EB	LT	90	55	1655	895
				TH	45	25	1635	720
				RT	35	20	550	180
			WB	LT	90	50	2010	1975
				TH	115	60	2010	1975
				RT	5	0	2010	1660

Figures 4 and 5 show the typical queues resulting from the 2028 Build condition. Pedestrians are shown as colored dots in the crosswalks (solid black links) at the Farrington Highway and Kualakai Parkway intersection on Figure 6.

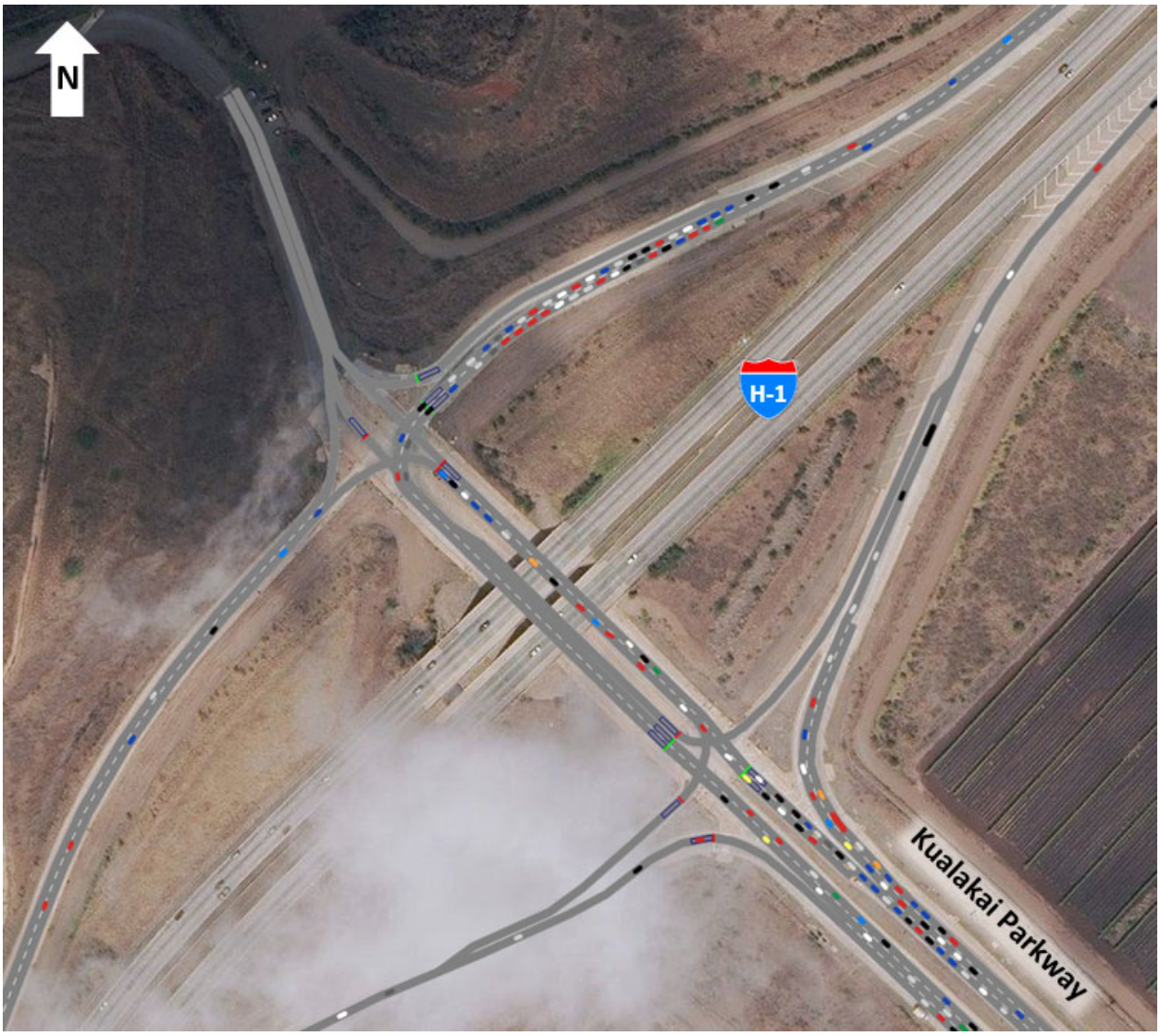


Figure 4. Future Build (2028) PM Peak Hour Queues – H-1 Interchange

Figure 5. Future Build (2028) PM Peak Hour Queues – Farrington Highway at Kualakai Parkway

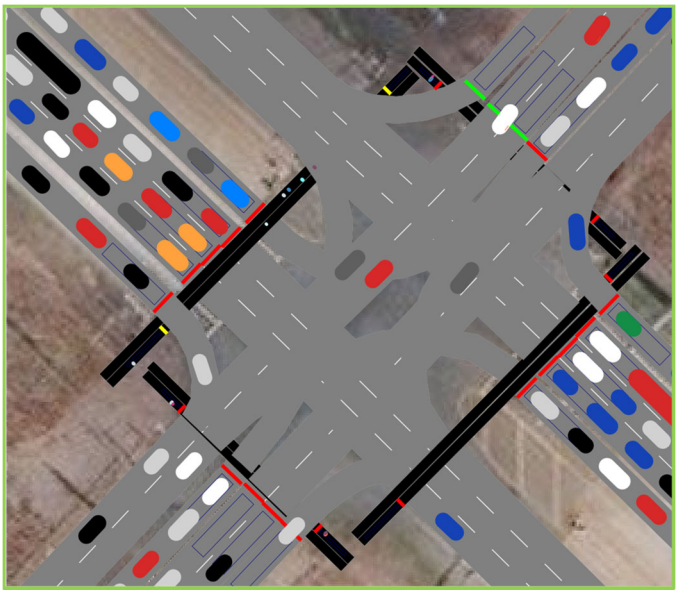


Figure 6. Vehicle-Pedestrian Interaction

Conditions with Mitigation

Section 5 of the *Farrington Highway Widening Study* describes potential mitigation at the intersection of Farrington Highway and Kualakai Parkway. Adding one additional left-turn lane (for a total of two left-turn lanes) on each approach leg would improve vehicle progression and reduce overall delay.

The westbound right-turn pocket from Farrington Highway towards the H-1 interchange was also extended to 800 feet of storage. Overall, the additional storage length and capacity greatly improves operations at this intersection. The westbound queues are reduced significantly compared to the Build condition without mitigation.

No mitigation is proposed at the H-1 eastbound and westbound ramp terminals. These intersections are expected to operate similarly to the Build condition without mitigation. While some queue lengths would increase, all off-ramp queueing is contained on the ramp and not expected to spill back onto the freeway mainline.

Table 2 compares the reported VISSIM queues by movement between the 2028 Build condition without and with mitigation.

Table 2. PM Peak Hour Queue Results

					2028 Build		2028 Build - With Mitigation	
Int. #	**Int. Name**	**Control Type**	**Approach Direction**	**Lane Group**	**95th Percentile Queue (ft)**	**Average Queue (ft)**	**95th Percentile Queue (ft)**	**Average Queue (ft)**
1	Kualakai Pkwy and H-1 WB Ramps	Signal	SB	TH	0	0	0	0
				RT	0	0	0	0
			NB	LT	530	325	535	400
				TH	530	325	535	400
			WB	RT	0	0	0	0
				LT	1085	735	1570	1225
2	Kualakai Pkwy and H-1 EB Ramps	Signal	SB	LT	5	0	5	0
				TH	260	125	450	220
			NB	TH	520	205	990	670
				RT	105	30	285	110
			EB	LT	0	0	5	0
				RT	5	0	0	0
3	Kualakai Pkwy and Farrington Hwy	Signal	SB	LT	575	340	115	60
				TH	1245	840	500	245
				RT	210	85	170	65
			NB	LT	995	725	170	90
				TH	1275	1030	780	405
				RT	340	150	170	70
			EB	LT	1655	895	1165	425
				TH	1635	720	1635	785
				RT	550	180	1470	545
			WB	LT	2010	1975	330	165
				TH	2010	1975	290	140
				RT	2010	1660	45	20

Figures 7 and 8 show typical queue conditions in the 2028 Build with mitigation scenario. Figure 9 shows the dual left-turn improvement at the Farrington Highway and Kualakai Parkway intersection, with interactions between vehicles and pedestrians (colored dots) in the crosswalks (solid black links).

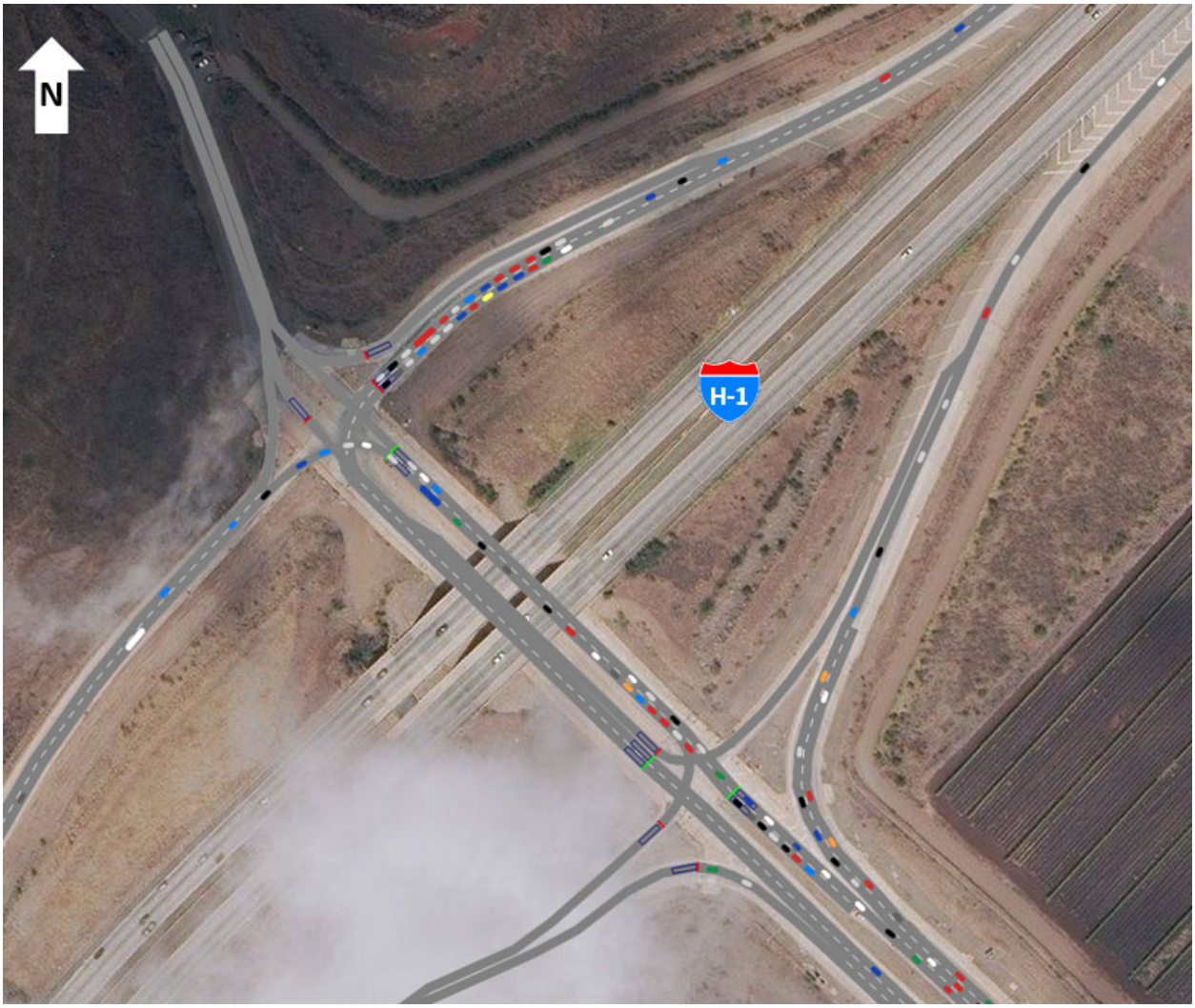


Figure 7. Future Build (2028) With Mitigation PM Peak Hour Queues – H-1 Interchange

Figure 8. Future Build (2028) With Mitigation PM Peak Hour Queues – Farrington Highway at Kualakai Parkway

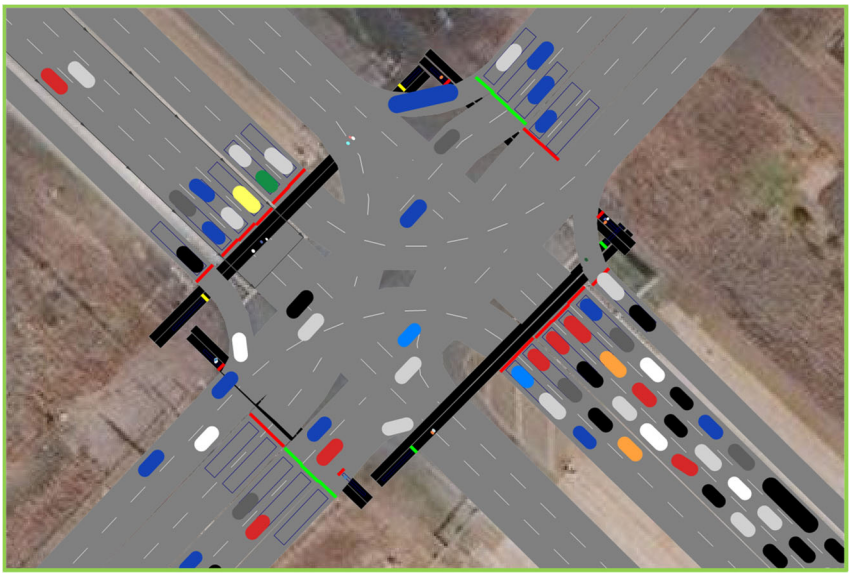


Figure 9. Vehicle-Pedestrian Interaction

Conclusions

Based on the VISSIM traffic operations results for the future year (2028) conditions, PM peak hour vehicle queues on Kualakai Parkway approaching the H-1 interchange are not expected to extend back far enough to affect traffic operations at the intersection of Farrington Highway and Kualakai Parkway. Southbound vehicle queues on Kualakai Parkway approaching Farrington Highway in the PM peak hour are also not expected to cause congestion and spillback onto the H-1 mainline.

Vehicles coming from either direction of H-1 are likely to have ample distance on Kualakai Parkway to make lane changes and position themselves into desired right- or left-turn lanes to Farrington Highway.

Eastbound and westbound queues on Farrington Highway at Kualakai Parkway are expected to be long, even with added turn-lane capacity mitigation. Further evaluation of potential mitigation measures is recommended at this study intersection to optimize traffic progression and reduce vehicle delay.

Appendix H

Previously Considered Grade Separation Concepts

TECHNICAL MEMORANDUM CH2MHILL

Farrington Highway Improvements:
Grade-Separation Concept Layouts

PREPARED FOR: Group 70

PREPARED BY: CH2M HILL

DATE: March 2, 2015

CH2M HILL was tasked to provide preliminary concept layouts for a potential grade-separation alternative at the intersection of Kualakai Parkway and Farrington Highway. This memorandum provides a brief description for each grade-separation option. A total of four grade-separation options were evaluated.

Option 1 – Provide a compressed diamond interchange with Farrington Highway over existing six-lane Kualakai Parkway.

- Both ramp terminals along Farrington Highway would be signalized with three-phase traffic signal control.
- Two lane on-ramp from Farrington Highway to Kualakai Parkway, then transition to one lane prior to merging to mainline (northbound Kualakai Parkway).
- One lane off-ramp from southbound Kualakai Parkway to Farrington Highway, then transition to two approach lanes and turn lane at ramp terminal.
- Due to close spacing between Farrington Highway and H-1 freeway (approx. 2,300′), the northbound on-ramp from Farrington Highway to the eastbound on-ramp to H-1 would be separated by less than 275′ for traffic merging and diverging, which would likely yield to a substandard weaving section, unsafe maneuvers, and poor traffic operating conditions (Freeway/Arterial weaving analysis would be required to determine the acceptable operating condition. Analysis is not under this current scope). A one lane Collector-Distributor could be added between these two on-ramps to minimize the weaving section, however a two lane eastbound on-ramp to H-1 would be required.
- Adding second eastbound on-ramp to H-1 may require an added lane to H1 eastbound mainline until all traffic can adequately merge with through traffic.

Option 2 – Same as Option 2 with the exception of:

- Maintain one existing eastbound on-ramp lane to H-1 to minimize conflicts with the mainline, however the weaving section along Kualakai Parkway between the northbound on-ramp from Farrington Highway to the eastbound on-ramp to H-1 would expect much more than 275′ to accommodate heavy traffic from these two ramp conditions. (Freeway/Arterial weaving analysis would be required to determine the acceptable operating condition. Analysis is not under this current scope).

Option 3 – Provide a PARCLO A with Southeast Quad only to:

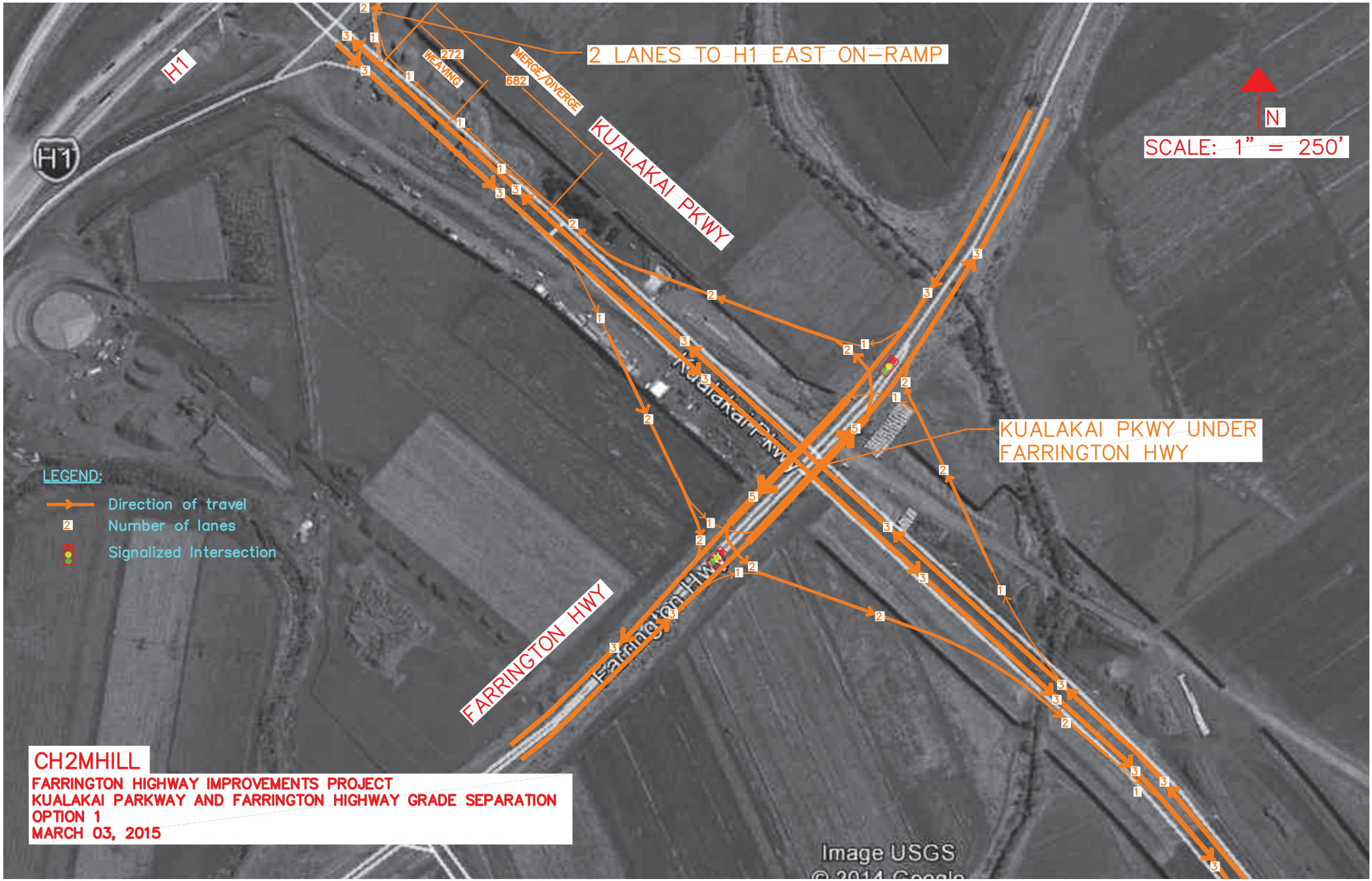
Draft

- Improve the weaving section between the Farrington Highway northbound on-ramp and eastbound H-1 on-ramp. Weaving section under this option would increase to nearly 1000 feet.
- Farrington Highway would be over existing six-lane Kualakai Parkway.
- Both ramp terminals along Farrington Highway would be signalized with three-phase traffic signal control.
- Two lane on-ramp from Farrington Highway to northbound Kualakai Parkway, then transition to one lane prior to merging to mainline.
- One lane off-ramp from southbound Kualakai Parkway to Farrington Highway, then transition to two approach lanes and turn lane at ramp terminal.

Option 4 – Similar to Option 4 with the addition of:

- Provide a northbound Collector-Distribution (C-D) system to remove the weaving section of Kualakai Parkway. Eastbound H-1 on-ramp traffic would be signed to take northbound C-D at Farrington Highway.
- Northbound on-ramp traffic from Farrington Highway would merge with northbound through traffic on Kualakai Parkway. Merging condition would have less conflicts than weaving condition on mainline.

Draft



CH2MHILL

FARRINGTON HIGHWAY IMPROVEMENTS PROJECT
KUALAKAI PARKWAY AND FARRINGTON HIGHWAY GRADE SEPARATION
OPTION 1
MARCH 03, 2015

CH2MHILL
FARRINGTON HIGHWAY IMPROVEMENTS PROJECT
KUALAKAI PARKWAY AND FARRINGTON HIGHWAY GRADE SEPARATION
OPTION 2
MARCH 03, 2015

H1
H1
H1 EAST ON-RAMP
992
WEAVING
KUALAKAI PKWY
N
SCALE: 1" = 250'
R 190'
DS: 25 MPH
KUALAKAI PKWY UNDER
FARRINGTON HWY
FARRINGTON HWY
LEGEND:
Direction of travel
Number of lanes
Signalized Intersection
CH2MHILL
FARRINGTON HIGHWAY IMPROVEMENTS PROJECT
KUALAKAI PARKWAY AND FARRINGTON HIGHWAY GRADE SEPARATION
OPTION 3
MARCH 03, 2015
Image USGS

CH2MHILL

FARRINGTON HIGHWAY IMPROVEMENTS PROJECT
KUALAKAI PARKWAY AND FARRINGTON HIGHWAY GRADE SEPARATION
OPTION 4
MARCH 03, 2015

Appendix I

Future Phase (2035) Intersection Reports

HCM 2010 Signalized Intersection Summary
1: Old Fort Weaver Road East Loop & Farrington Hwy

05/06/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	1750	0	105	1185	105	0	45	90	420	0	40
Future Volume (veh/h)	40	1750	0	105	1185	105	0	45	90	420	0	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1782	1782	0	1636	1636	1636	0	1622	1622	1765	1765	1800
Adj Flow Rate, veh/h	40	1750	0	105	1185	105	0	45	90	420	0	40
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	2	1	0
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
Percent Heavy Veh, %	1	1	0	10	10	10	0	11	11	2	2	2
Cap, veh/h	50	1818	0	120	1819	807	0	156	128	441	0	405
Arrive On Green	0.03	0.54	0.00	0.08	0.58	0.58	0.00	0.10	0.10	0.14	0.00	0.27
Sat Flow, veh/h	1697	3475	0	1558	3109	1379	0	1622	1335	3261	0	1500
Grp Volume(v), veh/h	40	1750	0	105	1185	105	0	45	90	420	0	40
Grp Sat Flow(s),veh/h/ln	1697	1693	0	1558	1555	1379	0	1622	1335	1630	0	1500
Q Serve(g_s), s	2.4	51.3	0.0	6.9	26.5	3.5	0.0	2.7	6.8	13.2	0.0	2.1
Cycle Q Clear(g_c), s	2.4	51.3	0.0	6.9	26.5	3.5	0.0	2.7	6.8	13.2	0.0	2.1
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	50	1818	0	120	1819	807	0	156	128	441	0	405
V/C Ratio(X)	0.80	0.96	0.00	0.87	0.65	0.13	0.00	0.29	0.70	0.95	0.00	0.10
Avail Cap(c_a), veh/h	115	1830	0	120	1819	807	0	250	206	441	0	492
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	50.0	23.0	0.0	47.3	14.4	9.7	0.0	43.5	45.4	44.5	0.0	28.4
Incr Delay (d2), s/veh	25.1	13.2	0.0	45.6	0.8	0.1	0.0	1.0	6.7	31.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	27.2	0.0	4.5	11.6	1.4	0.0	1.2	2.7	7.9	0.0	0.9
LnGrp Delay(d),s/veh	75.1	36.2	0.0	92.9	15.3	9.7	0.0	44.5	52.1	75.6	0.0	28.5
LnGrp LOS	E	D		F	B	A		D	D	E		C
Approach Vol, veh/h		1790			1395			135			460	
Approach Delay, s/veh		37.1			20.7			49.6			71.5	
Approach LOS		D			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	18.0	14.0	12.0	59.6		32.0	7.0	64.6
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s	14.0	16.0	8.0	56.0		34.0	7.0	57.0
Max Q Clear Time (g_c+I1), s	15.2	8.8	8.9	53.3		4.1	4.4	28.5
Green Ext Time (p_c), s	0.0	0.2	0.0	2.3		0.2	0.0	10.6

Intersection Summary	
HCM 2010 Ctrl Delay	35.7
HCM 2010 LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1780	30	0	1225	55	10
Future Volume (veh/h)	1780	30	0	1225	55	10
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1782	1800	0	1636	1731	1800
Adj Flow Rate, veh/h	1874	32	0	1289	58	11
Adj No. of Lanes	2	0	0	2	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	0	10	0	0
Cap, veh/h	2415	41	0	2204	144	27
Arrive On Green	0.71	0.71	0.00	0.71	0.11	0.11
Sat Flow, veh/h	3496	58	0	3273	1335	253
Grp Volume(v), veh/h	929	977	0	1289	70	0
Grp Sat Flow(s),veh/h/ln	1693	1771	0	1555	1611	0
Q Serve(g_s), s	15.5	15.7	0.0	9.0	1.8	0.0
Cycle Q Clear(g_c), s	15.5	15.7	0.0	9.0	1.8	0.0
Prop In Lane		0.03	0.00		0.83	0.16
Lane Grp Cap(c), veh/h	1200	1256	0	2204	174	0
V/C Ratio(X)	0.77	0.78	0.00	0.58	0.40	0.00
Avail Cap(c_a), veh/h	1395	1460	0	2562	590	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	4.1	4.1	0.0	3.2	18.2	0.0
Incr Delay (d2), s/veh	2.4	2.4	0.0	0.3	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.8	8.2	0.0	3.8	0.9	0.0
LnGrp Delay(d),s/veh	6.5	6.5	0.0	3.4	19.7	0.0
LnGrp LOS	A	A		A	B	
Approach Vol, veh/h	1906			1289	70	
Approach Delay, s/veh	6.5			3.4	19.7	
Approach LOS	A			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		8.7		35.0				35.0
Change Period (Y+Rc), s		4.0		4.0				4.0
Max Green Setting (Gmax), s		16.0		36.0				36.0
Max Q Clear Time (g_c+I1), s		3.8		17.7				11.0
Green Ext Time (p_c), s		0.1		13.3				10.7

Intersection Summary	
HCM 2010 Ctrl Delay	5.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Future Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Adj No. of Lanes	1	2	1	1	2	1	1	3	1	1	3	1
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
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	174	902	399	206	930	412	371	1462	451	383	1485	458
Arrive On Green	0.10	0.27	0.27	0.13	0.30	0.30	0.22	0.30	0.30	0.23	0.32	0.32
Sat Flow, veh/h	1681	3353	1483	1573	3138	1389	1681	4818	1485	1633	4680	1443
Grp Volume(v), veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Grp Sat Flow(s),veh/h/ln	1681	1676	1483	1573	1569	1389	1681	1606	1485	1633	1560	1443
Q Serve(g_s), s	15.0	28.7	18.0	19.0	32.6	43.0	32.0	44.0	44.0	34.0	44.9	40.6
Cycle Q Clear(g_c), s	15.0	28.7	18.0	19.0	32.6	43.0	32.0	44.0	44.0	34.0	44.9	40.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	174	902	399	206	930	412	371	1462	451	383	1485	458
V/C Ratio(X)	1.64	0.79	0.54	1.70	0.82	1.94	1.08	1.29	1.32	1.83	0.98	0.92
Avail Cap(c_a), veh/h	174	902	399	206	930	412	371	1462	451	383	1485	458
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.0	49.2	45.3	63.0	47.3	51.0	56.5	50.5	50.5	55.5	49.1	47.7
Incr Delay (d2), s/veh	312.1	4.9	1.5	334.2	5.7	432.5	69.3	137.0	159.0	382.9	19.4	23.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.0	13.9	7.5	27.4	14.9	66.0	22.0	38.0	37.9	56.0	22.0	19.2
LnGrp Delay(d),s/veh	377.1	54.1	46.8	397.2	53.1	483.5	125.8	187.5	209.5	438.4	68.5	71.0
LnGrp LOS	F	D	D	F	D	F	F	F	F	F	E	E
Approach Vol, veh/h		1215			1910			2885			2580	
Approach Delay, s/veh		128.6			296.4			183.5			169.3	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	37.0	44.0	22.0	42.0	35.0	46.0	18.0	46.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	31.0	37.0	16.0	35.0	29.0	39.0	12.0	39.0
Max Q Clear Time (g_c+I1), s	36.0	46.0	21.0	30.7	34.0	46.9	17.0	45.0
Green Ext Time (p_c), s	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	196.6
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1060	10	25	960	10	50
Future Vol, veh/h	1060	10	25	960	10	50
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	5	5	20	20
Mvmt Flow	1116	11	26	1011	11	53

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1137	0	1700	584
Stage 1	-	-	-	-	1132	-
Stage 2	-	-	-	-	568	-
Critical Hdwy	-	-	4.2	-	7.2	7.3
Critical Hdwy Stg 1	-	-	-	-	6.2	-
Critical Hdwy Stg 2	-	-	-	-	6.2	-
Follow-up Hdwy	-	-	2.25	-	3.7	3.5
Pot Cap-1 Maneuver	-	-	593	-	69	412
Stage 1	-	-	-	-	234	-
Stage 2	-	-	-	-	483	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	588	-	65	405
Mov Cap-2 Maneuver	-	-	-	-	166	-
Stage 1	-	-	-	-	232	-
Stage 2	-	-	-	-	458	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	166	405	-	-	588	-
HCM Lane V/C Ratio	0.063	0.13	-	-	0.045	-
HCM Control Delay (s)	28.2	15.2	-	-	11.4	-
HCM Lane LOS	D	C	-	-	B	-
HCM 95th %tile Q(veh)	0.2	0.4	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	510	370	245	560	110	430	80	275	75	40	50
Future Volume (veh/h)	145	510	370	245	560	110	430	80	275	75	40	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1800	1748	1748	1748	1800	1800	1800	1782	1782	1782
Adj Flow Rate, veh/h	153	537	389	258	589	116	453	84	289	79	42	53
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	3	3	3	0	0	0	1	1	1
Cap, veh/h	701	711	515	221	1016	450	556	689	565	430	682	560
Arrive On Green	0.22	0.39	0.39	0.13	0.31	0.31	0.38	0.38	0.37	0.38	0.38	0.37
Sat Flow, veh/h	3198	1812	1312	1664	3320	1471	1313	1800	1518	1011	1782	1503
Grp Volume(v), veh/h	153	487	439	258	589	116	453	84	289	79	42	53
Grp Sat Flow(s),veh/h/ln	1599	1644	1479	1664	1660	1471	1313	1800	1518	1011	1782	1503
Q Serve(g_s), s	3.8	25.0	25.0	13.0	14.6	5.8	32.6	3.0	14.4	5.4	1.5	2.2
Cycle Q Clear(g_c), s	3.8	25.0	25.0	13.0	14.6	5.8	34.0	3.0	14.4	8.3	1.5	2.2
Prop In Lane	1.00		0.89	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	701	645	580	221	1016	450	556	689	565	430	682	560
V/C Ratio(X)	0.22	0.76	0.76	1.17	0.58	0.26	0.81	0.12	0.51	0.18	0.06	0.09
Avail Cap(c_a), veh/h	701	757	681	221	1562	692	564	700	574	436	693	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.3	25.7	25.7	42.4	28.6	25.6	29.8	19.5	23.8	22.2	19.1	19.9
Incr Delay (d2), s/veh	0.2	3.7	4.1	112.5	0.5	0.3	8.8	0.1	0.7	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	12.0	10.9	12.8	6.8	2.4	13.1	1.5	6.2	1.5	0.7	0.9
LnGrp Delay(d),s/veh	31.5	29.4	29.8	154.9	29.1	25.9	38.7	19.6	24.5	22.4	19.1	20.0
LnGrp LOS	C	C	C	F	C	C	D	B	C	C	B	C
Approach Vol, veh/h		1079			963			826			174	
Approach Delay, s/veh		29.8			62.4			31.8			20.9	
Approach LOS		C			E			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		40.4	16.0	41.3		40.4	24.4	32.9
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		37.0	12.0	41.0		37.0	11.0	42.0
Max Q Clear Time (g_c+I1), s		36.0	15.0	27.0		10.3	5.8	16.6
Green Ext Time (p_c), s		0.4	0.0	5.2		0.7	0.2	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	40.2
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	380	415	225	205	460	380	310	735	210	390	980	925
Future Volume (veh/h)	380	415	225	205	460	380	310	735	210	390	980	925
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1731	1765	1765	1765	1731	1731	1731	1748	1748	1748
Adj Flow Rate, veh/h	380	415	0	205	460	380	310	735	0	390	1415	635
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
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
Percent Heavy Veh, %	4	4	4	2	2	2	4	4	4	3	3	3
Cap, veh/h	403	703	315	249	791	615	332	1326	593	485	1556	657
Arrive On Green	0.13	0.21	0.00	0.15	0.24	0.24	0.10	0.40	0.00	0.15	0.45	0.45
Sat Flow, veh/h	3198	3288	1471	1681	3353	2606	3198	3288	1471	3329	3495	1475
Grp Volume(v), veh/h	380	415	0	205	460	380	310	735	0	390	1415	635
Grp Sat Flow(s),veh/h/ln	1599	1644	1471	1681	1676	1303	1599	1644	1471	1664	1748	1475
Q Serve(g_s), s	15.9	15.3	0.0	16.0	16.4	17.6	13.0	23.2	0.0	15.3	50.9	56.5
Cycle Q Clear(g_c), s	15.9	15.3	0.0	16.0	16.4	17.6	13.0	23.2	0.0	15.3	50.9	56.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	403	703	315	249	791	615	332	1326	593	485	1556	657
V/C Ratio(X)	0.94	0.59	0.00	0.82	0.58	0.62	0.93	0.55	0.00	0.80	0.91	0.97
Avail Cap(c_a), veh/h	403	927	415	262	1045	812	332	1326	593	593	1556	657
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.4	47.7	0.0	55.7	45.6	46.1	59.9	30.9	0.0	55.7	34.9	36.4
Incr Delay (d2), s/veh	30.1	0.8	0.0	16.7	0.7	1.0	32.2	0.5	0.0	5.3	8.3	27.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	7.1	0.0	8.6	7.7	6.4	7.2	10.6	0.0	7.4	26.4	27.8
LnGrp Delay(d),s/veh	88.6	48.5	0.0	72.4	46.3	47.1	92.1	31.4	0.0	61.0	43.2	63.4
LnGrp LOS	F	D		E	D	D	F	C		E	D	E
Approach Vol, veh/h		795			1045			1045			2440	
Approach Delay, s/veh		67.6			51.7			49.4			51.3	
Approach LOS		E			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.6	57.4	23.0	31.8	17.0	63.0	20.0	34.8
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	22.0	47.0	19.0	35.0	12.0	57.0	15.0	39.0
Max Q Clear Time (g_c+I1), s	17.3	25.2	18.0	17.3	15.0	58.5	17.9	19.6
Green Ext Time (p_c), s	0.4	4.8	0.0	2.4	0.0	0.0	0.0	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	53.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1460	0	0	615	365	0	0	900	0
Future Volume (veh/h)	0	0	0	1460	0	0	615	365	0	0	900	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				1537	0	0	647	384	0	0	947	0
Adj No. of Lanes				2	0	1	2	1	0	0	2	0
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1513	0	675	598	853	0	0	894	0
Arrive On Green				0.45	0.00	0.00	0.18	0.48	0.00	0.00	0.27	0.00
Sat Flow, veh/h				3361	0	1500	3261	1765	0	0	3529	0
Grp Volume(v), veh/h				1537	0	0	647	384	0	0	947	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1630	1765	0	0	1676	0
Q Serve(g_s), s				54.0	0.0	0.0	22.0	17.2	0.0	0.0	32.0	0.0
Cycle Q Clear(g_c), s				54.0	0.0	0.0	22.0	17.2	0.0	0.0	32.0	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1513	0	675	598	853	0	0	894	0
V/C Ratio(X)				1.02	0.00	0.00	1.08	0.45	0.00	0.00	1.06	0.00
Avail Cap(c_a), veh/h				1513	0	675	598	853	0	0	894	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				33.0	0.0	0.0	49.0	20.5	0.0	0.0	44.0	0.0
Incr Delay (d2), s/veh				27.2	0.0	0.0	61.1	1.7	0.0	0.0	47.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				30.7	0.0	0.0	15.0	8.7	0.0	0.0	20.6	0.0
LnGrp Delay(d),s/veh				60.2	0.0	0.0	110.1	22.2	0.0	0.0	91.0	0.0
LnGrp LOS				F			F	C			F	
Approach Vol, veh/h					1537			1031			947	
Approach Delay, s/veh					60.2			77.3			91.0	
Approach LOS					E			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		62.0			26.0	36.0		58.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		58.0			22.0	32.0		54.0
Max Q Clear Time (g_c+I1), s		19.2			24.0	34.0		56.0
Green Ext Time (p_c), s		2.6			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	73.5
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	620	0	0	0	0	975	2000	400	1960	0
Future Volume (veh/h)	5	0	620	0	0	0	0	975	2000	400	1960	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	1026	0	421	2063	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	9	0	8				0	1858	1463	454	2954	0
Arrive On Green	0.01	0.00	0.00				0.00	0.55	0.00	0.27	0.88	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	1026	0	421	2063	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.2	0.0	0.0				0.0	13.8	0.0	17.2	13.4	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0				0.0	13.8	0.0	17.2	13.4	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	9	0	8				0	1858	1463	454	2954	0
V/C Ratio(X)	0.56	0.00	0.00				0.00	0.55	0.00	0.93	0.70	0.00
Avail Cap(c_a), veh/h	716	0	639				0	1858	1463	454	2954	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	34.9	0.0	0.0				0.0	10.1	0.0	25.0	1.3	0.0
Incr Delay (d2), s/veh	45.6	0.0	0.0				0.0	1.2	0.0	25.4	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0				0.0	6.6	0.0	11.2	6.3	0.0
LnGrp Delay(d),s/veh	80.5	0.0	0.0				0.0	11.3	0.0	50.4	2.7	0.0
LnGrp LOS	F							B		D	A	
Approach Vol, veh/h		5						1026			2484	
Approach Delay, s/veh		80.5						11.3			10.8	
Approach LOS		F						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	43.0		4.4		66.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	19.0	39.0		30.0		62.0		
Max Q Clear Time (g_c+I1), s	19.2	15.8		2.2		15.4		
Green Ext Time (p_c), s	0.0	7.7		0.0		29.7		

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
1: Old Fort Weaver Road East Loop & Farrington Hwy

05/06/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	1750	0	105	1185	105	0	45	90	420	0	40
Future Volume (veh/h)	40	1750	0	105	1185	105	0	45	90	420	0	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.97	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1782	1782	0	1636	1636	1636	0	1622	1622	1765	1765	1800
Adj Flow Rate, veh/h	40	1750	0	105	1185	105	0	45	90	420	0	40
Adj No. of Lanes	1	3	0	1	3	1	0	1	1	2	1	0
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
Percent Heavy Veh, %	1	1	0	10	10	10	0	11	11	2	2	2
Cap, veh/h	53	2019	0	129	2083	642	0	180	149	508	0	489
Arrive On Green	0.03	0.41	0.00	0.08	0.47	0.47	0.00	0.11	0.11	0.16	0.00	0.33
Sat Flow, veh/h	1697	5026	0	1558	4467	1376	0	1622	1341	3261	0	1500
Grp Volume(v), veh/h	40	1750	0	105	1185	105	0	45	90	420	0	40
Grp Sat Flow(s),veh/h/ln	1697	1622	0	1558	1489	1376	0	1622	1341	1630	0	1500
Q Serve(g_s), s	1.6	22.3	0.0	4.5	13.1	3.0	0.0	1.7	4.3	8.5	0.0	1.3
Cycle Q Clear(g_c), s	1.6	22.3	0.0	4.5	13.1	3.0	0.0	1.7	4.3	8.5	0.0	1.3
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	53	2019	0	129	2083	642	0	180	149	508	0	489
V/C Ratio(X)	0.76	0.87	0.00	0.82	0.57	0.16	0.00	0.25	0.60	0.83	0.00	0.08
Avail Cap(c_a), veh/h	150	2079	0	138	2083	642	0	430	356	528	0	729
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	32.6	18.1	0.0	30.6	13.2	10.5	0.0	27.6	28.7	27.8	0.0	15.9
Incr Delay (d2), s/veh	19.3	4.1	0.0	28.9	0.4	0.1	0.0	0.7	3.9	10.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	10.6	0.0	3.0	5.4	1.1	0.0	0.8	1.8	4.5	0.0	0.5
LnGrp Delay(d),s/veh	51.9	22.2	0.0	59.5	13.5	10.6	0.0	28.3	32.6	37.9	0.0	15.9
LnGrp LOS	D	C		E	B	B		C	C	D		B
Approach Vol, veh/h		1790			1395			135			460	
Approach Delay, s/veh		22.9			16.8			31.2			36.0	
Approach LOS		C			B			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	14.6	11.5	9.6	32.2		26.1	6.1	35.6
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s	11.0	18.0	6.0	29.0		33.0	6.0	29.0
Max Q Clear Time (g_c+I1), s	10.5	6.3	6.5	24.3		3.3	3.6	15.1
Green Ext Time (p_c), s	0.1	0.3	0.0	3.9		0.2	0.0	7.2

Intersection Summary	
HCM 2010 Ctrl Delay	22.5
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1780	30	0	1225	55	10
Future Volume (veh/h)	1780	30	0	1225	55	10
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1782	1800	0	1636	1731	1800
Adj Flow Rate, veh/h	1874	32	0	1289	58	11
Adj No. of Lanes	3	0	0	3	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	0	10	0	0
Cap, veh/h	2924	50	0	2651	196	37
Arrive On Green	0.59	0.59	0.00	0.59	0.15	0.15
Sat Flow, veh/h	5086	84	0	4762	1336	253
Grp Volume(v), veh/h	1234	672	0	1289	70	0
Grp Sat Flow(s),veh/h/ln	1622	1767	0	1489	1613	0
Q Serve(g_s), s	7.7	7.7	0.0	5.1	1.2	0.0
Cycle Q Clear(g_c), s	7.7	7.7	0.0	5.1	1.2	0.0
Prop In Lane		0.05	0.00		0.83	0.16
Lane Grp Cap(c), veh/h	1925	1048	0	2651	236	0
V/C Ratio(X)	0.64	0.64	0.00	0.49	0.30	0.00
Avail Cap(c_a), veh/h	2213	1205	0	3048	838	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	4.1	4.1	0.0	3.6	11.7	0.0
Incr Delay (d2), s/veh	0.5	0.9	0.0	0.1	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	3.8	0.0	2.1	0.6	0.0
LnGrp Delay(d),s/veh	4.6	5.0	0.0	3.7	12.4	0.0
LnGrp LOS	A	A		A	B	
Approach Vol, veh/h	1906			1289	70	
Approach Delay, s/veh	4.8			3.7	12.4	
Approach LOS	A			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		8.5		22.3				22.3
Change Period (Y+Rc), s		4.0		4.0				4.0
Max Green Setting (Gmax), s		16.0		21.0				21.0
Max Q Clear Time (g_c+I1), s		3.2		9.7				7.1
Green Ext Time (p_c), s		0.1		8.6				7.5

Intersection Summary	
HCM 2010 Ctrl Delay	4.5
HCM 2010 LOS	A

HCM 2010 Signalized Intersection Summary
3: Kualakai Pky & Farrington Hwy

05/06/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Future Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Adj No. of Lanes	1	3	1	1	3	2	1	3	1	1	3	1
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
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	174	1296	399	206	1337	725	371	1462	451	383	1485	458
Arrive On Green	0.10	0.27	0.27	0.13	0.30	0.30	0.22	0.30	0.30	0.23	0.32	0.32
Sat Flow, veh/h	1681	4818	1483	1573	4508	2445	1681	4818	1485	1633	4680	1443
Grp Volume(v), veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Grp Sat Flow(s),veh/h/ln	1681	1606	1483	1573	1503	1223	1681	1606	1485	1633	1560	1443
Q Serve(g_s), s	15.0	18.5	18.0	19.0	20.7	43.0	32.0	44.0	44.0	34.0	44.9	40.6
Cycle Q Clear(g_c), s	15.0	18.5	18.0	19.0	20.7	43.0	32.0	44.0	44.0	34.0	44.9	40.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	174	1296	399	206	1337	725	371	1462	451	383	1485	458
V/C Ratio(X)	1.64	0.55	0.54	1.70	0.57	1.10	1.08	1.29	1.32	1.83	0.98	0.92
Avail Cap(c_a), veh/h	174	1296	399	206	1337	725	371	1462	451	383	1485	458
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.0	45.5	45.3	63.0	43.2	51.0	56.5	50.5	50.5	55.5	49.1	47.7
Incr Delay (d2), s/veh	312.1	0.5	1.5	334.2	0.6	65.3	69.3	137.0	159.0	382.9	19.4	23.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.0	8.3	7.5	27.4	8.7	21.1	22.0	38.0	37.9	56.0	22.0	19.2
LnGrp Delay(d),s/veh	377.1	46.0	46.8	397.2	43.7	116.3	125.8	187.5	209.5	438.4	68.5	71.0
LnGrp LOS	F	D	D	F	D	F	F	F	F	F	E	E
Approach Vol, veh/h		1215			1910			2885			2580	
Approach Delay, s/veh		123.8			138.9			183.5			169.3	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	37.0	44.0	22.0	42.0	35.0	46.0	18.0	46.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	31.0	37.0	16.0	35.0	29.0	39.0	12.0	39.0
Max Q Clear Time (g_c+I1), s	36.0	46.0	21.0	20.5	34.0	46.9	17.0	45.0
Green Ext Time (p_c), s	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	160.9
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1060	10	25	960	10	50
Future Vol, veh/h	1060	10	25	960	10	50
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	5	5	20	20
Mvmt Flow	1116	11	26	1011	11	53

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1137	0	1700	584
Stage 1	-	-	-	-	1132	-
Stage 2	-	-	-	-	568	-
Critical Hdwy	-	-	4.2	-	7.2	7.3
Critical Hdwy Stg 1	-	-	-	-	6.2	-
Critical Hdwy Stg 2	-	-	-	-	6.2	-
Follow-up Hdwy	-	-	2.25	-	3.7	3.5
Pot Cap-1 Maneuver	-	-	593	-	69	412
Stage 1	-	-	-	-	234	-
Stage 2	-	-	-	-	483	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	588	-	65	405
Mov Cap-2 Maneuver	-	-	-	-	166	-
Stage 1	-	-	-	-	232	-
Stage 2	-	-	-	-	458	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	166	405	-	-	588	-
HCM Lane V/C Ratio	0.063	0.13	-	-	0.045	-
HCM Control Delay (s)	28.2	15.2	-	-	11.4	-
HCM Lane LOS	D	C	-	-	B	-
HCM 95th %tile Q(veh)	0.2	0.4	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	510	370	245	560	110	430	80	275	75	40	50
Future Volume (veh/h)	145	510	370	245	560	110	430	80	275	75	40	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1800	1748	1748	1748	1800	1800	1800	1782	1782	1782
Adj Flow Rate, veh/h	153	537	389	258	589	116	453	84	289	79	42	53
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	3	3	3	0	0	0	1	1	1
Cap, veh/h	701	711	515	221	1016	450	556	689	565	430	682	560
Arrive On Green	0.22	0.39	0.39	0.13	0.31	0.31	0.38	0.38	0.37	0.38	0.38	0.37
Sat Flow, veh/h	3198	1812	1312	1664	3320	1471	1313	1800	1518	1011	1782	1503
Grp Volume(v), veh/h	153	487	439	258	589	116	453	84	289	79	42	53
Grp Sat Flow(s),veh/h/ln	1599	1644	1479	1664	1660	1471	1313	1800	1518	1011	1782	1503
Q Serve(g_s), s	3.8	25.0	25.0	13.0	14.6	5.8	32.6	3.0	14.4	5.4	1.5	2.2
Cycle Q Clear(g_c), s	3.8	25.0	25.0	13.0	14.6	5.8	34.0	3.0	14.4	8.3	1.5	2.2
Prop In Lane	1.00		0.89	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	701	645	580	221	1016	450	556	689	565	430	682	560
V/C Ratio(X)	0.22	0.76	0.76	1.17	0.58	0.26	0.81	0.12	0.51	0.18	0.06	0.09
Avail Cap(c_a), veh/h	701	757	681	221	1562	692	564	700	574	436	693	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.3	25.7	25.7	42.4	28.6	25.6	29.8	19.5	23.8	22.2	19.1	19.9
Incr Delay (d2), s/veh	0.2	3.7	4.1	112.5	0.5	0.3	8.8	0.1	0.7	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	12.0	10.9	12.8	6.8	2.4	13.1	1.5	6.2	1.5	0.7	0.9
LnGrp Delay(d),s/veh	31.5	29.4	29.8	154.9	29.1	25.9	38.7	19.6	24.5	22.4	19.1	20.0
LnGrp LOS	C	C	C	F	C	C	D	B	C	C	B	C
Approach Vol, veh/h		1079			963			826			174	
Approach Delay, s/veh		29.8			62.4			31.8			20.9	
Approach LOS		C			E			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		40.4	16.0	41.3		40.4	24.4	32.9
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		37.0	12.0	41.0		37.0	11.0	42.0
Max Q Clear Time (g_c+I1), s		36.0	15.0	27.0		10.3	5.8	16.6
Green Ext Time (p_c), s		0.4	0.0	5.2		0.7	0.2	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	40.2
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	380	415	225	205	460	380	310	735	210	390	980	925
Future Volume (veh/h)	380	415	225	205	460	380	310	735	210	390	980	925
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1731	1731	1765	1765	1765	1731	1731	1731	1748	1748	1748
Adj Flow Rate, veh/h	380	415	0	205	460	380	310	735	0	390	1415	635
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
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
Percent Heavy Veh, %	4	4	4	2	2	2	4	4	4	3	3	3
Cap, veh/h	403	703	315	249	791	615	332	1326	593	485	1556	657
Arrive On Green	0.13	0.21	0.00	0.15	0.24	0.24	0.10	0.40	0.00	0.15	0.45	0.45
Sat Flow, veh/h	3198	3288	1471	1681	3353	2606	3198	3288	1471	3329	3495	1475
Grp Volume(v), veh/h	380	415	0	205	460	380	310	735	0	390	1415	635
Grp Sat Flow(s),veh/h/ln	1599	1644	1471	1681	1676	1303	1599	1644	1471	1664	1748	1475
Q Serve(g_s), s	15.9	15.3	0.0	16.0	16.4	17.6	13.0	23.2	0.0	15.3	50.9	56.5
Cycle Q Clear(g_c), s	15.9	15.3	0.0	16.0	16.4	17.6	13.0	23.2	0.0	15.3	50.9	56.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	403	703	315	249	791	615	332	1326	593	485	1556	657
V/C Ratio(X)	0.94	0.59	0.00	0.82	0.58	0.62	0.93	0.55	0.00	0.80	0.91	0.97
Avail Cap(c_a), veh/h	403	927	415	262	1045	812	332	1326	593	593	1556	657
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.4	47.7	0.0	55.7	45.6	46.1	59.9	30.9	0.0	55.7	34.9	36.4
Incr Delay (d2), s/veh	30.1	0.8	0.0	16.7	0.7	1.0	32.2	0.5	0.0	5.3	8.3	27.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	7.1	0.0	8.6	7.7	6.4	7.2	10.6	0.0	7.4	26.4	27.8
LnGrp Delay(d),s/veh	88.6	48.5	0.0	72.4	46.3	47.1	92.1	31.4	0.0	61.0	43.2	63.4
LnGrp LOS	F	D		E	D	D	F	C		E	D	E
Approach Vol, veh/h		795			1045			1045			2440	
Approach Delay, s/veh		67.6			51.7			49.4			51.3	
Approach LOS		E			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.6	57.4	23.0	31.8	17.0	63.0	20.0	34.8
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	22.0	47.0	19.0	35.0	12.0	57.0	15.0	39.0
Max Q Clear Time (g_c+I1), s	17.3	25.2	18.0	17.3	15.0	58.5	17.9	19.6
Green Ext Time (p_c), s	0.4	4.8	0.0	2.4	0.0	0.0	0.0	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	53.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1460	0	0	615	365	0	0	900	0
Future Volume (veh/h)	0	0	0	1460	0	0	615	365	0	0	900	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				1537	0	0	647	384	0	0	947	0
Adj No. of Lanes				2	0	1	2	1	0	0	2	0
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				1513	0	675	598	853	0	0	894	0
Arrive On Green				0.45	0.00	0.00	0.18	0.48	0.00	0.00	0.27	0.00
Sat Flow, veh/h				3361	0	1500	3261	1765	0	0	3529	0
Grp Volume(v), veh/h				1537	0	0	647	384	0	0	947	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1630	1765	0	0	1676	0
Q Serve(g_s), s				54.0	0.0	0.0	22.0	17.2	0.0	0.0	32.0	0.0
Cycle Q Clear(g_c), s				54.0	0.0	0.0	22.0	17.2	0.0	0.0	32.0	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				1513	0	675	598	853	0	0	894	0
V/C Ratio(X)				1.02	0.00	0.00	1.08	0.45	0.00	0.00	1.06	0.00
Avail Cap(c_a), veh/h				1513	0	675	598	853	0	0	894	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				33.0	0.0	0.0	49.0	20.5	0.0	0.0	44.0	0.0
Incr Delay (d2), s/veh				27.2	0.0	0.0	61.1	1.7	0.0	0.0	47.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				30.7	0.0	0.0	15.0	8.7	0.0	0.0	20.6	0.0
LnGrp Delay(d),s/veh				60.2	0.0	0.0	110.1	22.2	0.0	0.0	91.0	0.0
LnGrp LOS				F			F	C			F	
Approach Vol, veh/h					1537			1031			947	
Approach Delay, s/veh					60.2			77.3			91.0	
Approach LOS					E			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		62.0			26.0	36.0		58.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		58.0			22.0	32.0		54.0
Max Q Clear Time (g_c+I1), s		19.2			24.0	34.0		56.0
Green Ext Time (p_c), s		2.6			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	73.5
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	620	0	0	0	0	975	2000	400	1960	0
Future Volume (veh/h)	5	0	620	0	0	0	0	975	2000	400	1960	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	1026	0	421	2063	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	9	0	8				0	1858	1463	454	2954	0
Arrive On Green	0.01	0.00	0.00				0.00	0.55	0.00	0.27	0.88	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	1026	0	421	2063	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.2	0.0	0.0				0.0	13.8	0.0	17.2	13.4	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0				0.0	13.8	0.0	17.2	13.4	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	9	0	8				0	1858	1463	454	2954	0
V/C Ratio(X)	0.56	0.00	0.00				0.00	0.55	0.00	0.93	0.70	0.00
Avail Cap(c_a), veh/h	716	0	639				0	1858	1463	454	2954	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	34.9	0.0	0.0				0.0	10.1	0.0	25.0	1.3	0.0
Incr Delay (d2), s/veh	45.6	0.0	0.0				0.0	1.2	0.0	25.4	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0				0.0	6.6	0.0	11.2	6.3	0.0
LnGrp Delay(d),s/veh	80.5	0.0	0.0				0.0	11.3	0.0	50.4	2.7	0.0
LnGrp LOS	F							B		D	A	
Approach Vol, veh/h		5						1026			2484	
Approach Delay, s/veh		80.5						11.3			10.8	
Approach LOS		F						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	43.0		4.4		66.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	19.0	39.0		30.0		62.0		
Max Q Clear Time (g_c+I1), s	19.2	15.8		2.2		15.4		
Green Ext Time (p_c), s	0.0	7.7		0.0		29.7		

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Future Volume (veh/h)	285	715	215	350	760	800	400	1890	595	700	1460	420
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1651	1651	1651	1765	1765	1765	1714	1714	1714
Adj Flow Rate, veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Adj No. of Lanes	2	3	1	2	3	2	2	3	1	3	3	1
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
Percent Heavy Veh, %	2	2	2	9	9	9	2	2	2	5	5	5
Cap, veh/h	362	1392	429	339	1302	706	483	1856	573	682	1803	557
Arrive On Green	0.11	0.29	0.29	0.11	0.29	0.29	0.15	0.39	0.39	0.15	0.39	0.39
Sat Flow, veh/h	3261	4818	1484	3051	4508	2445	3261	4818	1488	4604	4680	1446
Grp Volume(v), veh/h	285	715	215	350	760	800	400	1890	595	700	1460	420
Grp Sat Flow(s),veh/h/ln	1630	1606	1484	1526	1503	1222	1630	1606	1488	1535	1560	1446
Q Serve(g_s), s	11.5	16.7	16.3	15.0	19.5	39.0	16.1	52.0	52.0	20.0	37.6	34.0
Cycle Q Clear(g_c), s	11.5	16.7	16.3	15.0	19.5	39.0	16.1	52.0	52.0	20.0	37.6	34.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	362	1392	429	339	1302	706	483	1856	573	682	1803	557
V/C Ratio(X)	0.79	0.51	0.50	1.03	0.58	1.13	0.83	1.02	1.04	1.03	0.81	0.75
Avail Cap(c_a), veh/h	362	1392	429	339	1302	706	483	1856	573	682	1803	557
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.4	40.1	39.9	60.0	41.1	48.0	55.8	41.5	41.5	57.5	37.1	36.0
Incr Delay (d2), s/veh	10.9	0.3	0.9	57.5	0.7	76.7	11.4	25.7	47.8	41.3	2.9	5.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	7.5	6.8	9.0	8.2	20.7	8.0	27.4	28.9	11.1	16.7	14.4
LnGrp Delay(d),s/veh	69.4	40.4	40.8	117.5	41.7	124.7	67.3	67.2	89.3	98.8	40.0	41.8
LnGrp LOS	E	D	D	F	D	F	E	F	F	F	D	D
Approach Vol, veh/h		1215			1910			2885			2580	
Approach Delay, s/veh		47.3			90.3			71.7			56.2	
Approach LOS		D			F			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	52.0	18.0	42.0	23.0	52.0	18.0	42.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	17.0	45.0	12.0	35.0	17.0	45.0	12.0	35.0
Max Q Clear Time (g_c+I1), s	22.0	54.0	17.0	18.7	18.1	39.6	13.5	41.0
Green Ext Time (p_c), s	0.0	0.0	0.0	5.1	0.0	4.3	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	67.8
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
1: Old Fort Weaver Road East Loop & Farrington Hwy

05/06/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	1430	0	265	1950	525	0	105	85	795	0	275
Future Volume (veh/h)	145	1430	0	265	1950	525	0	105	85	795	0	275
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.95	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1714	1714	0	1714	1714	1714	0	1714	1714	1765	1765	1800
Adj Flow Rate, veh/h	145	1430	0	265	1950	525	0	105	85	795	0	275
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	2	1	0
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
Percent Heavy Veh, %	5	5	0	5	5	5	0	5	5	2	2	2
Cap, veh/h	128	1489	0	257	1745	773	0	98	79	699	0	321
Arrive On Green	0.08	0.46	0.00	0.16	0.54	0.54	0.00	0.06	0.06	0.21	0.00	0.21
Sat Flow, veh/h	1633	3343	0	1633	3257	1444	0	1714	1381	3261	0	1500
Grp Volume(v), veh/h	145	1430	0	265	1950	525	0	105	85	795	0	275
Grp Sat Flow(s),veh/h/ln	1633	1629	0	1633	1629	1444	0	1714	1381	1630	0	1500
Q Serve(g_s), s	11.0	59.5	0.0	22.0	75.0	37.2	0.0	8.0	8.0	30.0	0.0	24.7
Cycle Q Clear(g_c), s	11.0	59.5	0.0	22.0	75.0	37.2	0.0	8.0	8.0	30.0	0.0	24.7
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	128	1489	0	257	1745	773	0	98	79	699	0	321
V/C Ratio(X)	1.13	0.96	0.00	1.03	1.12	0.68	0.00	1.07	1.08	1.14	0.00	0.86
Avail Cap(c_a), veh/h	128	1489	0	257	1745	773	0	98	79	699	0	321
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	64.5	36.8	0.0	59.0	32.5	23.7	0.0	66.0	66.0	55.0	0.0	52.9
Incr Delay (d2), s/veh	118.8	15.0	0.0	65.0	61.4	2.4	0.0	111.7	124.0	78.8	0.0	19.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.9	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.2	29.7	0.0	14.5	48.3	15.2	0.0	6.8	5.8	21.1	0.0	12.0
LnGrp Delay(d),s/veh	183.3	51.7	0.0	124.0	93.9	26.1	0.0	178.1	191.0	133.8	0.0	72.6
LnGrp LOS	F	D		F	F	C		F	F	F		E
Approach Vol, veh/h		1575			2740			190			1070	
Approach Delay, s/veh		63.8			83.8			183.8			118.1	
Approach LOS		E			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		12.0	26.0	68.0		34.0	15.0	79.0
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		8.0	22.0	64.0		30.0	11.0	75.0
Max Q Clear Time (g_c+I1), s		10.0	24.0	61.5		32.0	13.0	77.0
Green Ext Time (p_c), s		0.0	0.0	2.0		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	88.1
HCM 2010 LOS	F

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1560	35	0	2225	75	15
Future Volume (veh/h)	1560	35	0	2225	75	15
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1800	0	1765	1748	1800
Adj Flow Rate, veh/h	1642	37	0	2294	79	16
Adj No. of Lanes	2	0	0	2	0	0
Peak Hour Factor	0.95	0.95	0.97	0.97	0.95	0.95
Percent Heavy Veh, %	4	4	0	2	0	0
Cap, veh/h	2561	58	0	2612	136	28
Arrive On Green	0.78	0.78	0.00	0.78	0.10	0.10
Sat Flow, veh/h	3374	74	0	3529	1336	271
Grp Volume(v), veh/h	820	859	0	2294	96	0
Grp Sat Flow(s),veh/h/ln	1644	1717	0	1676	1623	0
Q Serve(g_s), s	14.8	14.9	0.0	32.2	3.8	0.0
Cycle Q Clear(g_c), s	14.8	14.9	0.0	32.2	3.8	0.0
Prop In Lane		0.04	0.00		0.82	0.17
Lane Grp Cap(c), veh/h	1281	1338	0	2612	165	0
V/C Ratio(X)	0.64	0.64	0.00	0.88	0.58	0.00
Avail Cap(c_a), veh/h	1369	1430	0	2792	386	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	3.3	3.3	0.0	5.2	28.8	0.0
Incr Delay (d2), s/veh	0.9	0.9	0.0	3.4	3.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	7.0	0.0	15.6	1.9	0.0
LnGrp Delay(d),s/veh	4.2	4.2	0.0	8.6	32.0	0.0
LnGrp LOS	A	A		A	C	
Approach Vol, veh/h	1679			2294	96	
Approach Delay, s/veh	4.2			8.6	32.0	
Approach LOS	A			A	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		10.9		56.4				56.4
Change Period (Y+Rc), s		4.0		4.0				4.0
Max Green Setting (Gmax), s		16.0		56.0				56.0
Max Q Clear Time (g_c+I1), s		5.8		16.9				34.2
Green Ext Time (p_c), s		0.1		17.8				18.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Future Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Adj No. of Lanes	1	2	1	1	2	1	1	3	1	1	3	1
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
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	233	885	392	224	872	386	277	1113	342	407	1492	460
Arrive On Green	0.14	0.27	0.27	0.13	0.26	0.26	0.17	0.23	0.23	0.24	0.31	0.31
Sat Flow, veh/h	1664	3320	1469	1681	3353	1483	1664	4771	1466	1697	4865	1500
Grp Volume(v), veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Grp Sat Flow(s),veh/h/ln	1664	1660	1469	1681	1676	1483	1664	1590	1466	1697	1622	1500
Q Serve(g_s), s	21.0	40.0	40.0	20.0	39.0	39.0	25.0	35.0	35.0	36.0	46.0	46.0
Cycle Q Clear(g_c), s	21.0	40.0	40.0	20.0	39.0	39.0	25.0	35.0	35.0	36.0	46.0	46.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	233	885	392	224	872	386	277	1113	342	407	1492	460
V/C Ratio(X)	1.80	1.10	1.05	1.87	1.22	1.66	1.89	1.33	1.67	1.91	1.38	1.08
Avail Cap(c_a), veh/h	233	885	392	224	872	386	277	1113	342	407	1492	460
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.5	55.0	55.0	65.0	55.5	55.5	62.5	57.5	57.5	57.0	52.0	52.0
Incr Delay (d2), s/veh	377.7	61.8	58.2	409.9	110.1	308.4	415.0	152.6	312.3	420.7	174.1	63.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.1	25.9	22.5	34.8	31.4	49.0	43.5	31.1	43.8	64.5	44.6	27.2
LnGrp Delay(d),s/veh	442.2	116.8	113.2	474.9	165.6	363.9	477.5	210.1	369.8	477.7	226.1	115.9
LnGrp LOS	F	F	F	F	F	F	F	F	F	F	F	F
Approach Vol, veh/h		1805			2125			2570			3330	
Approach Delay, s/veh		191.7			286.4			300.1			268.6	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	41.0	38.0	25.0	46.0	30.0	49.0	26.0	45.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	35.0	31.0	19.0	39.0	24.0	42.0	20.0	38.0
Max Q Clear Time (g_c+I1), s	38.0	37.0	22.0	42.0	27.0	48.0	23.0	41.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	266.6
HCM 2010 LOS	F

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1410	10	80	1695	15	90
Future Vol, veh/h	1410	10	80	1695	15	90
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	1	1	0	0
Mvmt Flow	1484	11	84	1784	16	95

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1505	0	2570	768
Stage 1	-	-	-	-	1500	-
Stage 2	-	-	-	-	1070	-
Critical Hdwy	-	-	4.12	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.21	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	446	-	22	349
Stage 1	-	-	-	-	174	-
Stage 2	-	-	-	-	295	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	442	-	18	343
Mov Cap-2 Maneuver	-	-	-	-	99	-
Stage 1	-	-	-	-	173	-
Stage 2	-	-	-	-	237	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	23.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	99	343	-	-	442	-
HCM Lane V/C Ratio	0.159	0.276	-	-	0.191	-
HCM Control Delay (s)	48.1	19.5	-	-	15.1	-
HCM Lane LOS	E	C	-	-	C	-
HCM 95th %tile Q(veh)	0.5	1.1	-	-	0.7	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	715	435	375	735	225	410	155	360	175	135	140
Future Volume (veh/h)	270	715	435	375	735	225	410	155	360	175	135	140
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1765	1765	1765	1800	1800	1800
Adj Flow Rate, veh/h	284	753	458	395	774	237	432	163	379	184	142	147
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	0	0
Cap, veh/h	809	722	436	350	1073	475	387	635	523	316	648	534
Arrive On Green	0.25	0.36	0.36	0.21	0.32	0.32	0.36	0.36	0.35	0.36	0.36	0.35
Sat Flow, veh/h	3261	2004	1211	1681	3353	1486	1081	1765	1487	875	1800	1517
Grp Volume(v), veh/h	284	629	582	395	774	237	432	163	379	184	142	147
Grp Sat Flow(s),veh/h/ln	1630	1676	1539	1681	1676	1486	1081	1765	1487	875	1800	1517
Q Serve(g_s), s	9.0	45.0	45.0	26.0	25.5	16.1	38.1	8.1	27.7	23.5	6.9	8.7
Cycle Q Clear(g_c), s	9.0	45.0	45.0	26.0	25.5	16.1	45.0	8.1	27.7	31.6	6.9	8.7
Prop In Lane	1.00		0.79	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	809	604	554	350	1073	475	387	635	523	316	648	534
V/C Ratio(X)	0.35	1.04	1.05	1.13	0.72	0.50	1.12	0.26	0.72	0.58	0.22	0.28
Avail Cap(c_a), veh/h	809	604	554	350	1448	642	387	635	523	316	648	534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.7	40.0	40.0	49.5	37.6	34.4	46.3	28.2	35.2	39.4	27.8	29.1
Incr Delay (d2), s/veh	0.3	48.1	52.1	88.2	1.2	0.8	80.7	0.2	4.9	2.7	0.2	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	28.9	27.1	20.6	12.0	6.8	22.0	4.0	12.1	5.9	3.4	3.7
LnGrp Delay(d),s/veh	39.0	88.1	92.1	137.7	38.8	35.2	127.0	28.4	40.1	42.1	28.0	29.3
LnGrp LOS	D	F	F	F	D	D	F	C	D	D	C	C
Approach Vol, veh/h		1495			1406			974			473	
Approach Delay, s/veh		80.3			65.9			76.7			33.9	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		48.0	29.0	48.0		48.0	34.0	43.0
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		44.0	25.0	41.0		44.0	16.0	50.0
Max Q Clear Time (g_c+I1), s		47.0	28.0	47.0		33.6	11.0	27.5
Green Ext Time (p_c), s		0.0	0.0	0.0		1.8	0.4	6.3

Intersection Summary	
HCM 2010 Ctrl Delay	69.8
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	955	725	375	260	460	560	315	1155	285	410	950	745
Future Volume (veh/h)	955	725	375	260	460	560	315	1155	285	410	950	745
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1782	1782	1782	1765	1765	1765	1782	1782	1782
Adj Flow Rate, veh/h	955	725	0	260	460	560	315	1155	0	410	1220	565
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
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
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	1	1	1
Cap, veh/h	707	987	441	303	842	655	283	1114	498	368	1262	532
Arrive On Green	0.22	0.29	0.00	0.18	0.25	0.25	0.09	0.33	0.00	0.11	0.35	0.35
Sat Flow, veh/h	3261	3353	1500	1697	3386	2634	3261	3353	1500	3395	3564	1502
Grp Volume(v), veh/h	955	725	0	260	460	560	315	1155	0	410	1220	565
Grp Sat Flow(s),veh/h/ln	1630	1676	1500	1697	1693	1317	1630	1676	1500	1697	1782	1502
Q Serve(g_s), s	30.0	26.9	0.0	20.6	16.3	20.8	12.0	46.0	0.0	15.0	46.5	25.4
Cycle Q Clear(g_c), s	30.0	26.9	0.0	20.6	16.3	20.8	12.0	46.0	0.0	15.0	46.5	25.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	707	987	441	303	842	655	283	1114	498	368	1262	532
V/C Ratio(X)	1.35	0.73	0.00	0.86	0.55	0.86	1.11	1.04	0.00	1.11	0.97	1.06
Avail Cap(c_a), veh/h	707	1090	488	331	1027	799	283	1114	498	368	1262	532
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.2	44.0	0.0	55.2	45.2	27.2	63.2	46.2	0.0	61.7	43.9	12.0
Incr Delay (d2), s/veh	167.4	2.4	0.0	17.3	0.6	7.7	87.8	36.9	0.0	81.6	17.9	56.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.9	12.8	0.0	11.1	7.7	8.6	8.8	26.9	0.0	11.2	26.0	21.4
LnGrp Delay(d),s/veh	221.6	46.3	0.0	72.5	45.8	34.9	151.0	83.1	0.0	143.3	61.8	68.8
LnGrp LOS	F	D		E	D	C	F	F		F	E	F
Approach Vol, veh/h		1680			1280			1470			2195	
Approach Delay, s/veh		146.0			46.4			97.6			78.8	
Approach LOS		F			D			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	49.0	27.7	43.7	15.0	52.0	34.0	37.4
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	13.0	43.0	25.0	42.0	10.0	46.0	28.0	* 39
Max Q Clear Time (g_c+I1), s	17.0	48.0	22.6	28.9	14.0	48.5	32.0	22.8
Green Ext Time (p_c), s	0.0	0.0	0.1	4.0	0.0	0.0	0.0	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	93.8
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	2175	0	0	490	425	0	0	425	0
Future Volume (veh/h)	0	0	0	2175	0	0	490	425	0	0	425	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				2289	0	0	516	447	0	0	447	0
Adj No. of Lanes				2	0	1	2	1	0	0	2	0
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				2174	0	970	478	529	0	0	425	0
Arrive On Green				0.65	0.00	0.00	0.15	0.30	0.00	0.00	0.13	0.00
Sat Flow, veh/h				3361	0	1500	3261	1765	0	0	3529	0
Grp Volume(v), veh/h				2289	0	0	516	447	0	0	447	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1630	1765	0	0	1676	0
Q Serve(g_s), s				97.0	0.0	0.0	22.0	35.6	0.0	0.0	19.0	0.0
Cycle Q Clear(g_c), s				97.0	0.0	0.0	22.0	35.6	0.0	0.0	19.0	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				2174	0	970	478	529	0	0	425	0
V/C Ratio(X)				1.05	0.00	0.00	1.08	0.84	0.00	0.00	1.05	0.00
Avail Cap(c_a), veh/h				2174	0	970	478	529	0	0	425	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				26.5	0.0	0.0	64.0	49.2	0.0	0.0	65.5	0.0
Incr Delay (d2), s/veh				35.1	0.0	0.0	64.1	15.2	0.0	0.0	58.1	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				55.3	0.0	0.0	14.2	19.6	0.0	0.0	12.2	0.0
LnGrp Delay(d),s/veh				61.6	0.0	0.0	128.1	64.4	0.0	0.0	123.6	0.0
LnGrp LOS				F			F	E			F	
Approach Vol, veh/h					2289			963			447	
Approach Delay, s/veh					61.6			98.5			123.6	
Approach LOS					E			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		49.0			26.0	23.0		101.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		45.0			22.0	19.0		97.0
Max Q Clear Time (g_c+I1), s		37.6			24.0	21.0		99.0
Green Ext Time (p_c), s		1.6			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	78.7
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	650	0	0	0	0	910	1625	100	2500	0
Future Volume (veh/h)	5	0	650	0	0	0	0	910	1625	100	2500	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	958	0	105	2632	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	9	0	8				0	2530	1992	133	2975	0
Arrive On Green	0.01	0.00	0.00				0.00	0.75	0.00	0.08	0.89	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	958	0	105	2632	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.2	0.0	0.0				0.0	7.3	0.0	4.6	30.6	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0				0.0	7.3	0.0	4.6	30.6	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	9	0	8				0	2530	1992	133	2975	0
V/C Ratio(X)	0.56	0.00	0.00				0.00	0.38	0.00	0.79	0.88	0.00
Avail Cap(c_a), veh/h	136	0	121				0	2530	1992	226	2975	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.9	0.0	0.0				0.0	3.1	0.0	33.7	2.2	0.0
Incr Delay (d2), s/veh	45.9	0.0	0.0				0.0	0.4	0.0	10.0	4.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0				0.0	3.5	0.0	2.5	14.6	0.0
LnGrp Delay(d),s/veh	82.8	0.0	0.0				0.0	3.6	0.0	43.7	6.5	0.0
LnGrp LOS	F							A		D	A	
Approach Vol, veh/h		5						958			2737	
Approach Delay, s/veh		82.8						3.6			7.9	
Approach LOS		F						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	9.9	60.1		4.4		70.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	10.0	52.0		6.0		66.0		
Max Q Clear Time (g_c+I1), s	6.6	9.3		2.2		32.6		
Green Ext Time (p_c), s	0.1	8.2		0.0		29.6		

Intersection Summary	
HCM 2010 Ctrl Delay	6.9
HCM 2010 LOS	A

HCM 2010 Signalized Intersection Summary
1: Old Fort Weaver Road East Loop & Farrington Hwy

05/06/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	1430	0	265	1950	525	0	105	85	795	0	275
Future Volume (veh/h)	145	1430	0	265	1950	525	0	105	85	795	0	275
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		0.96	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1714	1714	0	1714	1714	1714	0	1714	1714	1765	1765	1800
Adj Flow Rate, veh/h	145	1430	0	265	1950	525	0	105	85	795	0	275
Adj No. of Lanes	1	3	0	1	3	1	0	1	1	2	1	0
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
Percent Heavy Veh, %	5	5	0	5	5	5	0	5	5	2	2	2
Cap, veh/h	145	1560	0	272	1924	592	0	133	109	797	0	367
Arrive On Green	0.09	0.33	0.00	0.17	0.41	0.41	0.00	0.08	0.08	0.24	0.00	0.24
Sat Flow, veh/h	1633	4834	0	1633	4680	1439	0	1714	1401	3261	0	1500
Grp Volume(v), veh/h	145	1430	0	265	1950	525	0	105	85	795	0	275
Grp Sat Flow(s),veh/h/ln	1633	1560	0	1633	1560	1439	0	1714	1401	1630	0	1500
Q Serve(g_s), s	8.0	26.4	0.0	14.5	37.0	30.4	0.0	5.4	5.4	21.9	0.0	15.3
Cycle Q Clear(g_c), s	8.0	26.4	0.0	14.5	37.0	30.4	0.0	5.4	5.4	21.9	0.0	15.3
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	145	1560	0	272	1924	592	0	133	109	797	0	367
V/C Ratio(X)	1.00	0.92	0.00	0.97	1.01	0.89	0.00	0.79	0.78	1.00	0.00	0.75
Avail Cap(c_a), veh/h	145	1560	0	272	1924	592	0	133	109	797	0	367
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	41.0	28.8	0.0	37.3	26.5	24.6	0.0	40.8	40.7	34.0	0.0	31.5
Incr Delay (d2), s/veh	74.4	8.9	0.0	47.2	23.9	15.2	0.0	26.2	29.6	31.2	0.0	8.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	12.5	0.0	10.1	20.1	14.5	0.0	3.5	3.0	13.3	0.0	7.2
LnGrp Delay(d),s/veh	115.4	37.7	0.0	84.5	50.4	39.7	0.0	67.0	70.3	65.2	0.0	39.8
LnGrp LOS	F	D		F	F	D		E	E	E		D
Approach Vol, veh/h		1575			2740			190			1070	
Approach Delay, s/veh		44.9			51.7			68.5			58.7	
Approach LOS		D			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		11.0	19.0	34.0		26.0	12.0	41.0
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		7.0	15.0	30.0		22.0	8.0	37.0
Max Q Clear Time (g_c+I1), s		7.4	16.5	28.4		23.9	10.0	39.0
Green Ext Time (p_c), s		0.0	0.0	1.3		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	51.7
HCM 2010 LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1560	35	0	2225	75	15
Future Volume (veh/h)	1560	35	0	2225	75	15
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1731	1800	0	1765	1748	1800
Adj Flow Rate, veh/h	1642	37	0	2294	79	16
Adj No. of Lanes	3	0	0	3	0	0
Peak Hour Factor	0.95	0.95	0.97	0.97	0.95	0.95
Percent Heavy Veh, %	4	4	0	2	0	0
Cap, veh/h	3242	73	0	3286	165	33
Arrive On Green	0.68	0.68	0.00	0.68	0.12	0.12
Sat Flow, veh/h	4910	107	0	5135	1337	271
Grp Volume(v), veh/h	1088	591	0	2294	96	0
Grp Sat Flow(s),veh/h/ln	1575	1711	0	1606	1625	0
Q Serve(g_s), s	6.9	6.9	0.0	11.9	2.3	0.0
Cycle Q Clear(g_c), s	6.9	6.9	0.0	11.9	2.3	0.0
Prop In Lane		0.06	0.00		0.82	0.17
Lane Grp Cap(c), veh/h	2149	1167	0	3286	201	0
V/C Ratio(X)	0.51	0.51	0.00	0.70	0.48	0.00
Avail Cap(c_a), veh/h	2374	1290	0	3631	632	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	3.2	3.2	0.0	4.0	16.8	0.0
Incr Delay (d2), s/veh	0.2	0.3	0.0	0.5	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	3.2	0.0	5.3	1.1	0.0
LnGrp Delay(d),s/veh	3.4	3.5	0.0	4.5	18.6	0.0
LnGrp LOS	A	A		A	B	
Approach Vol, veh/h	1679			2294	96	
Approach Delay, s/veh	3.4			4.5	18.6	
Approach LOS	A			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				8
Phs Duration (G+Y+Rc), s		9.1		32.1				32.1
Change Period (Y+Rc), s		4.0		4.0				4.0
Max Green Setting (Gmax), s		16.0		31.0				31.0
Max Q Clear Time (g_c+I1), s		4.3		8.9				13.9
Green Ext Time (p_c), s		0.2		12.4				14.2

Intersection Summary	
HCM 2010 Ctrl Delay	4.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Future Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Adj No. of Lanes	1	3	1	1	3	2	1	3	1	1	3	1
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
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	244	1177	362	235	1156	626	288	1113	342	430	1524	470
Arrive On Green	0.15	0.25	0.25	0.14	0.24	0.24	0.17	0.23	0.23	0.25	0.31	0.31
Sat Flow, veh/h	1664	4771	1467	1681	4818	2607	1664	4771	1466	1697	4865	1500
Grp Volume(v), veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Grp Sat Flow(s),veh/h/ln	1664	1590	1467	1681	1606	1304	1664	1590	1466	1697	1622	1500
Q Serve(g_s), s	22.0	29.0	37.0	21.0	32.4	36.0	26.0	35.0	35.0	38.0	47.0	47.0
Cycle Q Clear(g_c), s	22.0	29.0	37.0	21.0	32.4	36.0	26.0	35.0	35.0	38.0	47.0	47.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	244	1177	362	235	1156	626	288	1113	342	430	1524	470
V/C Ratio(X)	1.72	0.83	1.13	1.78	0.92	1.02	1.82	1.33	1.67	1.81	1.35	1.05
Avail Cap(c_a), veh/h	244	1177	362	235	1156	626	288	1113	342	430	1524	470
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.0	53.5	56.5	64.5	55.6	57.0	62.0	57.5	57.5	56.0	51.5	51.5
Incr Delay (d2), s/veh	341.0	5.1	88.4	369.9	11.9	41.9	382.3	152.6	312.3	375.4	161.0	56.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	33.2	13.3	23.9	33.9	15.7	16.6	42.6	31.1	43.8	62.6	43.8	26.8
LnGrp Delay(d),s/veh	405.0	58.6	144.9	434.4	67.5	98.9	444.3	210.1	369.8	431.4	212.5	107.6
LnGrp LOS	F	E	F	F	E	F	F	F	F	F	F	F
Approach Vol, veh/h		1805			2125			2570			3330	
Approach Delay, s/veh		158.8			149.5			293.3			248.2	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	43.0	38.0	26.0	43.0	31.0	50.0	27.0	42.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	37.0	31.0	20.0	36.0	25.0	43.0	21.0	35.0
Max Q Clear Time (g_c+I1), s	40.0	37.0	23.0	39.0	28.0	49.0	24.0	38.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	222.3
HCM 2010 LOS	F

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1410	10	80	1695	15	90
Future Vol, veh/h	1410	10	80	1695	15	90
Conflicting Peds, #/hr	0	10	10	0	10	10
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	215	-	0	600
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	1	1	0	0
Mvmt Flow	1484	11	84	1784	16	95

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1505	0	2570	768
Stage 1	-	-	-	-	1500	-
Stage 2	-	-	-	-	1070	-
Critical Hdwy	-	-	4.12	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.21	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	446	-	22	349
Stage 1	-	-	-	-	174	-
Stage 2	-	-	-	-	295	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	442	-	18	343
Mov Cap-2 Maneuver	-	-	-	-	99	-
Stage 1	-	-	-	-	173	-
Stage 2	-	-	-	-	237	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	23.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	99	343	-	-	442	-
HCM Lane V/C Ratio	0.159	0.276	-	-	0.191	-
HCM Control Delay (s)	48.1	19.5	-	-	15.1	-
HCM Lane LOS	E	C	-	-	C	-
HCM 95th %tile Q(veh)	0.5	1.1	-	-	0.7	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	715	435	375	735	225	410	155	360	175	135	140
Future Volume (veh/h)	270	715	435	375	735	225	410	155	360	175	135	140
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1765	1765	1765	1800	1800	1800
Adj Flow Rate, veh/h	284	753	458	395	774	237	432	163	379	184	142	147
Adj No. of Lanes	2	2	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	0	0	0
Cap, veh/h	809	722	436	350	1073	475	387	635	523	316	648	534
Arrive On Green	0.25	0.36	0.36	0.21	0.32	0.32	0.36	0.36	0.35	0.36	0.36	0.35
Sat Flow, veh/h	3261	2004	1211	1681	3353	1486	1081	1765	1487	875	1800	1517
Grp Volume(v), veh/h	284	629	582	395	774	237	432	163	379	184	142	147
Grp Sat Flow(s),veh/h/ln	1630	1676	1539	1681	1676	1486	1081	1765	1487	875	1800	1517
Q Serve(g_s), s	9.0	45.0	45.0	26.0	25.5	16.1	38.1	8.1	27.7	23.5	6.9	8.7
Cycle Q Clear(g_c), s	9.0	45.0	45.0	26.0	25.5	16.1	45.0	8.1	27.7	31.6	6.9	8.7
Prop In Lane	1.00		0.79	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	809	604	554	350	1073	475	387	635	523	316	648	534
V/C Ratio(X)	0.35	1.04	1.05	1.13	0.72	0.50	1.12	0.26	0.72	0.58	0.22	0.28
Avail Cap(c_a), veh/h	809	604	554	350	1448	642	387	635	523	316	648	534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.7	40.0	40.0	49.5	37.6	34.4	46.3	28.2	35.2	39.4	27.8	29.1
Incr Delay (d2), s/veh	0.3	48.1	52.1	88.2	1.2	0.8	80.7	0.2	4.9	2.7	0.2	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	28.9	27.1	20.6	12.0	6.8	22.0	4.0	12.1	5.9	3.4	3.7
LnGrp Delay(d),s/veh	39.0	88.1	92.1	137.7	38.8	35.2	127.0	28.4	40.1	42.1	28.0	29.3
LnGrp LOS	D	F	F	F	D	D	F	C	D	D	C	C
Approach Vol, veh/h		1495			1406			974			473	
Approach Delay, s/veh		80.3			65.9			76.7			33.9	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		48.0	29.0	48.0		48.0	34.0	43.0
Change Period (Y+Rc), s		4.0	4.0	7.0		4.0	4.0	7.0
Max Green Setting (Gmax), s		44.0	25.0	41.0		44.0	16.0	50.0
Max Q Clear Time (g_c+I1), s		47.0	28.0	47.0		33.6	11.0	27.5
Green Ext Time (p_c), s		0.0	0.0	0.0		1.8	0.4	6.3

Intersection Summary	
HCM 2010 Ctrl Delay	69.8
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	955	725	375	260	460	560	315	1155	285	410	950	745
Future Volume (veh/h)	955	725	375	260	460	560	315	1155	285	410	950	745
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1782	1782	1782	1765	1765	1765	1782	1782	1782
Adj Flow Rate, veh/h	955	725	0	260	460	560	315	1155	0	410	1220	565
Adj No. of Lanes	2	2	1	1	2	2	2	2	1	2	2	1
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
Percent Heavy Veh, %	2	2	2	1	1	1	2	2	2	1	1	1
Cap, veh/h	707	987	441	303	842	655	283	1114	498	368	1262	532
Arrive On Green	0.22	0.29	0.00	0.18	0.25	0.25	0.09	0.33	0.00	0.11	0.35	0.35
Sat Flow, veh/h	3261	3353	1500	1697	3386	2634	3261	3353	1500	3395	3564	1502
Grp Volume(v), veh/h	955	725	0	260	460	560	315	1155	0	410	1220	565
Grp Sat Flow(s),veh/h/ln	1630	1676	1500	1697	1693	1317	1630	1676	1500	1697	1782	1502
Q Serve(g_s), s	30.0	26.9	0.0	20.6	16.3	20.8	12.0	46.0	0.0	15.0	46.5	25.4
Cycle Q Clear(g_c), s	30.0	26.9	0.0	20.6	16.3	20.8	12.0	46.0	0.0	15.0	46.5	25.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	707	987	441	303	842	655	283	1114	498	368	1262	532
V/C Ratio(X)	1.35	0.73	0.00	0.86	0.55	0.86	1.11	1.04	0.00	1.11	0.97	1.06
Avail Cap(c_a), veh/h	707	1090	488	331	1027	799	283	1114	498	368	1262	532
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.2	44.0	0.0	55.2	45.2	27.2	63.2	46.2	0.0	61.7	43.9	12.0
Incr Delay (d2), s/veh	167.4	2.4	0.0	17.3	0.6	7.7	87.8	36.9	0.0	81.6	17.9	56.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.9	12.8	0.0	11.1	7.7	8.6	8.8	26.9	0.0	11.2	26.0	21.4
LnGrp Delay(d),s/veh	221.6	46.3	0.0	72.5	45.8	34.9	151.0	83.1	0.0	143.3	61.8	68.8
LnGrp LOS	F	D		E	D	C	F	F		F	E	F
Approach Vol, veh/h		1680			1280			1470			2195	
Approach Delay, s/veh		146.0			46.4			97.6			78.8	
Approach LOS		F			D			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	18.0	49.0	27.7	43.7	15.0	52.0	34.0	37.4
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	13.0	43.0	25.0	42.0	10.0	46.0	28.0	* 39
Max Q Clear Time (g_c+I1), s	17.0	48.0	22.6	28.9	14.0	48.5	32.0	22.8
Green Ext Time (p_c), s	0.0	0.0	0.1	4.0	0.0	0.0	0.0	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	93.8
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	2175	0	0	490	425	0	0	425	0
Future Volume (veh/h)	0	0	0	2175	0	0	490	425	0	0	425	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1765	1765	1765	1765	1765	0	0	1765	1800
Adj Flow Rate, veh/h				2289	0	0	516	447	0	0	447	0
Adj No. of Lanes				2	0	1	2	1	0	0	2	0
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				2	2	2	2	2	0	0	2	2
Cap, veh/h				2174	0	970	478	529	0	0	425	0
Arrive On Green				0.65	0.00	0.00	0.15	0.30	0.00	0.00	0.13	0.00
Sat Flow, veh/h				3361	0	1500	3261	1765	0	0	3529	0
Grp Volume(v), veh/h				2289	0	0	516	447	0	0	447	0
Grp Sat Flow(s),veh/h/ln				1681	0	1500	1630	1765	0	0	1676	0
Q Serve(g_s), s				97.0	0.0	0.0	22.0	35.6	0.0	0.0	19.0	0.0
Cycle Q Clear(g_c), s				97.0	0.0	0.0	22.0	35.6	0.0	0.0	19.0	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				2174	0	970	478	529	0	0	425	0
V/C Ratio(X)				1.05	0.00	0.00	1.08	0.84	0.00	0.00	1.05	0.00
Avail Cap(c_a), veh/h				2174	0	970	478	529	0	0	425	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				26.5	0.0	0.0	64.0	49.2	0.0	0.0	65.5	0.0
Incr Delay (d2), s/veh				35.1	0.0	0.0	64.1	15.2	0.0	0.0	58.1	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				55.3	0.0	0.0	14.2	19.6	0.0	0.0	12.2	0.0
LnGrp Delay(d),s/veh				61.6	0.0	0.0	128.1	64.4	0.0	0.0	123.6	0.0
LnGrp LOS				F			F	E			F	
Approach Vol, veh/h					2289			963			447	
Approach Delay, s/veh					61.6			98.5			123.6	
Approach LOS					E			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		49.0			26.0	23.0		101.0
Change Period (Y+Rc), s		4.0			4.0	4.0		4.0
Max Green Setting (Gmax), s		45.0			22.0	19.0		97.0
Max Q Clear Time (g_c+I1), s		37.6			24.0	21.0		99.0
Green Ext Time (p_c), s		1.6			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	78.7
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	650	0	0	0	0	910	1625	100	2500	0
Future Volume (veh/h)	5	0	650	0	0	0	0	910	1625	100	2500	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1765	1765	1765	0
Adj Flow Rate, veh/h	5	0	0				0	958	0	105	2632	0
Adj No. of Lanes	0	1	1				0	2	2	1	2	0
Peak Hour Factor	0.95	0.95	0.95				0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	9	0	8				0	2530	1992	133	2975	0
Arrive On Green	0.01	0.00	0.00				0.00	0.75	0.00	0.08	0.89	0.00
Sat Flow, veh/h	1681	0	1500				0	3441	2640	1681	3441	0
Grp Volume(v), veh/h	5	0	0				0	958	0	105	2632	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1320	1681	1676	0
Q Serve(g_s), s	0.2	0.0	0.0				0.0	7.3	0.0	4.6	30.6	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0				0.0	7.3	0.0	4.6	30.6	0.0
Prop In Lane	1.00		1.00				0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	9	0	8				0	2530	1992	133	2975	0
V/C Ratio(X)	0.56	0.00	0.00				0.00	0.38	0.00	0.79	0.88	0.00
Avail Cap(c_a), veh/h	136	0	121				0	2530	1992	226	2975	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00				0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	36.9	0.0	0.0				0.0	3.1	0.0	33.7	2.2	0.0
Incr Delay (d2), s/veh	45.9	0.0	0.0				0.0	0.4	0.0	10.0	4.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0				0.0	3.5	0.0	2.5	14.6	0.0
LnGrp Delay(d),s/veh	82.8	0.0	0.0				0.0	3.6	0.0	43.7	6.5	0.0
LnGrp LOS	F							A		D	A	
Approach Vol, veh/h		5						958			2737	
Approach Delay, s/veh		82.8						3.6			7.9	
Approach LOS		F						A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	9.9	60.1		4.4		70.0		
Change Period (Y+Rc), s	4.0	4.0		4.0		4.0		
Max Green Setting (Gmax), s	10.0	52.0		6.0		66.0		
Max Q Clear Time (g_c+I1), s	6.6	9.3		2.2		32.6		
Green Ext Time (p_c), s	0.1	8.2		0.0		29.6		

Intersection Summary	
HCM 2010 Ctrl Delay	6.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Future Volume (veh/h)	420	975	410	420	1065	640	525	1475	570	780	2055	495
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1748	1748	1748	1765	1765	1765	1748	1748	1748	1782	1782	1782
Adj Flow Rate, veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Adj No. of Lanes	2	3	1	2	3	2	2	3	1	3	3	1
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
Percent Heavy Veh, %	3	3	3	2	2	2	3	3	3	1	1	1
Cap, veh/h	344	1145	352	348	1156	626	452	1718	530	798	1881	581
Arrive On Green	0.11	0.24	0.24	0.11	0.24	0.24	0.14	0.36	0.36	0.17	0.39	0.39
Sat Flow, veh/h	3229	4771	1467	3261	4818	2607	3229	4771	1473	4786	4865	1503
Grp Volume(v), veh/h	420	975	410	420	1065	640	525	1475	570	780	2055	495
Grp Sat Flow(s),veh/h/ln	1614	1590	1467	1630	1606	1304	1614	1590	1473	1595	1622	1503
Q Serve(g_s), s	16.0	29.3	36.0	16.0	32.4	36.0	21.0	43.0	54.0	24.3	58.0	45.2
Cycle Q Clear(g_c), s	16.0	29.3	36.0	16.0	32.4	36.0	21.0	43.0	54.0	24.3	58.0	45.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	344	1145	352	348	1156	626	452	1718	530	798	1881	581
V/C Ratio(X)	1.22	0.85	1.16	1.21	0.92	1.02	1.16	0.86	1.07	0.98	1.09	0.85
Avail Cap(c_a), veh/h	344	1145	352	348	1156	626	452	1718	530	798	1881	581
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.0	54.4	57.0	67.0	55.6	57.0	64.5	44.5	48.0	62.2	46.0	42.1
Incr Delay (d2), s/veh	122.2	6.3	100.7	117.4	11.9	41.9	94.6	4.6	60.7	26.4	50.8	11.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.0	13.6	24.4	12.9	15.7	16.6	15.3	19.6	30.9	12.7	34.8	20.6
LnGrp Delay(d),s/veh	189.2	60.8	157.7	184.4	67.5	98.9	159.1	49.1	108.7	88.6	96.8	53.7
LnGrp LOS	F	E	F	F	E	F	F	D	F	F	F	D
Approach Vol, veh/h		1805			2125			2570			3330	
Approach Delay, s/veh		112.7			100.1			84.8			88.5	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	30.0	57.0	21.0	42.0	26.0	61.0	21.0	42.0
Change Period (Y+Rc), s	6.0	7.0	6.0	7.0	6.0	7.0	6.0	7.0
Max Green Setting (Gmax), s	24.0	50.0	15.0	35.0	20.0	54.0	15.0	35.0
Max Q Clear Time (g_c+I1), s	26.3	56.0	18.0	38.0	23.0	60.0	18.0	38.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	94.5
HCM 2010 LOS	F

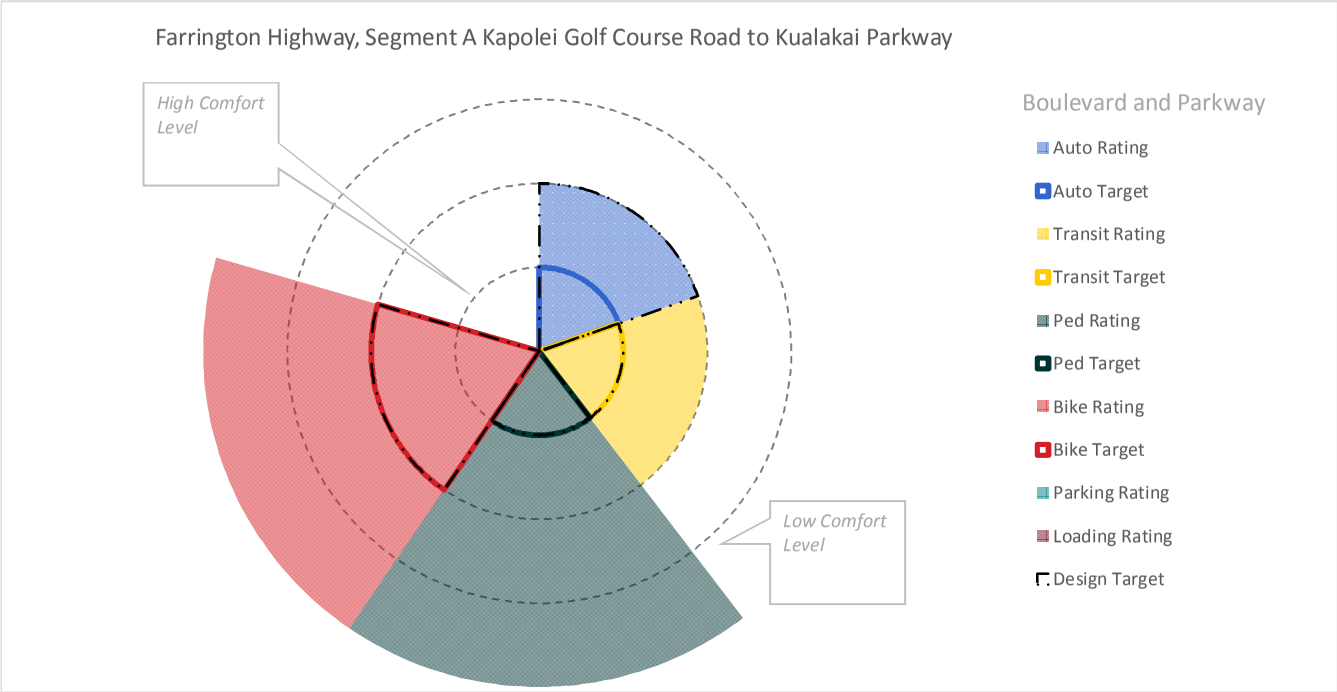
Appendix J

Multimodal Assessment

STREET NAME:	**Farrington Highway, Segment A Kapolei Golf Course Road to Kualakai Parkway**
SELECT THE STREET TYPE =>	Boulevard and Parkway

INPUT EXISTING CONDITIONS RATING HERE =>	Auto	Transit	Ped	Bike	Parking	Loading
	2	*2*	*4*	*4*		

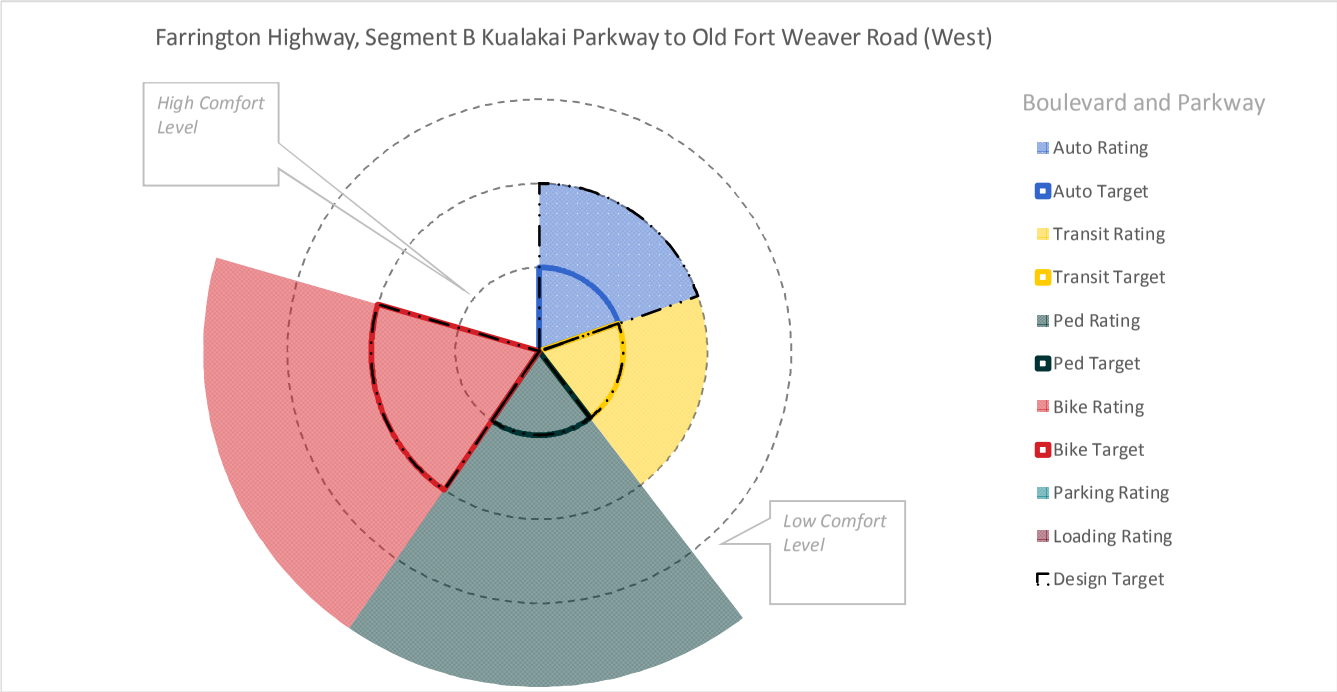
Street Design Priority and Rating	**Modal Elements**						**Modal Elements for this Street Type**	**Other Design Impacts**	
	Auto	Transit	Ped	Bike	Parking	Loading		**Highest Transect**	**Design Speed (mph)**
Street Priority Target	1	1	1	2			4	T5: Urban Center	35
Existing Conditions Rating	2	2	4	4					
Design Concept Rating	2	1	1	2					



STREET NAME:	**Farrington Highway, Segment B Kualakai Parkway to Old Fort Weaver Road (West)**
SELECT THE STREET TYPE =>	Boulevard and Parkway

INPUT EXISTING CONDITIONS RATING HERE =>	Auto	Transit	Ped	Bike	Parking	Loading
	2	*2*	*4*	*4*		

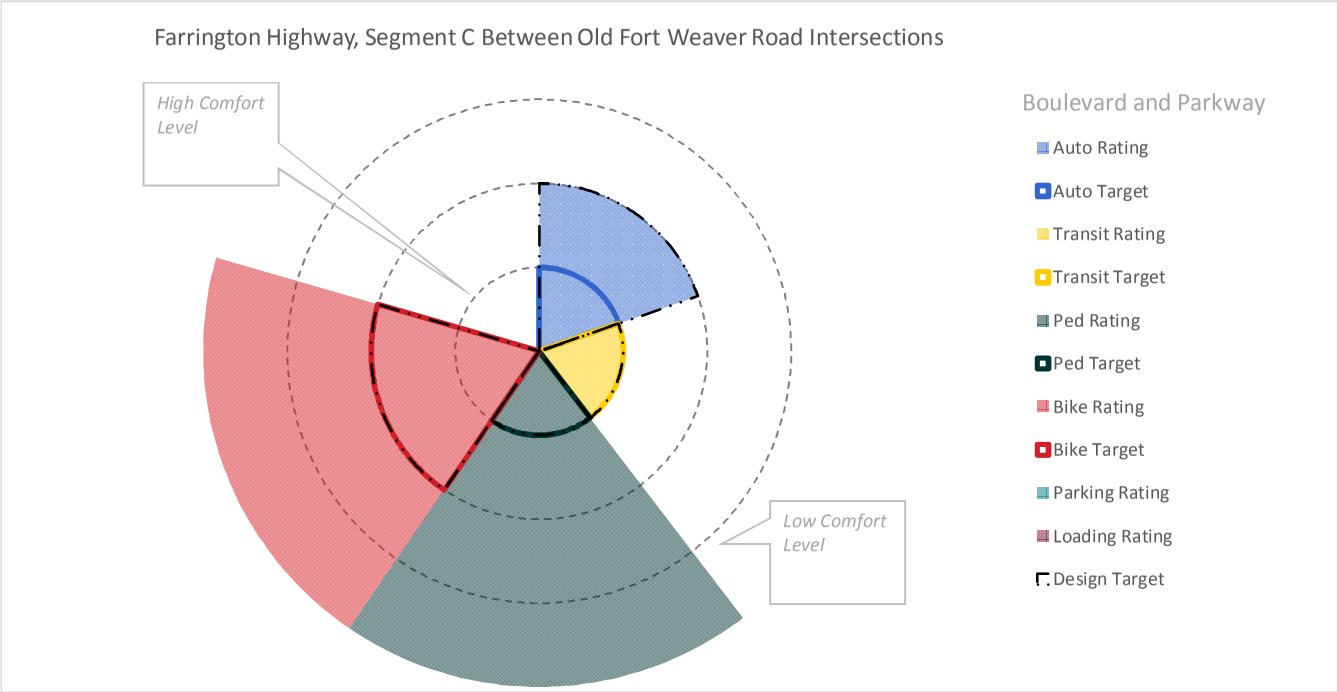
Street Design Priority and Rating	**Modal Elements**						**Modal Elements for this Street Type**	**Other Design Impacts**	
	Auto	Transit	Ped	Bike	Parking	Loading		**Highest Transect**	**Design Speed (mph)**
Street Priority Target	1	1	1	2			4	T5: Urban Center	35
Existing Conditions Rating	2	2	4	4					
Design Concept Rating	2	1	1	2					



STREET NAME:	**Farrington Highway, Segment C Between Old Fort Weaver Road Intersections**
SELECT THE STREET TYPE =>	Boulevard and Parkway

INPUT EXISTING CONDITIONS RATING HERE =>	Auto	Transit	Ped	Bike	Parking	Loading
	2	*1*	*4*	*4*		

Street Design Priority and Rating	**Modal Elements**						**Modal Elements for this Street Type**	**Other Design Impacts**	
	Auto	Transit	Ped	Bike	Parking	Loading		**Highest Transect**	**Design Speed (mph)**
Street Priority Target	1	1	1	2			4	T5: Urban Center	35
Existing Conditions Rating	2	1	4	4					
Design Concept Rating	2	1	1	2					



Transit Capacity & Quality of Service Manual, Third Edition

Multimodal Transit LOS Computational Engine

The procedures provided in this spreadsheet automate the multimodal transit QOS calculation method given in Chapter 5 of the TCQSM, 3rd Edition. The spreadsheet allows the analysis of up to 20 street segments (or alternative scenarios).

This spreadsheet assumes the user is already familiar with Chapter 5 of the TCQSM.

This spreadsheet is provided as-is, without support or warranty as to its accuracy, completeness, or reliability. No responsibility is assumed by TCRP or the developers for incorrect results or damages resulting from the use of this spreadsheet.

Multimodal Transit LOS Calculation

This sheet calculates the transit LOS of a street segment (i.e., section of street between traffic signals or other traffic control causing through traffic on the street to stop).

Default Values

This sheet contains default values that the user can override based on local conditions. The default values include base travel time rates, travel time rate elasticity, and values of time of shelters, benches, and waiting.

Lookup (hidden)

This sheet stores the values used by drop-down menus in the Multimodal Transit LOS Calculation sheet.

Revision History

This sheet describes the changes made with each spreadsheet version.

Version 2.0 ***3/15/2013***

Multimodal Transit LOS Calculation

		Existing Condition (2018 PM)						Future Condition (2028 PM)					
		Seg A - EB	Seg A - WB	Seg B - EB	Seg B - WB	Seg C - EB	Seg C - WB	Seg A - EB	Seg A - WB	Seg B - EB	Seg B - WB	Seg C - EB	Seg C - WB
Inputs		1	2	3	4	5	6	7	8	9	10	11	12
	TRANSIT OPERATIONS INFORMATION												
	Number of local buses on street segment per hour (bus/h)	3	3	3	3	3	3	6	6	6	6	6	6
	Number of express buses stopping in segment per hour (bus/h)	2	0	2	0	4	0	4	0	4	0	4	0
t_{ex}	Average excess wait time (min)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
L_f	Average passenger load factor (p/seat)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
S	Average transit travel speed (mi/h)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
l_{pt}	Average passenger trip length (mi)	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
	Is the segment in the CBD of a metro area of 5 million or more?	No	No	No	No	No	No	No	No	No	No	No	No
	TRANSIT AMENITY DATA												
p_{sh}	Percent stops in segment with a shelter	0%	0%	100%	0%	0%	0%	100%	100%	100%	100%	100%	100%
p_{be}	Percent stops in segment with a bench	0%	0%	100%	0%	0%	0%	100%	100%	100%	100%	100%	100%
	PEDESTRIAN ENVIRONMENT DATA												
W_A	Sidewalk width (ft) (Enter 0 if no sidewalk)	0.0	0.0	0.0	0.0	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0
W_{buf}	Buffer width from sidewalk to street (ft)	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	10.0	10.0	6.0	6.0
	Does a continuous barrier exist between the street and sidewalk?	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
	Is the street divided?	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
	Are parking spaces striped?	No	No	No	No	No	No	No	No	No	No	No	No
p_{pk}	Proportion of on-street parking occupied	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
W_{bl}	Bicycle lane width (ft)	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0
W_{os}	Shoulder/parking lane width (ft)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W_{ol}	Outside travel lane (closest to sidewalk) width (ft)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
v_m	Outside lane demand flow rate at midsegment (veh/h)	395	585	315	400	325	375	630	660	510	560	360	360
S_R	Average vehicle running speed, including intersection delay (mi/h)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Calculations													
f	Transit frequency (bus/h)	5	3	5	3	7	3	10	6	10	6	10	6
f_h	Headway factor	3.00	2.48	3.00	2.48	3.26	2.48	3.47	3.15	3.47	3.15	3.47	3.15
f_{pl}	Passenger load weighting 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
T_{at}	Perceived amenity time rate (min/mi)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
T_{ex}	Excess wait time rate due to late arrivals (min/mi)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
T_{ptt}	Perceived travel time rate (min/mi)	3.0	3.0	2.9	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9
T_{btt}	Base travel time rate (min/mi)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
f_{tt}	Perceived travel time factor	1.12	1.12	1.13	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13	1.13
$s_{w\text{-}r}$	Transit wait-ride score	3.35	2.77	3.40	2.77	3.64	2.77	3.93	3.57	3.93	3.57	3.93	3.57
f_s	Motorized vehicle speed adjustment factor	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
f_v	Motorized vehicle volume adjustment factor	0.90	1.33	0.72	0.91	0.74	0.85	1.43	1.50	1.16	1.27	0.82	0.82
W_{aA}	Adjusted available sidewalk width (ft)	0.0	0.0	0.0	0.0	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0
f_{sw}	Sidewalk width coefficient	6.00	6.00	6.00	6.00	6.00	6.00	3.60	3.60	3.60	3.60	3.60	3.60
f_b	Buffer area coefficient	1.00	1.00	1.00	1.00	1.00	1.00	5.37	5.37	5.37	5.37	5.37	5.37
W_t	Total width of outside lane, bike lane, and parking lane/shoulder (ft)	11.0	11.0	11.0	11.0	11.0	11.0	16.0	16.0	16.0	16.0	16.0	16.0
W_v	Effective total width as a function of traffic volume (ft)	11.0	11.0	11.0	11.0	11.0	11.0	16.0	16.0	16.0	16.0	16.0	16.0
W_1	Effective width of combined bike lane and shoulder (ft)	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0
f_w	Cross-section adjustment factor	-2.94	-2.94	-2.94	-2.94	-2.94	-2.94	-5.67	-5.67	-5.67	-5.67	-5.37	-5.37
I_p	Pedestrian environment score	4.36	4.79	4.18	4.37	4.20	4.32	2.17	2.24	1.90	2.02	1.85	1.85
	Pedestrian LOS	E	E	D	E	D	E	B	B	A	B	A	A
I_t	Transit LOS score	1.63	2.57	1.52	2.51	1.18	2.50	0.44	0.98	0.39	0.95	0.39	0.92

Output												
Transit LOS, by Direction	***A***	***B***	***A***	***B***	***A***	***B***	***A***	***A***	***A***	***A***	***A***	***A***
Transit LOS, by Segment	***B***		***B***		***A***		***A***		***A***		***A***	
Multimodal Priority Rating Scale	***2***		***2***		***1***		***1***		***1***		***1***	

Bicycle Facility Selection Tool

Tab: Introduction

This tool calculates the current Level of Traffic Stress (LTS) for a given roadway segment based on data you provide for traffic volume, speed limit, roadway configuration, and the presence or lack of existing bicycle accommodations. The tool then allows the user to explore alternative configurations incorporating bicycle accommodations and automatically generates a projected LTS for the new configuration.

Level of Traffic Stress Overview

Level of Traffic Stress (LTS) is a method for determining the suitability of a roadway for bicycling by a wide spectrum of people. In general, the lower the LTS score, the more suitable the roadway is for a broader spectrum of users. Higher LTS scores may only be suitable for more confident bicyclists. Individual LTS scores are described as follows:

LTS 1 - Suitable for bicyclists of all ages and abilities

LTS 2 - Comfortable for the average adult bicyclist

LTS 3 - Tolerable for experienced and confident bicyclists

LTS 4 - Highly stressful

Getting Started

This workbook contains three tabs:

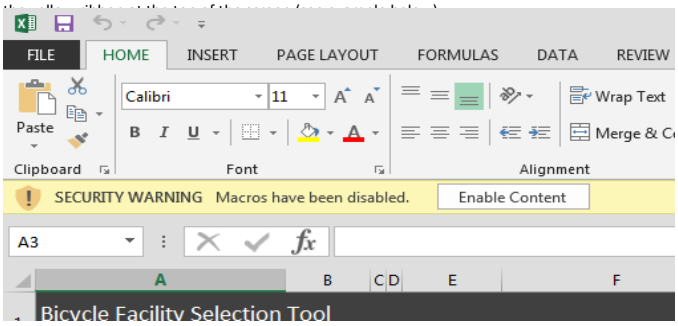
Introduction - The tab you are currently viewing.

Facility Selection - This tab recommends compatible facility types for a roadway based on traffic volume and speed limit. It allows the user to select facility types based on intended bicyclist user types.

Street Configuration - This tab asks the user to input the existing and proposed roadway characteristics. Based on this information, the current and future LTS scores are computed.

Enabling Macros

When you first open this workbook, you will need to enable macros to allow all of the tool's functions to work. Enabling macros in Excel 2013 can be performed by clicking the **"Enable Content"** button in



Limitations

LTS is intended to provide a simple answer to the question, "how comfortable will I feel riding a bike on a particular street?" It seeks to answer this across large geographic areas using data that is readily available. Although it can provide a general idea based on the inputs given here, each situation may present unique circumstances that cannot be fully accounted for in an assessment of this nature.

In addition, LTS is useful in an urban/suburban environment and is not well suited for rural settings as the LTS methodology is highly sensitive to speed.

Finally, LTS is used to evaluate roadway segments and does not offer a scoring scheme for paths and trails (including side paths). Therefore, a road configuration may score very poorly under LTS, but be

Tab: Facility Selection*

Selecting an appropriate bikeway facility type (e.g., bike lanes, shared use path, or shared roadway) necessitates considering traffic volume (average daily trips or ADT), motor vehicle speed limit, and the types of users (confident, avid bicyclists or less confident, casual bicyclists) anticipated to use the bikeway. The Facility Selection tab of this tool uses these inputs to generate potentially compatible bikeway facility types for less confident and more confident bicyclists.

In the green "**ADT**" cell, enter the traffic volume.

In the green "**Posted Speed Limit**" cell, enter the speed limit.

Visual charts (nomographs) will then populate where the project falls within a range of potential bikeway types. This helps to illustrate how changes in traffic volumes and speed limits can make certain bikeway types more or less compatible.

Toward the bottom of the tab, considerations for bikeways in rural contexts are provided, as are thresholds for paved shoulder widths.

Tab: Street Configurations*

This tool functions when the user inputs the existing and proposed configurations of the roadway in the green cells on the Street Configuration tab. LTS scores will be automatically generated. A graphical plan-view representation of conditions will be displayed for the existing configuration and the proposed configuration.

Existing Street Configuration

In the green "**Lane Width (ft)**" row, enter the width of each existing parking lane, bike lane, travel lane, and turn lane in feet (using numerals). The width of the column will automatically adjust based on the value entered.

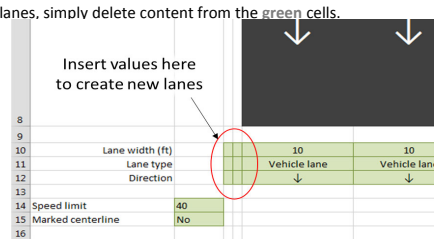
In the green "**Lane type**" row, click in each cell and select the appropriate lane type from the drop-down list. The appearance of the lane will change to represent the lane type. Manually entering a lane type is not allowed.

In the green "**Direction**" row, click in each cell and select the appropriate lane direction from the drop-down list.

In the green "**Speed limit**" and green "**Marked centerline**" cells, enter the current posted or prevailing speed limit and whether a marked centerline is present.

It is possible to add lanes beyond what is provided by default in the green cells to the left or right of the roadway graphic (see example below).

To remove lanes, simply delete content from the green cells.



After the existing configuration has been entered, visually inspect the graphic representation to ensure its accuracy. The curb to curb width in feet and existing LTS will be automatically calculated.

Proposed Street Configuration

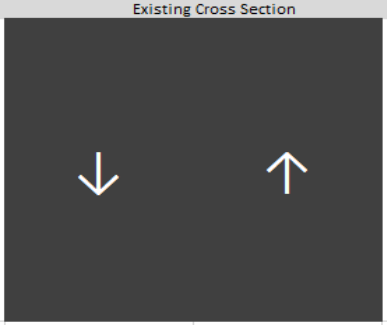
Repeat the process for the existing configuration, but explore various solutions such as lowering the speed limit, adding a bike lane, adding a buffer, removing or narrowing lanes, etc. The resulting LTS score of the proposed configuration will be automatically generated. A green cell is provided to give the proposed configuration a unique name or number (e.g., "ABC lane alternative" or "Alt. 2A."

Level of Traffic Stress Assessment - Existing Street Configuration

		Road name:	Farrington Highway
		From:	Kapolei Golf Course Road
Curb to curb width (ft)	22	To:	Kualakai Parkway
Existing stress in ↓ direction	LTS 4		
Existing stress in ↑ direction	LTS 4		

Existing Cross Section

Segment A



Lane width (ft)	11	11
Lane type	Vehicle lane	Vehicle lane
Direction	↓	↑

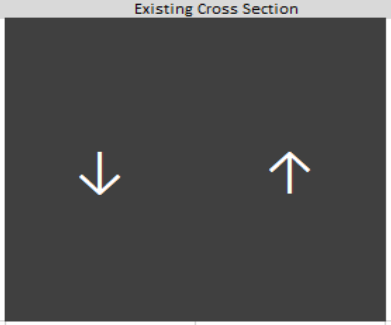
Prevailing speed	35
Marked centerline	Yes
AADT	9800

Level of Traffic Stress Assessment - Existing Street Configuration

		Road name:	Farrington Highway
		From:	Kualakai Parkway
Curb to curb width (ft)	22	To:	Old Fort Weaver (West Loop)
Existing stress in ↓ direction	LTS 4		
Existing stress in ↑ direction	LTS 4		

Existing Cross Section

Segment B



Lane width (ft)	11	11
Lane type	Vehicle lane	Vehicle lane
Direction	↓	↑

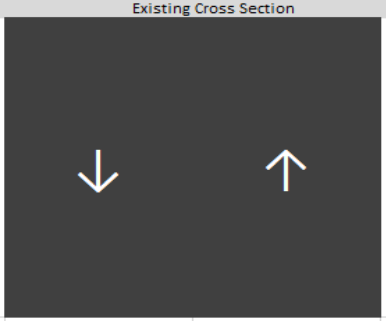
Prevailing speed	35
Marked centerline	Yes
AADT	8900

Level of Traffic Stress Assessment - Existing Street Configuration

		Road name:	Farrington Highway
		From:	Old Fort Weaver (West Loop)
Curb to curb width (ft)	22	To:	Old Fort Weaver (East Loop)
Existing stress in ↓ direction	LTS 4		
Existing stress in ↑ direction	LTS 4		

Existing Cross Section

Segment C



Lane width (ft)	11	11
Lane type	Vehicle lane	Vehicle lane
Direction	↓	↑

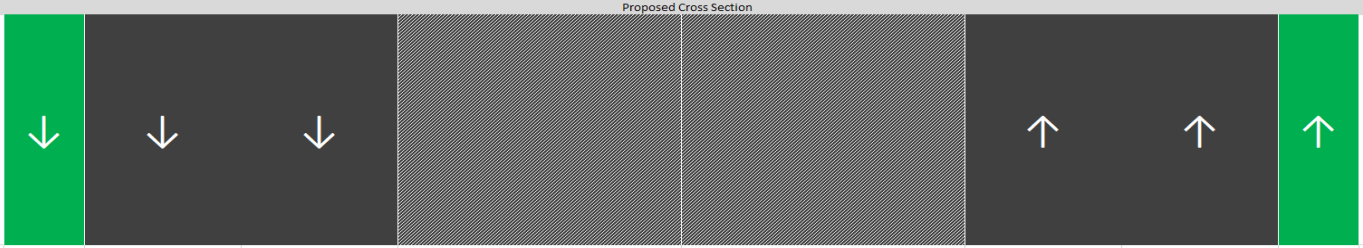
Prevailing speed	35
Marked centerline	Yes
AADT	8600

Level of Traffic Stress Assessment - Proposed Street Configuration

		Road name:	Farrington Highway
		From:	Kapolei Golf Course Road
Curb to curb width (ft)	104	To:	Kualakai Parkway
Proposed stress in ↓ direction	LTS 2	Alternative Name/Number:	Farrington Highway Improvements
Proposed stress in ↑ direction	LTS 2		

Segment A

Proposed Cross Section



Lane width (ft)		0	6	12	12	22	22	12	12	6	0
Lane type		Nor	Bike lane	Vehicle lane	Vehicle lane	Median	Median	Vehicle lane	Vehicle lane	Bike lane	one
Direction		↓	↓	↓	↓			↑	↑	↑	↑

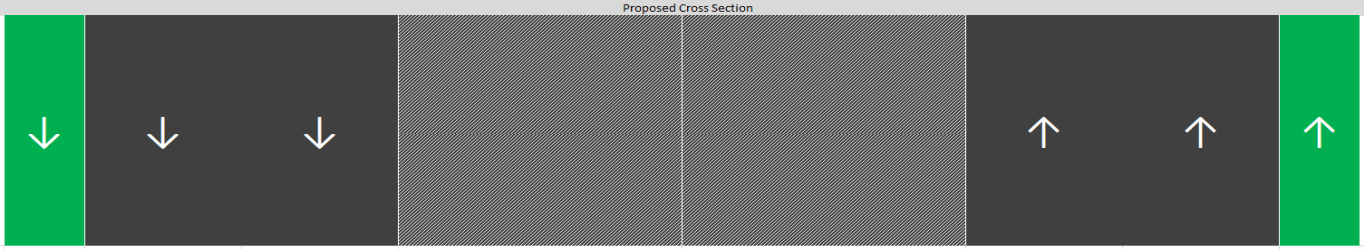
Speed limit	35
Marked centerline	Yes
AADT	25700

Level of Traffic Stress Assessment - Proposed Street Configuration

		Road name:	Farrington Highway
		From:	Kualakai Parkway
Curb to curb width (ft)	104	To:	Old Fort Weaver (West Loop)
Proposed stress in ↓ direction	LTS 2	Alternative Name/Number:	Farrington Highway Improvements
Proposed stress in ↑ direction	LTS 2		

Segment B

Proposed Cross Section



Lane width (ft)		0	6	12	12	22	22	12	12	6	0
Lane type		Nor	Bike lane	Vehicle lane	Vehicle lane	Median	Median	Vehicle lane	Vehicle lane	Bike lane	one
Direction		↓	↓	↓	↓			↑	↑	↑	↑

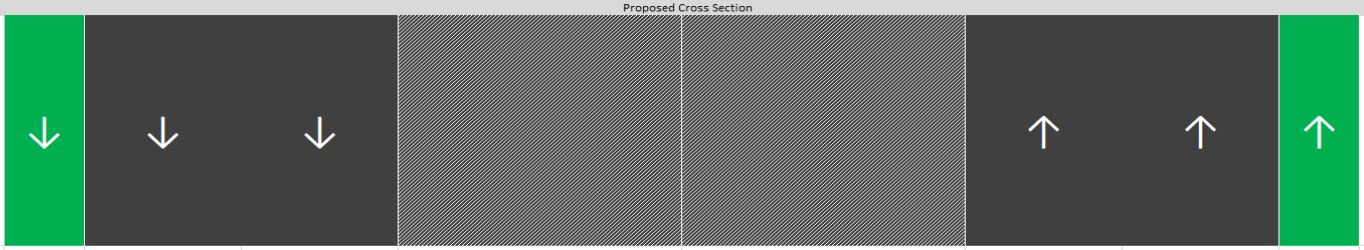
Speed limit	35
Marked centerline	Yes
AADT	21400

Level of Traffic Stress Assessment - Proposed Street Configuration

		Road name:	Farrington Highway
		From:	Old Fort Weaver (West Loop)
Curb to curb width (ft)	104	To:	Old Fort Weaver (East Loop)
Proposed stress in ↓ direction	LTS 2	Alternative Name/Number:	Farrington Highway Improvements
Proposed stress in ↑ direction	LTS 2		

Segment C

Proposed Cross Section



Lane width (ft)		#	6	12	12	22	22	12	12	6	#
Lane type		Nor	Bike lane	Vehicle lane	Vehicle lane	Median	Median	Vehicle lane	Vehicle lane	Bike lane	one
Direction		↓	↓	↓	↓			↑	↑	↑	↑

Speed limit	35
Marked centerline	Yes
AADT	14550

Intersection Assessment - Farrington Highway at Kualakai Parkway - Existing Conditions (2018)

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
Intersection Safety	Crosswalks	All ways	22	22	13	22	0	0	0	0
Intersection Safety	Crosswalks	1 Missing	9	22	14	16	0	0	0	0
Intersection Safety	Crosswalks	2 Missing	7	22	15	15	0	0	0	0
Intersection Safety	Crosswalks	3 Missing	4	22	16	13	0	0	0	0
Intersection Safety	Crosswalks	None	0	22	17	11	1	0	22	11
Intersection Safety	High Visibility Crosswalks	All ways	13	13	18	13	0	0	0	0
Intersection Safety	High Visibility Crosswalks	1 Missing	5	13	19	9	0	0	0	0
Intersection Safety	High Visibility Crosswalks	2 Missing	3	13	20	8	0	0	0	0
Intersection Safety	High Visibility Crosswalks	3 Missing	2	13	21	8	0	0	0	0
Intersection Safety	High Visibility Crosswalks	None	0	13	22	7	1	0	13	7
Intersection Safety	Intersection Lighting	4+ Streetlights	19	19	23	19	1	19	19	19
Intersection Safety	Intersection Lighting	3 Streetlights	15	19	24	17	0	0	0	0
Intersection Safety	Intersection Lighting	2 Streetlights	11	19	25	15	0	0	0	0
Intersection Safety	Intersection Lighting	1 Streetlight	9	19	26	14	0	0	0	0
Intersection Safety	Intersection Lighting	None	0	19	27	10	0	0	0	0
Intersection Safety	Traffic Control	Traffic Signal	11	11	28	11	1	11	11	11
Intersection Safety	Traffic Control	Stop All Way	9	11	29	9	0	0	0	0
Intersection Safety	Traffic Control	Uncontrolled	4	11	30	4	0	0	0	0
Intersection Safety	Traffic Control	Roundabout	2	11	31	2	0	0	0	0
Intersection Safety	Traffic Control	Yield (no roundabout)	0	11	32	0	0	0	0	0
Intersection Safety	Pedestrian Signal	All ways	9	9	33	9	0	0	0	0
Intersection Safety	Pedestrian Signal	Some ways	4	9	34	4	0	0	0	0
Intersection Safety	Pedestrian Signal	None	0	9	35	0	1	0	9	0
Intersection Safety	Countdown in Signal	All ways	17	17	36	17	0	0	0	0
Intersection Safety	Countdown in Signal	Some ways	7	17	37	7	0	0	0	0
Intersection Safety	Countdown in Signal	None	0	17	38	0	1	0	17	0
Intersection Safety	Wait Time	Less than 40 seconds	11	11	39	11	1	11	11	11
Intersection Safety	Wait Time	40 seconds or more	0	11	40	0	0	0	0	0
Intersection Safety	Crossing Speed	3.5 feet/second or less	11	11	41	11	1	11	11	11
Intersection Safety	Crossing Speed	More than 3.5 feet/second	0	11	42	0	0	0	0	0
Intersection Safety	Pedestrian Refuge Island	Yes, wider than 4 ft	13	13	43	13	1	13	13	13
Intersection Safety	Pedestrian Refuge Island	Yes, 4 ft or narrower	7	13	44	7	0	0	0	0
Intersection Safety	Pedestrian Refuge Island	None	0	13	45	0	0	0	0	0
Intersection Safety	Curb ramps	Missing one or more ramp	0	11	46	0	1	0	11	0
Intersection Safety	Curb ramps	All corners ramped	11	11	47	11	0	0	0	0
Intersection Safety	Intersection TCFs	None	0	10	48	0	1	0	10	0
Intersection Safety	Intersection TCFs	1 TCF	5	10	49	5	0	0	0	0
Intersection Safety	Intersection TCFs	2 TCFs	8	10	50	8	0	0	0	0
Intersection Safety	Intersection TCFs	3+ TCFs	10	10	51	10	0	0	0	0
Intersection Safety	Countermeasures	None	0	11	52	6	1	0	11	6
Intersection Safety	Countermeasures	1 Countermeasure	4	11	53	8	0	0	0	0
Intersection Safety	Countermeasures	2 Countermeasures	7	11	54	9	0	0	0	0
Intersection Safety	Countermeasures	3+ Countermeasures	11	11	55	11	0	0	0	0
								65	158	89
							SCORE	41		56

Intersection Assessment - Farrington Highway at Kualakai Parkway - Year (2028) Build Conditions

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
Intersection Safety	Crosswalks	All ways	22	22	13	22	1	22	22	22
Intersection Safety	Crosswalks	1 Missing	9	22	14	16	0	0	0	0
Intersection Safety	Crosswalks	2 Missing	7	22	15	15	0	0	0	0
Intersection Safety	Crosswalks	3 Missing	4	22	16	13	0	0	0	0
Intersection Safety	Crosswalks	None	0	22	17	11	0	0	0	0
Intersection Safety	High Visibility Crosswalks	All ways	13	13	18	13	1	13	13	13
Intersection Safety	High Visibility Crosswalks	1 Missing	5	13	19	9	0	0	0	0
Intersection Safety	High Visibility Crosswalks	2 Missing	3	13	20	8	0	0	0	0
Intersection Safety	High Visibility Crosswalks	3 Missing	2	13	21	8	0	0	0	0
Intersection Safety	High Visibility Crosswalks	None	0	13	22	7	0	0	0	0
Intersection Safety	Intersection Lighting	4+ Streetlights	19	19	23	19	1	19	19	19
Intersection Safety	Intersection Lighting	3 Streetlights	15	19	24	17	0	0	0	0
Intersection Safety	Intersection Lighting	2 Streetlights	11	19	25	15	0	0	0	0
Intersection Safety	Intersection Lighting	1 Streetlight	9	19	26	14	0	0	0	0
Intersection Safety	Intersection Lighting	None	0	19	27	10	0	0	0	0
Intersection Safety	Traffic Control	Traffic Signal	11	11	28	11	1	11	11	11
Intersection Safety	Traffic Control	Stop All Way	9	11	29	9	0	0	0	0
Intersection Safety	Traffic Control	Uncontrolled	4	11	30	4	0	0	0	0
Intersection Safety	Traffic Control	Roundabout	2	11	31	2	0	0	0	0
Intersection Safety	Traffic Control	Yield (no roundabout)	0	11	32	0	0	0	0	0
Intersection Safety	Pedestrian Signal	All ways	9	9	33	9	1	9	9	9
Intersection Safety	Pedestrian Signal	Some ways	4	9	34	4	0	0	0	0
Intersection Safety	Pedestrian Signal	None	0	9	35	0	0	0	0	0
Intersection Safety	Countdown in Signal	All ways	17	17	36	17	1	17	17	17
Intersection Safety	Countdown in Signal	Some ways	7	17	37	7	0	0	0	0
Intersection Safety	Countdown in Signal	None	0	17	38	0	0	0	0	0
Intersection Safety	Wait Time	Less than 40 seconds	11	11	39	11	0	0	0	0
Intersection Safety	Wait Time	40 seconds or more	0	11	40	0	1	0	11	0
Intersection Safety	Crossing Speed	3.5 feet/second or less	11	11	41	11	1	11	11	11
Intersection Safety	Crossing Speed	More than 3.5 feet/second	0	11	42	0	0	0	0	0
Intersection Safety	Pedestrian Refuge Island	Yes, wider than 4 ft	13	13	43	13	0	0	0	0
Intersection Safety	Pedestrian Refuge Island	Yes, 4 ft or narrower	7	13	44	7	1	7	13	7
Intersection Safety	Pedestrian Refuge Island	None	0	13	45	0	0	0	0	0
Intersection Safety	Curb ramps	Missing one or more ramp	0	11	46	0	0	0	0	0
Intersection Safety	Curb ramps	All corners ramped	11	11	47	11	1	11	11	11
Intersection Safety	Intersection TCFs	None	0	10	48	0	1	0	10	0
Intersection Safety	Intersection TCFs	1 TCF	5	10	49	5	0	0	0	0
Intersection Safety	Intersection TCFs	2 TCFs	8	10	50	8	0	0	0	0
Intersection Safety	Intersection TCFs	3+ TCFs	10	10	51	10	0	0	0	0
Intersection Safety	Countermeasures	None	0	11	52	6	0	0	0	0
Intersection Safety	Countermeasures	1 Countermeasure	4	11	53	8	1	4	11	8
Intersection Safety	Countermeasures	2 Countermeasures	7	11	54	9	0	0	0	0
Intersection Safety	Countermeasures	3+ Countermeasures	11	11	55	11	0	0	0	0
								124	158	128
							SCORE	78		81

Segment A - Farrington Highway between Kapolei Golf Course Rd and Kualakai Parkway - Existing Conditions (2018)

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
								Default Score		
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes [1]	2 Lanes	9	20	111	9	1	9	20	9
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes	4+ Lanes	0	20	113	0	0	0	0	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume [2]	6001-12000 VPD	4	15	119	4	1	4	15	4
Traffic	Traffic Volume	More than 12000 VPD	0	15	120	0	0	0	0	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk	8 - 12 ft	20	22	125	20	0	0	0	0
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	1	0	22	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway	8 ft or more	22	22	131	22	0	0	0	0
Street Design	Width of Throughway	No sidewalk	0	22	132	0	1	0	22	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	0	0	0	0
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	1	0	22	0
Street Design	Sidewalk Impediments	None	24	24	138	24	0	0	0	0
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	1	0	24	0
Street Design	Trees	None	0	9	142	0	1	0	9	0
Street Design	Trees	Sporadically lined	7	9	143	7	0	0	0	0
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	1	15	15	15
Street Design	Driveway Cuts	1 to 5	7	15	146	7	0	0	0	0
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	0	0	0	0
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	1	0	13	0
Street Design	Planters or Gardens	Yes	4	4	154	4	0	0	0	0
Street Design	Planters or Gardens	No	0	4	155	0	1	0	4	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	1	0	11	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	0	0	0	0
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	1	9	17	13
Perceived Safety	Street Lighting	Continuous	17	17	165	17	0	0	0	0
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	1	0	4	0
Perceived Safety	Empty Spaces	No	4	4	171	4	0	0	0	0
								50	248	54
							SCORE	20		22

NOTES

[1] Farrington Highway is one lane in each direction of travel.

[2] Number of vehicles per day is 9,800 (estimated from peak hour intersection counts). Includes both directions of travel.

Segment B - Farrington Highway between Kualakai Parkway and Old Fort Weaver (West) - Existing Conditions (2018)

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
								Default Score		
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes [1]	2 Lanes	9	20	111	9	1	9	20	9
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes	4+ Lanes	0	20	113	0	0	0	0	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume [2]	6001-12000 VPD	4	15	119	4	1	4	15	4
Traffic	Traffic Volume	More than 12000 VPD	0	15	120	0	0	0	0	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk	8 - 12 ft	20	22	125	20	0	0	0	0
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	1	0	22	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway	8 ft or more	22	22	131	22	0	0	0	0
Street Design	Width of Throughway	No sidewalk	0	22	132	0	1	0	22	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	0	0	0	0
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	1	0	22	0
Street Design	Sidewalk Impediments	None	24	24	138	24	0	0	0	0
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	1	0	24	0
Street Design	Trees	None	0	9	142	0	1	0	9	0
Street Design	Trees	Sporadically lined	7	9	143	7	0	0	0	0
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	1	15	15	15
Street Design	Driveway Cuts	1 to 5	7	15	146	7	0	0	0	0
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	0	0	0	0
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	1	0	13	0
Street Design	Planters or Gardens	Yes	4	4	154	4	0	0	0	0
Street Design	Planters or Gardens	No	0	4	155	0	1	0	4	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	1	0	11	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	0	0	0	0
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	1	9	17	13
Perceived Safety	Street Lighting	Continuous	17	17	165	17	0	0	0	0
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	1	0	4	0
Perceived Safety	Empty Spaces	No	4	4	171	4	0	0	0	0
								50	248	54
							SCORE	20		22

NOTES

[1] Farrington Highway is one lane in each direction of travel.

[2] Number of vehicles per day is 8,900 (estimated from peak hour intersection counts). Includes both directions of travel.

Segment C - Farrington Highway between Old Fort Weaver Intersections - Existing Conditions (2018)

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
								Default Score		
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes [1]	2 Lanes	9	20	111	9	1	9	20	9
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes	4+ Lanes	0	20	113	0	0	0	0	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume [2]	6001-12000 VPD	4	15	119	4	1	4	15	4
Traffic	Traffic Volume	More than 12000 VPD	0	15	120	0	0	0	0	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk	8 - 12 ft	20	22	125	20	0	0	0	0
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	1	0	22	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway	8 ft or more	22	22	131	22	0	0	0	0
Street Design	Width of Throughway	No sidewalk	0	22	132	0	1	0	22	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	0	0	0	0
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	1	0	22	0
Street Design	Sidewalk Impediments	None	24	24	138	24	0	0	0	0
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	1	0	24	0
Street Design	Trees	None	0	9	142	0	1	0	9	0
Street Design	Trees	Sporadically lined	7	9	143	7	0	0	0	0
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	1	15	15	15
Street Design	Driveway Cuts	1 to 5	7	15	146	7	0	0	0	0
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	0	0	0	0
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	1	0	13	0
Street Design	Planters or Gardens	Yes	4	4	154	4	0	0	0	0
Street Design	Planters or Gardens	No	0	4	155	0	1	0	4	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	1	0	11	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	0	0	0	0
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	1	9	17	13
Perceived Safety	Street Lighting	Continuous	17	17	165	17	0	0	0	0
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	1	0	4	0
Perceived Safety	Empty Spaces	No	4	4	171	4	0	0	0	0
								50	248	54
							SCORE	20		22

NOTES

[1] Farrington Highway is one lane in each direction of travel.

[2] Number of vehicles per day is 8,600 (estimated from peak hour intersection counts). Includes both directions of travel.

Segment A - Farrington Highway between Kapolei Golf Course Rd and Kualakai Parkway - Year (2028) Build Conditions

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes	2 Lanes	9	20	111	9	0	0	0	0
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes [1]	4+ Lanes	0	20	113	0	1	0	20	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume	6001-12000 VPD	4	15	119	4	0	0	0	0
Traffic	Traffic Volume [2]	More than 12000 VPD	0	15	120	0	1	0	15	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk [3]	8 - 12 ft	20	22	125	20	1	20	22	20
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	0	0	0	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway [3]	8 ft or more	22	22	131	22	1	22	22	22
Street Design	Width of Throughway	No sidewalk	0	22	132	0	0	0	0	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	1	22	22	22
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	0	0	0	0
Street Design	Sidewalk Impediments	None	24	24	138	24	1	24	24	24
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	0	0	0	0
Street Design	Trees	None	0	9	142	0	0	0	0	0
Street Design	Trees	Sporadically lined	7	9	143	7	1	7	9	7
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	0	0	0	0
Street Design	Driveway Cuts	1 to 5	7	15	146	7	1	7	15	7
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	1	11	13	11
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	0	0	0	0
Street Design	Planters or Gardens	Yes	4	4	154	4	1	4	4	4
Street Design	Planters or Gardens	No	0	4	155	0	0	0	0	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	0	0	0	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	1	7	11	7
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	0	0	0	0
Perceived Safety	Street Lighting	Continuous	17	17	165	17	1	17	17	17
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	0	0	0	0
Perceived Safety	Empty Spaces	No	4	4	171	4	1	4	4	4
								158	248	158
							SCORE	64		64

NOTES

[1] Farrington Highway is assumed to be two lanes in each direction of travel.

[2] Number of vehicles per day is 25,700 (estimated from peak hour intersection counts). Includes both directions of travel.

[3] Per preliminary design plans. Proposed cross section includes 8-foot sidewalks on both sides of the highway.

Segment B - Farrington Highway between Kualakai Parkway and Old Fort Weaver (West) - Year (2028) Build Conditions

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes	2 Lanes	9	20	111	9	0	0	0	0
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes [1]	4+ Lanes	0	20	113	0	1	0	20	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume	6001-12000 VPD	4	15	119	4	0	0	0	0
Traffic	Traffic Volume [2]	More than 12000 VPD	0	15	120	0	1	0	15	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk [3]	8 - 12 ft	20	22	125	20	1	20	22	20
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	0	0	0	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway [3]	8 ft or more	22	22	131	22	1	22	22	22
Street Design	Width of Throughway	No sidewalk	0	22	132	0	0	0	0	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	1	22	22	22
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	0	0	0	0
Street Design	Sidewalk Impediments	None	24	24	138	24	1	24	24	24
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	0	0	0	0
Street Design	Trees	None	0	9	142	0	0	0	0	0
Street Design	Trees	Sporadically lined	7	9	143	7	1	7	9	7
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	0	0	0	0
Street Design	Driveway Cuts	1 to 5	7	15	146	7	1	7	15	7
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	1	11	13	11
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	0	0	0	0
Street Design	Planters or Gardens	Yes	4	4	154	4	1	4	4	4
Street Design	Planters or Gardens	No	0	4	155	0	0	0	0	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	0	0	0	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	1	7	11	7
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	0	0	0	0
Perceived Safety	Street Lighting	Continuous	17	17	165	17	1	17	17	17
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	0	0	0	0
Perceived Safety	Empty Spaces	No	4	4	171	4	1	4	4	4
								158	248	158
							SCORE	64		64

NOTES

[1] Farrington Highway is assumed to be two lanes in each direction of travel.

[2] Number of vehicles per day is 21,400 (estimated from peak hour intersection counts). Includes both directions of travel.

[3] Per preliminary design plans. Proposed cross section includes 8-foot sidewalks on both sides of the highway.

Segment C - Farrington Highway between Old Fort Weaver Intersections - Year (2028) Build Conditions

Domain	Indicator	Variable	Default Value	Max	IDNUM	AltValue	input	Default Score	Max Score	Alt Score
								Default Score		
Traffic	Number of Lanes	Shared/Pedestrian only street	20	20	109	20	0	0	0	0
Traffic	Number of Lanes	1 Lane	13	20	110	13	0	0	0	0
Traffic	Number of Lanes	2 Lanes	9	20	111	9	0	0	0	0
Traffic	Number of Lanes	3 Lanes	4	20	112	4	0	0	0	0
Traffic	Number of Lanes [1]	4+ Lanes	0	20	113	0	1	0	20	0
Traffic	Posted Speed Limit	25 mph or none posted	4	19	114	4	0	0	0	0
Traffic	Posted Speed Limit	Under 25 mph	19	19	115	19	0	0	0	0
Traffic	Posted Speed Limit	Over 25 mph	0	19	116	0	1	0	19	0
Traffic	Traffic Volume	Fewer than 1000 VPD	15	15	117	15	0	0	0	0
Traffic	Traffic Volume	1000-6000 VPD	11	15	118	11	0	0	0	0
Traffic	Traffic Volume	6001-12000 VPD	4	15	119	4	0	0	0	0
Traffic	Traffic Volume [2]	More than 12000 VPD	0	15	120	0	1	0	15	0
Traffic	Street TCFs	None	0	10	121	0	1	0	10	0
Traffic	Street TCFs	1+ TCFs	10	10	122	10	0	0	0	0
Street Design	Width of Sidewalk	Less than 5 feet	9	22	123	9	0	0	0	0
Street Design	Width of Sidewalk	5 - 8 ft	15	22	124	15	0	0	0	0
Street Design	Width of Sidewalk [3]	8 - 12 ft	20	22	125	20	1	20	22	20
Street Design	Width of Sidewalk	12 ft or more	22	22	126	22	0	0	0	0
Street Design	Width of Sidewalk	No sidewalk	0	22	127	0	0	0	0	0
Street Design	Width of Throughway	Less than 4 feet	8	22	128	8	0	0	0	0
Street Design	Width of Throughway	4 - 6 ft	13	22	129	13	0	0	0	0
Street Design	Width of Throughway	6 - 8 ft	17	22	130	17	0	0	0	0
Street Design	Width of Throughway [3]	8 ft or more	22	22	131	22	1	22	22	22
Street Design	Width of Throughway	No sidewalk	0	22	132	0	0	0	0	0
Street Design	Sidewalk Obstructions	None	22	22	133	22	1	22	22	22
Street Design	Sidewalk Obstructions	Temporary only	11	22	134	11	0	0	0	0
Street Design	Sidewalk Obstructions	Permanent only	4	22	135	4	0	0	0	0
Street Design	Sidewalk Obstructions	Both permanent & temporary	4	22	136	4	0	0	0	0
Street Design	Sidewalk Obstructions	No sidewalk	0	22	137	0	0	0	0	0
Street Design	Sidewalk Impediments	None	24	24	138	24	1	24	24	24
Street Design	Sidewalk Impediments	Minor	13	24	139	13	0	0	0	0
Street Design	Sidewalk Impediments	Significant	4	24	140	4	0	0	0	0
Street Design	Sidewalk Impediments	No sidewalk	0	24	141	0	0	0	0	0
Street Design	Trees	None	0	9	142	0	0	0	0	0
Street Design	Trees	Sporadically lined	7	9	143	7	1	7	9	7
Street Design	Trees	Continuously lined	9	9	144	9	0	0	0	0
Street Design	Driveway Cuts	None	15	15	145	15	0	0	0	0
Street Design	Driveway Cuts	1 to 5	7	15	146	7	1	7	15	7
Street Design	Driveway Cuts	More than 5	0	15	147	0	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and PP	13	13	148	13	0	0	0	0
Street Design	Presence of a Buffer	Bike lane and NPPP	13	13	149	13	0	0	0	0
Street Design	Presence of a Buffer	Parallel parking	11	13	150	11	0	0	0	0
Street Design	Presence of a Buffer	Bike lane	11	13	151	11	1	11	13	11
Street Design	Presence of a Buffer	Non-Peak Parallel Parking	9	13	152	9	0	0	0	0
Street Design	Presence of a Buffer	None	0	13	153	0	0	0	0	0
Street Design	Planters or Gardens	Yes	4	4	154	4	1	4	4	4
Street Design	Planters or Gardens	No	0	4	155	0	0	0	0	0
Street Design	Public Seating	Yes	4	4	156	4	0	0	0	0
Street Design	Public Seating	No	0	4	157	0	1	0	4	0
Land Use	Public Art or Historic Sites	Yes	4	4	158	4	0	0	0	0
Land Use	Public Art or Historic Sites	No	0	4	159	0	1	0	4	0
Land Use	Retail Use or Public Places	None	0	11	160	0	0	0	0	0
Land Use	Retail Use or Public Places	1 or 2	7	11	161	7	1	7	11	7
Land Use	Retail Use or Public Places	3 or more	11	11	162	11	0	0	0	0
Perceived Safety	Street Lighting	None	0	17	163	9	0	0	0	0
Perceived Safety	Street Lighting	Sporadic	9	17	164	13	0	0	0	0
Perceived Safety	Street Lighting	Continuous	17	17	165	17	1	17	17	17
Perceived Safety	Illegal Graffiti	Yes	0	2	166	0	0	0	0	0
Perceived Safety	Illegal Graffiti	No	2	2	167	2	1	2	2	2
Perceived Safety	Litter	Yes	0	11	168	0	0	0	0	0
Perceived Safety	Litter	No	11	11	169	11	1	11	11	11
Perceived Safety	Empty Spaces	Yes	0	4	170	0	0	0	0	0
Perceived Safety	Empty Spaces	No	4	4	171	4	1	4	4	4
								158	248	158
							SCORE	64		64

NOTES

[1] Farrington Highway is assumed to be two lanes in each direction of travel.

[2] Number of vehicles per day is 14,550 (estimated from peak hour intersection counts). Includes both directions of travel.

[3] Per preliminary design plans. Proposed cross section includes 8-foot sidewalks on both sides of the highway.

Farrington Highway - Auto LOS Results

		Existing Conditions (2018), 2-lane Farrington Highway				Year (2028) Build Conditions, 4-lane Farrington Highway			
	Segment	Segment Volume (veh per day)	Intersection Delay (sec per veh)	LOS	Auto Score	Segment Volume (veh per day)	Intersection Delay (sec per veh)	LOS	Auto Score
AM Peak	Segment A - Farrington Highway between Kapolei Golf Course Rd and Kualakai Parkway								
	Farrington Highway at Kapolei Golf Course Road		13.4	B	1		21.6	C	1
	Roadway between Kapolei Golf Course Rd and Kualakai Parkway	11,300		D	2	18,500		D	2
	Farrington Highway at Kualakai Parkway		24.5	C	1		48.8	C	1
	Segment A - Auto LOS				**2**				**2**
	Segment B - Farrington Highway between Kualakai Parkway and Old Fort Weaver (West)								
	Farrington Highway at Kualakai Parkway		24.5	C	1		48.8	C	1
	Roadway between Kualakai Parkway and Old Fort Weaver (West)	8,550		D	2	18,150		D	2
	Farrington Highway at Old Fort Weaver (West)		23.3	C	1		16.2	C	1
	Segment B - Auto LOS				**2**				**2**
	Segment C - Farrington Highway between Old Fort Weaver Intersections								
	Farrington Highway at Old Fort Weaver (West)		23.3	C	1		16.2	C	1
	Roadway between Old Fort Weaver Intersections	8,600		D	2	14,550		D	2
	Farrington Highway at Old Fort Weaver (East)		20.6	C	1		14.3	B	1
	Segment C - Auto LOS				**2**				**2**
PM Peak	Segment A - Farrington Highway between Kapolei Golf Course Rd and Kualakai Parkway								
	Farrington Highway at Kapolei Golf Course Road		13.3	B	1		23.0	C	1
	Roadway between Kapolei Golf Course Rd and Kualakai Parkway	11,300		D	2	25,700		D	2
	Farrington Highway at Kualakai Parkway		27.2	C	1		71.1	E	3
	Segment A - Auto LOS				**2**				**2**
	Segment B - Farrington Highway between Kualakai Parkway and Old Fort Weaver (West)								
	Farrington Highway at Kualakai Parkway		27.2	C	1		71.1	E	3
	Roadway between Kualakai Parkway and Old Fort Weaver (West)	8,550		D	2	21,400		D	2
	Farrington Highway at Old Fort Weaver (West)		16.6	C	1		17.4	C	1
	Segment B - Auto LOS				**2**				**2**
	Segment C - Farrington Highway between Old Fort Weaver Intersections								
	Farrington Highway at Old Fort Weaver (West)		16.6	C	1		17.4	C	1
	Roadway between Old Fort Weaver Intersections	7,000		D	2	14,350		D	2
	Farrington Highway at Old Fort Weaver (East)		11.6	B	1		12.6	B	1
	Segment C - Auto LOS				**2**				**2**

NOTES

Segment volumes represent daily traffic in both directions of travel, and are estimated based on the AM or PM peak hour volumes.

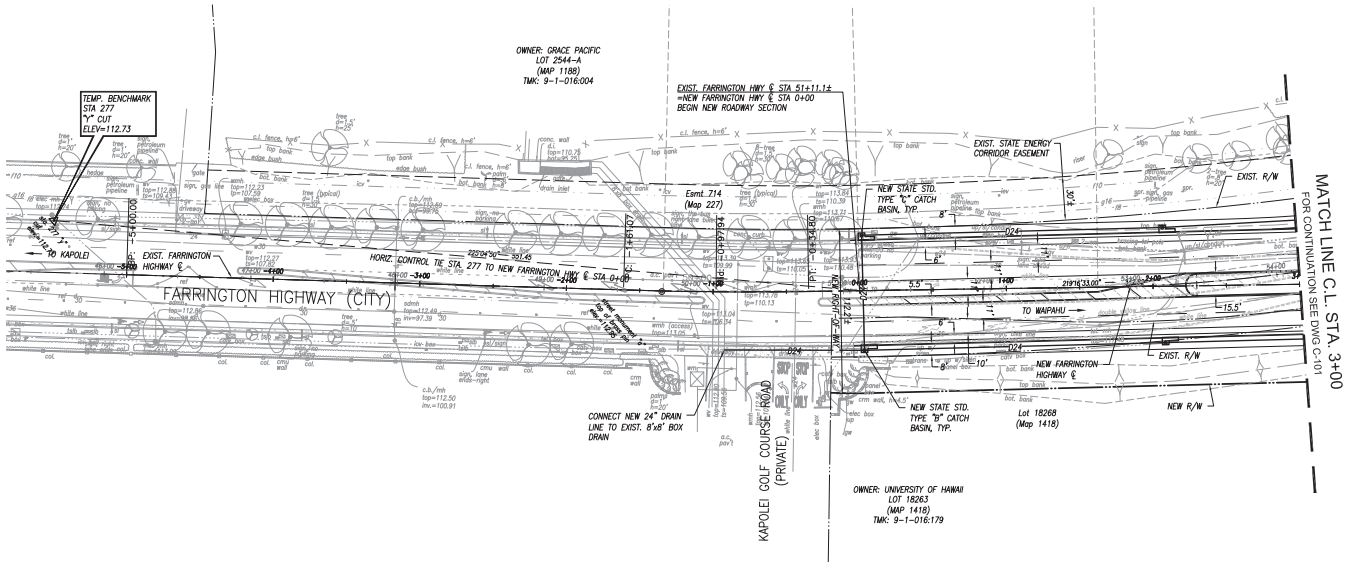
Existing conditions volumes for Segment A and Segment B are based on field count data. All other segment volumes are based on peak hour intersection volumes.

Intersection results for 2028 Build condition are based on the analysis of the 2nd highest peak hour volumes.

Auto LOS is based on the roadway segment score.

Appendix K

Farrington Highway Preliminary Roadway Plans and Typical Cross Section

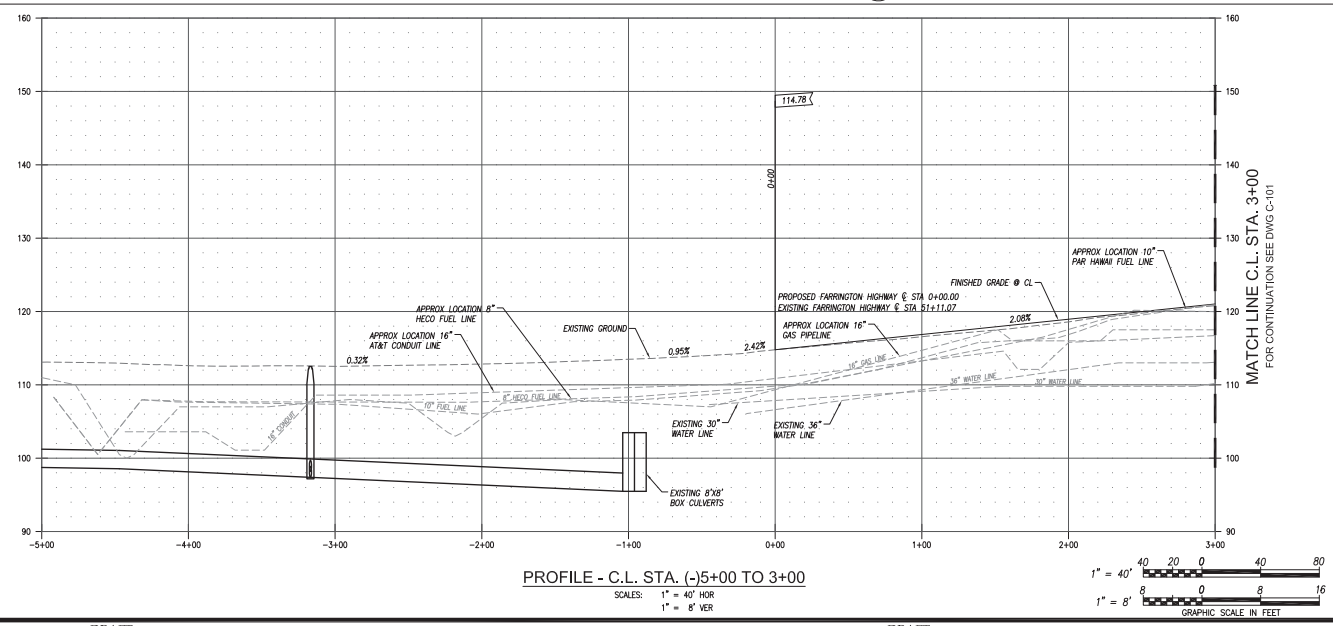


PLAN - C.L. STA. (-)5+00 TO 3+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. (-)5+00 TO 3+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS WILL BE MADE TO CONFORM WITH THE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA (-)5+00 TO 3+00

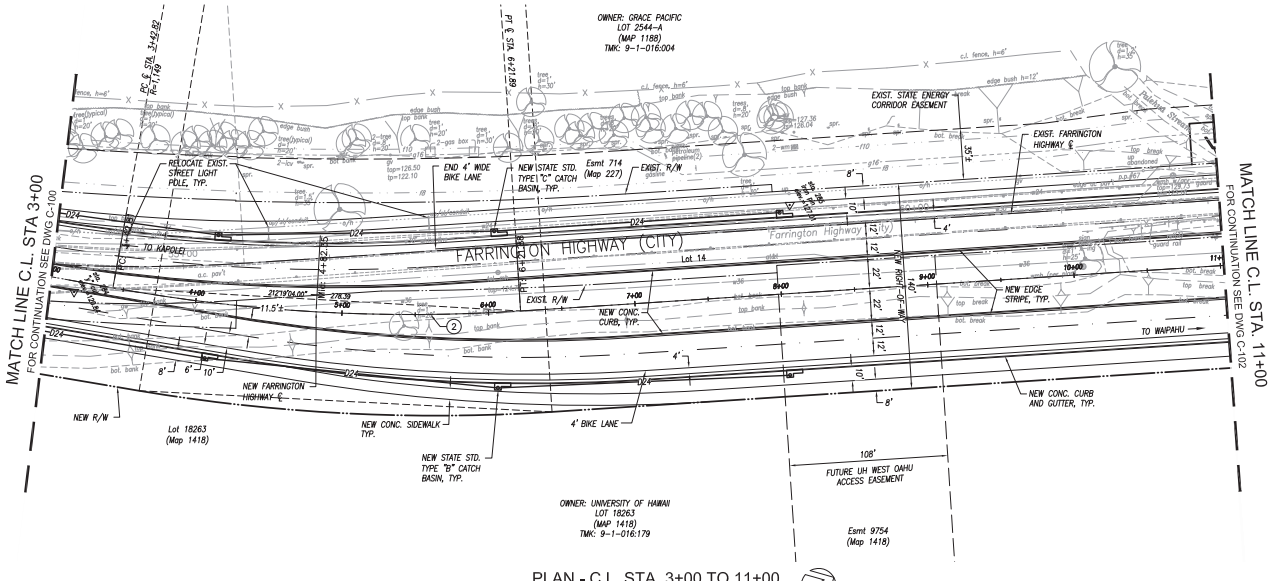
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE

DRAWING NO. C-100
SHEET 5 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

DRAFT DRAFT DRAFT



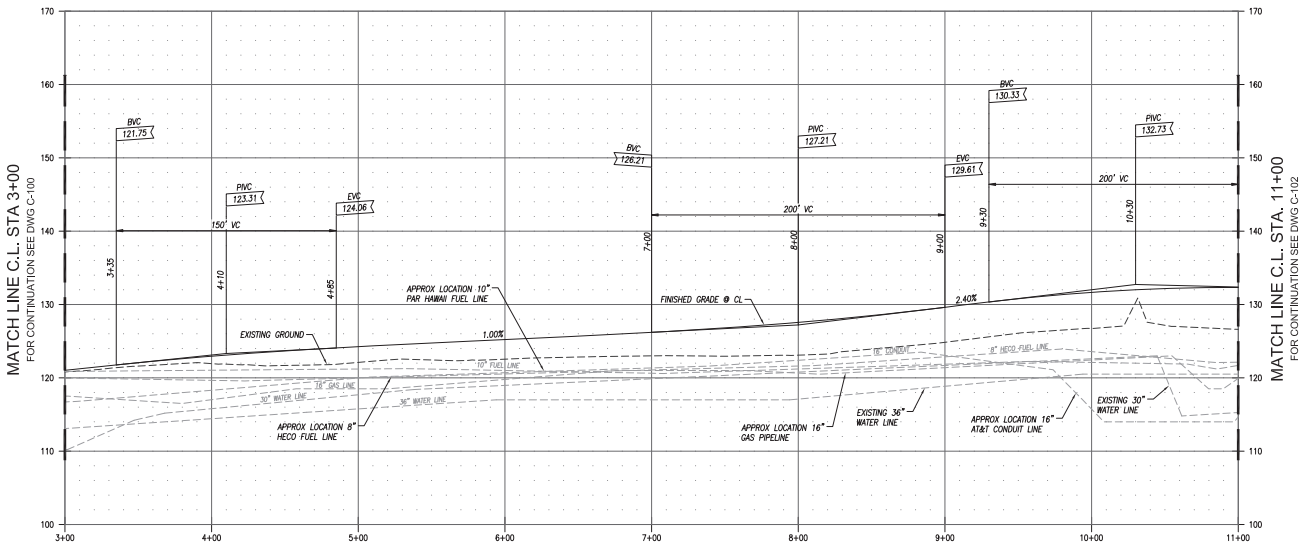
PLAN - C.L. STA. 3+00 TO 11+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
2	13°54'58"	6°57'30"	1,149.00	140.23	278.39	279.07

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 3+00 TO 11+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSISTS OF ____ SHEETS AND UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

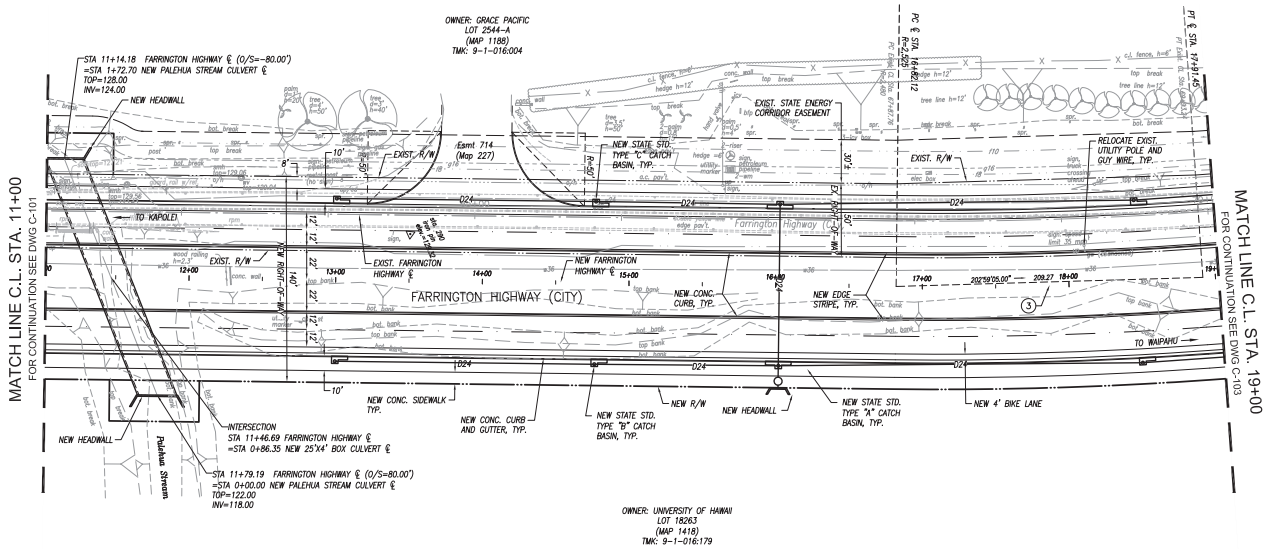
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 3+00 TO 11+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE
DRAWING NO. C-101
SHEET 6 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

DRAFT DRAFT DRAFT



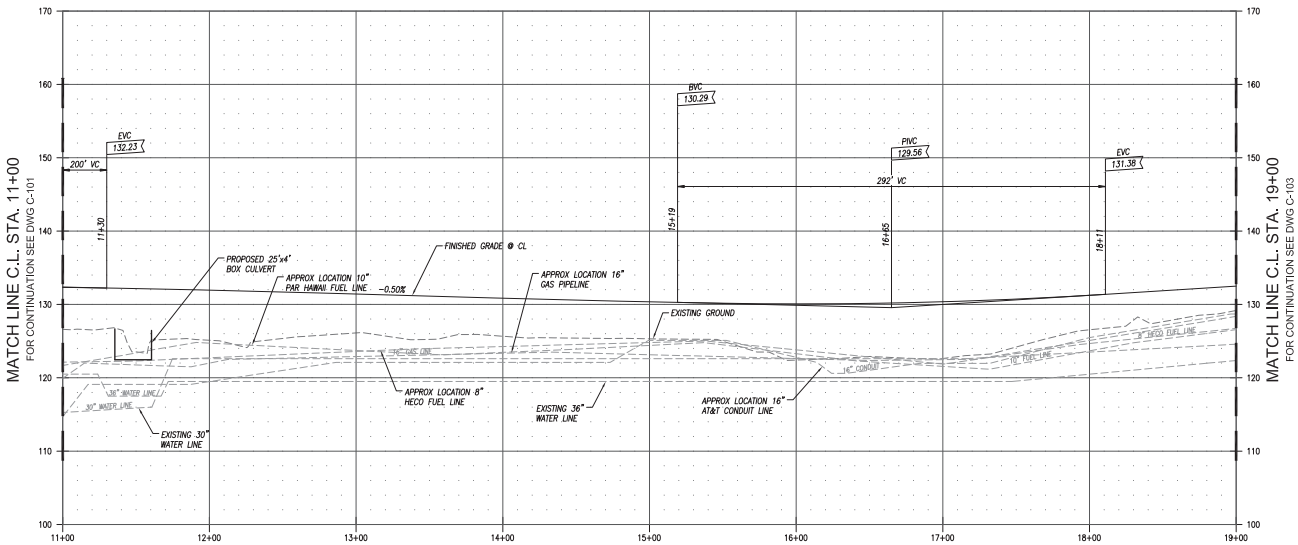
PLAN - C.L. STA. 11+00 TO 19+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
3	4°45'00"	2°22'30"	2,525.00	104.73	209.27	209.33

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 11+00 TO 19+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

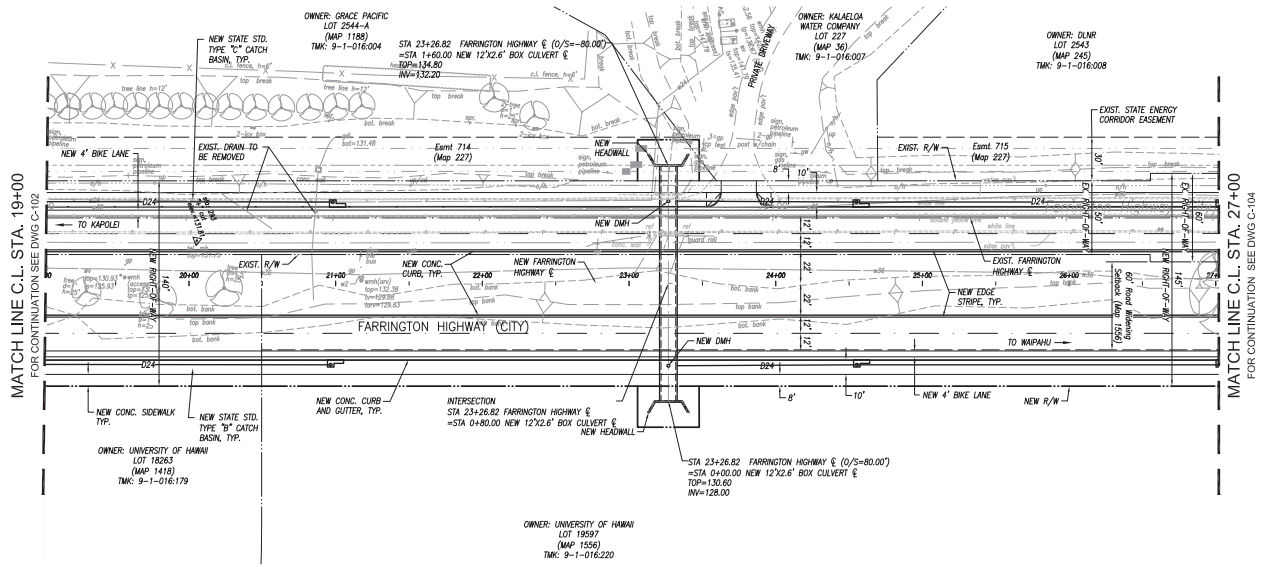
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 11+00 TO 19+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-102
SHEET 7 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

DRAFT DRAFT DRAFT

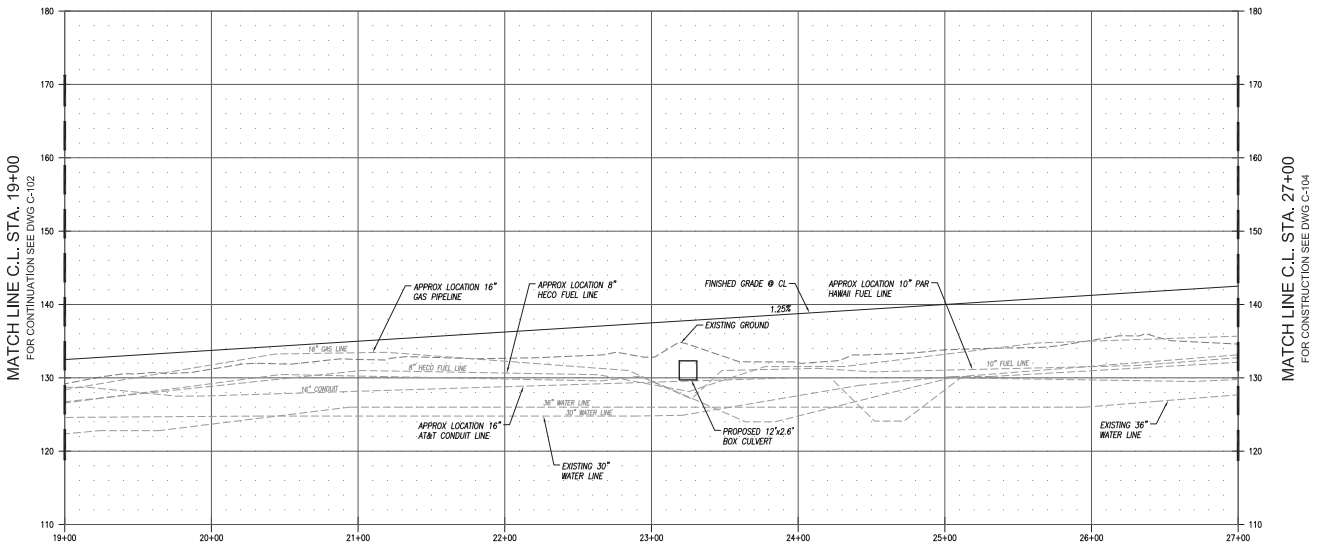


PLAN - C.L. STA. 19+00 TO 27+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 19+00 TO 27+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 19+00 TO 27+00

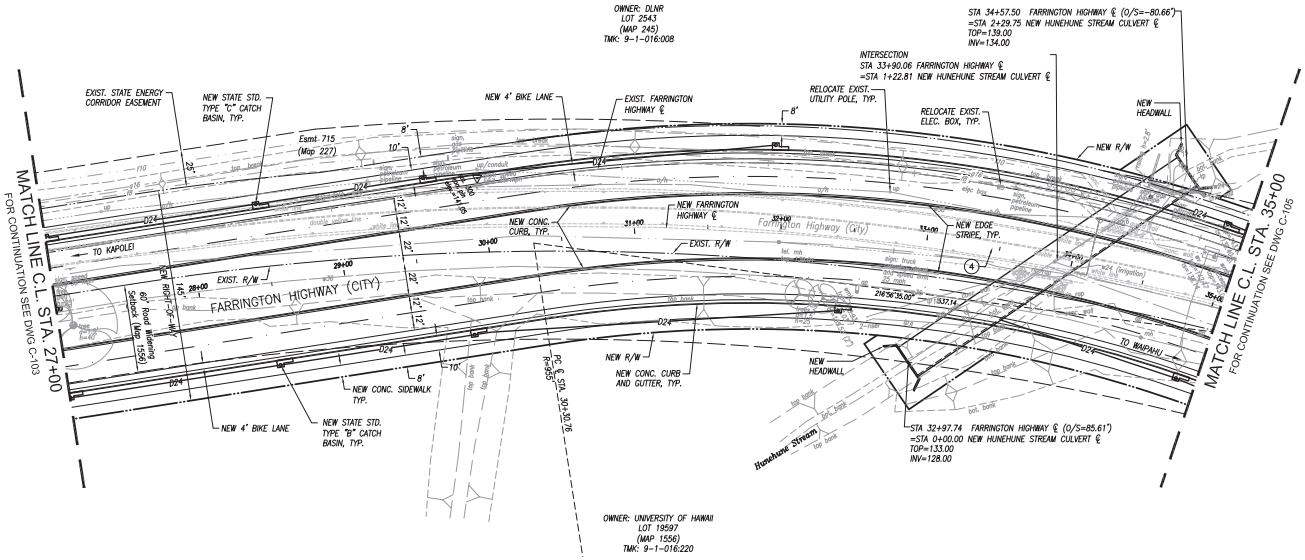
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE

DRAWING NO. C-103
SHEET 8 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

DRAFT DRAFT DRAFT



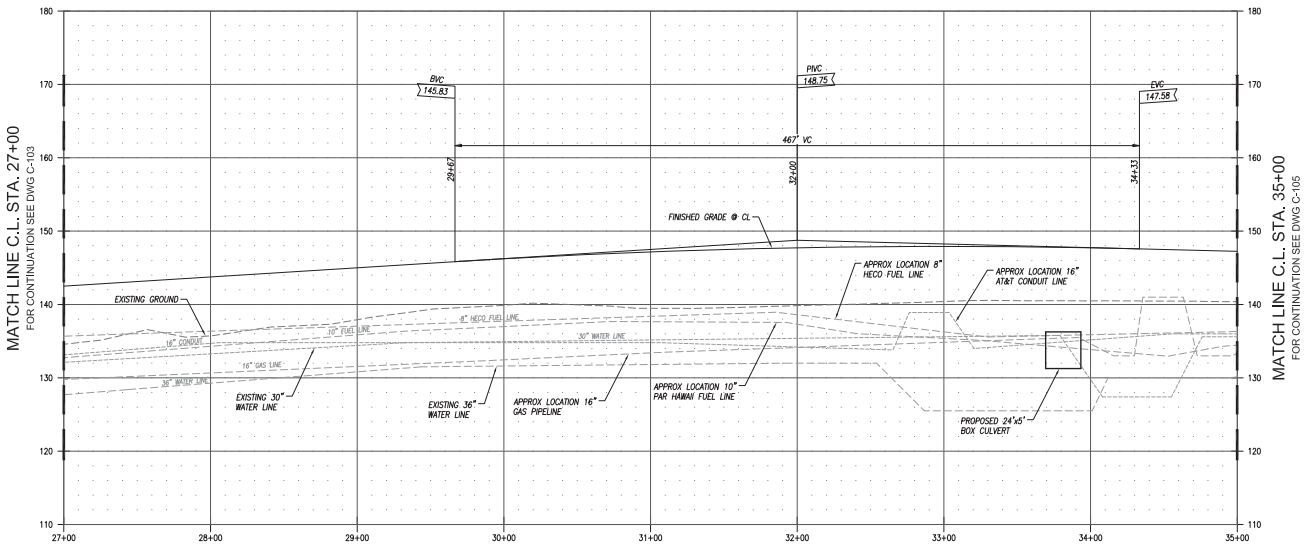
PLAN - C.L. STA. 27+00 TO 35+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
4	32°40'00"	16°20'00"	955.00	279.86	537.14	544.48

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 27+00 TO 35+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONFORMS TO THE STATUTES AND UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

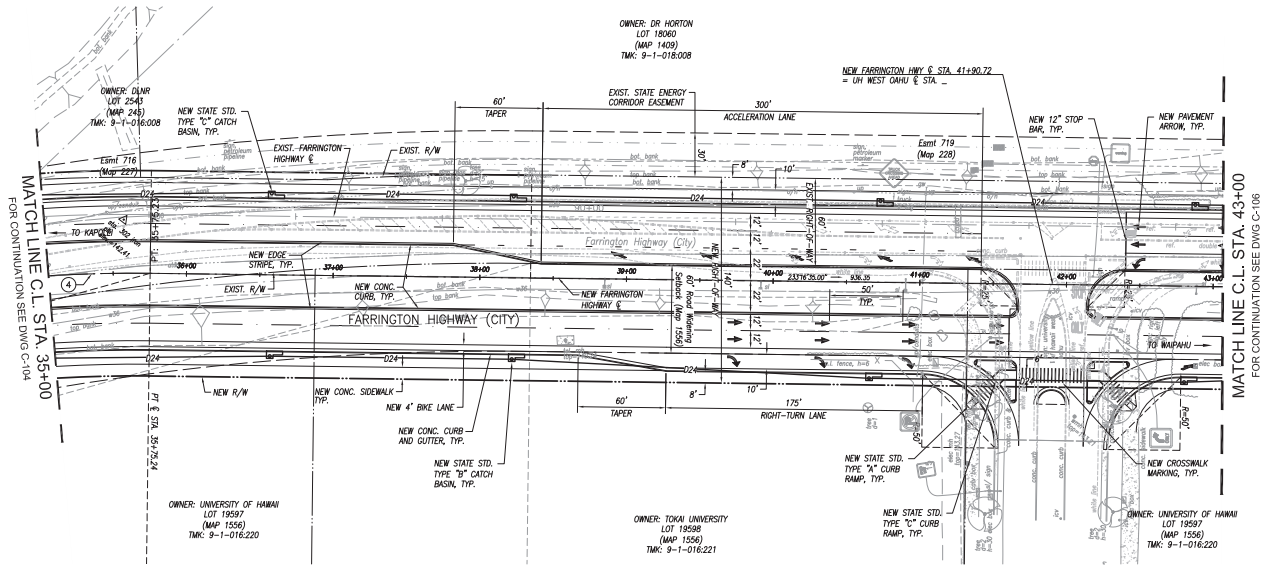
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 27+00 TO 35+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE
DRAWING NO. C-104
SHEET 9 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

DRAFT DRAFT DRAFT



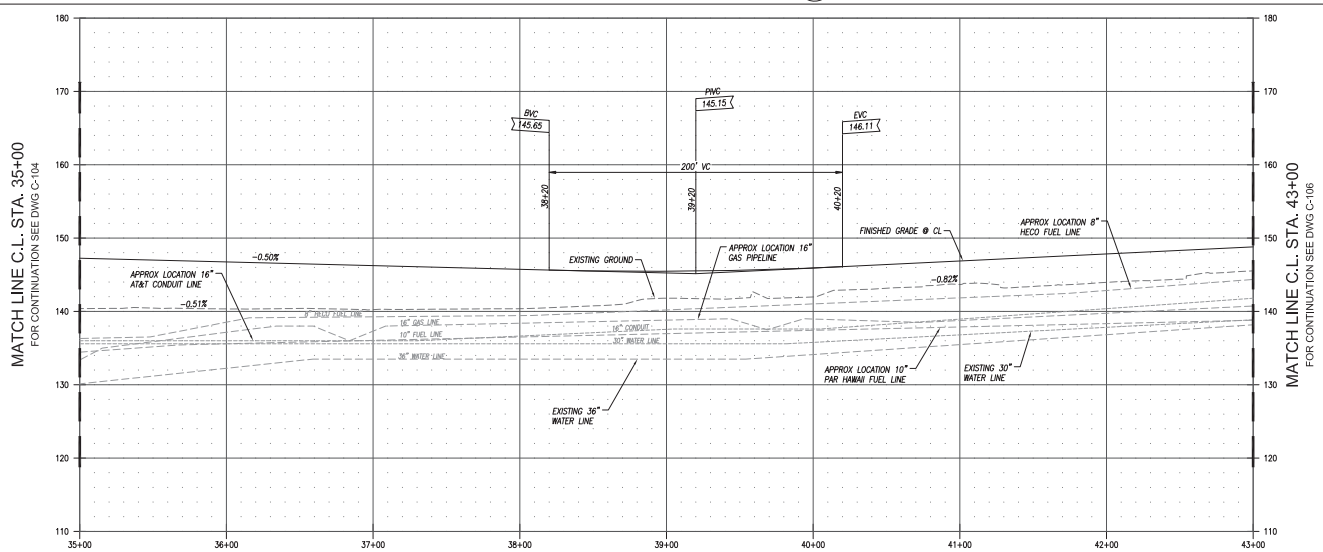
PLAN - C.L. STA. 35+00 TO 43+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
4	32°40'	16°20'	955.00	279.86	537.14	544.48

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 35+00 TO 43+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONFORMS TO THE STATUTES AND UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 35+00 TO 43+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-105
SHEET 10 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-1_0+00-43+00.dwg

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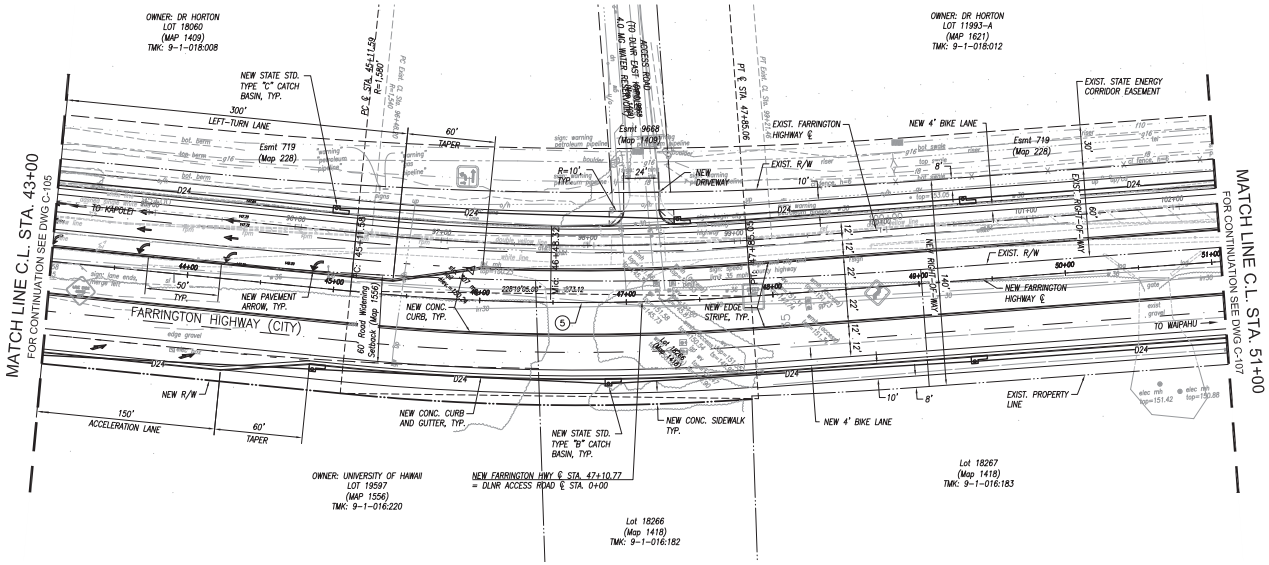


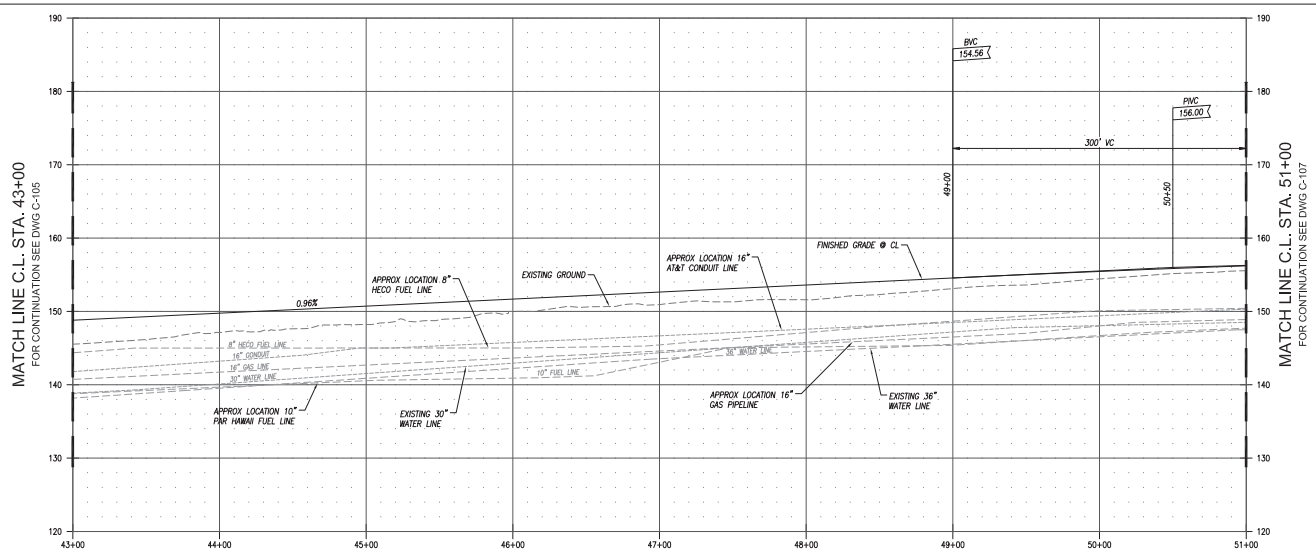
PLAN - C.L. STA. 43+00 TO 51+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
5	9°55'	4°57'31"	1580.00	137.07	273.12	273.46

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 43+00 TO 51+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

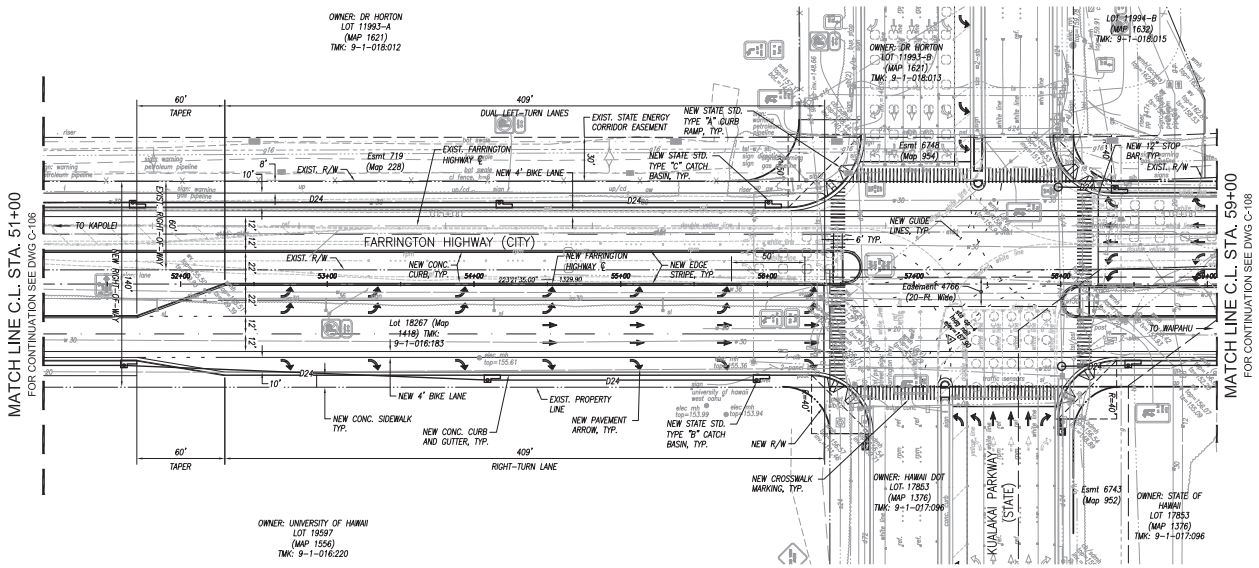
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 43+00 TO 51+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE
DRAWING NO. C-106
SHEET 11 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT

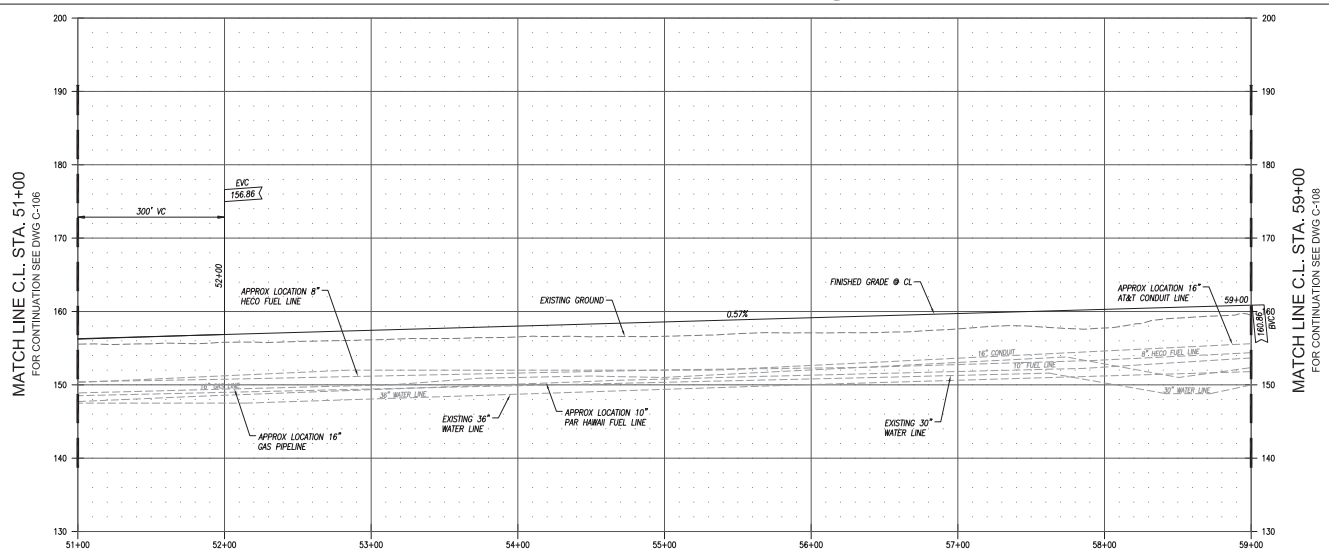


PLAN - C.L. STA. 51+00 TO 59+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 51+00 TO 59+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80

1" = 8' 8 0 8 16

GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 51+00 TO 59+00

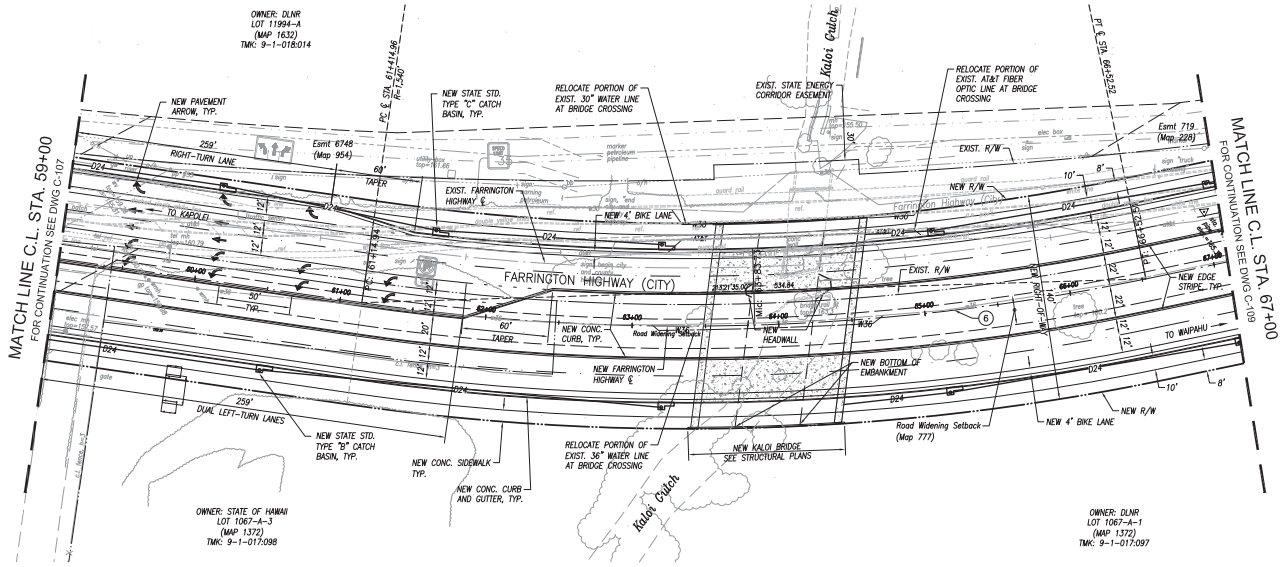
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE

DRAWING NO. C-107
SHEET 12 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT



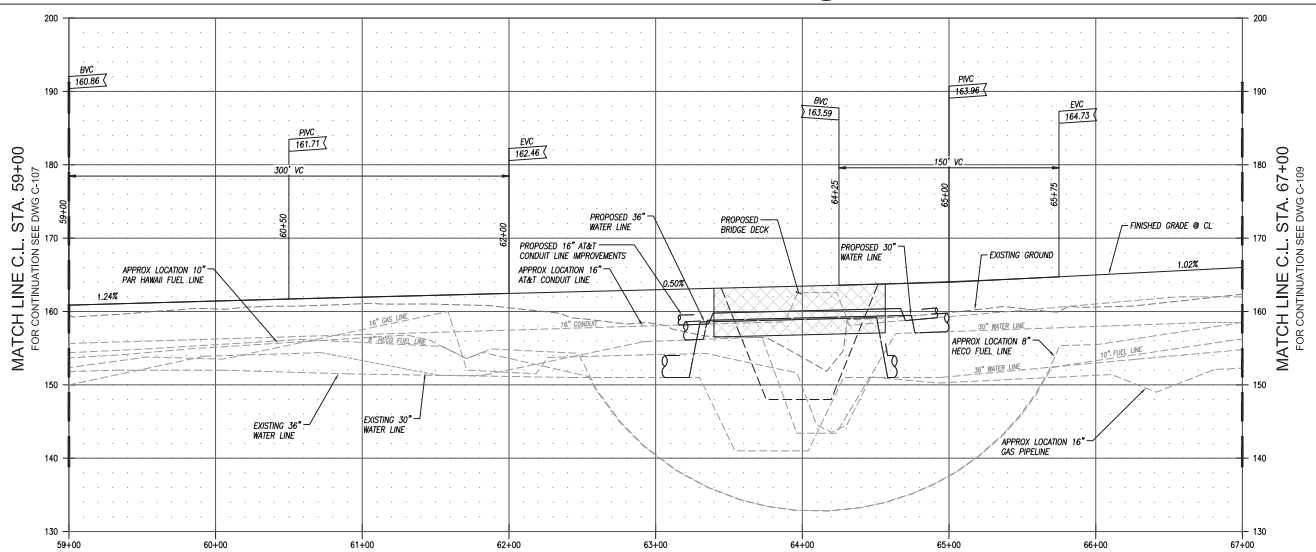
PLAN - C.L. STA. 59+00 TO 67+00

SCALE: 1" = 40'

CURVE TABLE						
CURVE NO	Δ	Δ/2	R	T	C	Lc
6	20°00'	10°00'	1540.00	271.54	534.84	537.56

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 59+00 TO 67+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAWS UNDER MY ORGANIZATION. CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF REGISTRATION OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

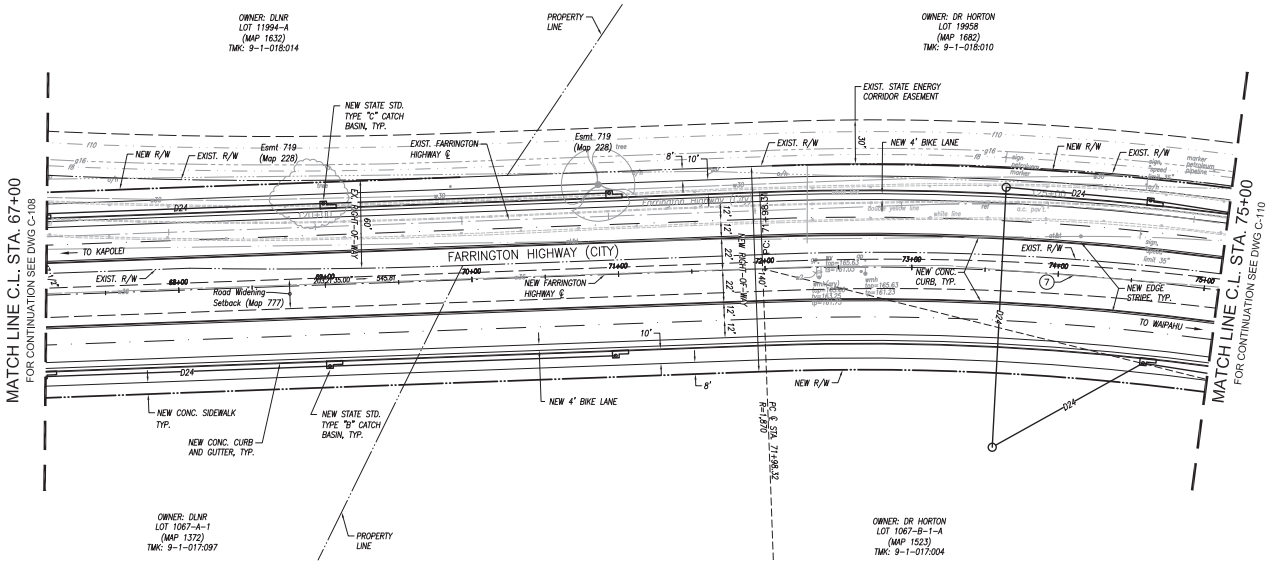
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 59+00 TO 67+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-108
SHEET 13 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT



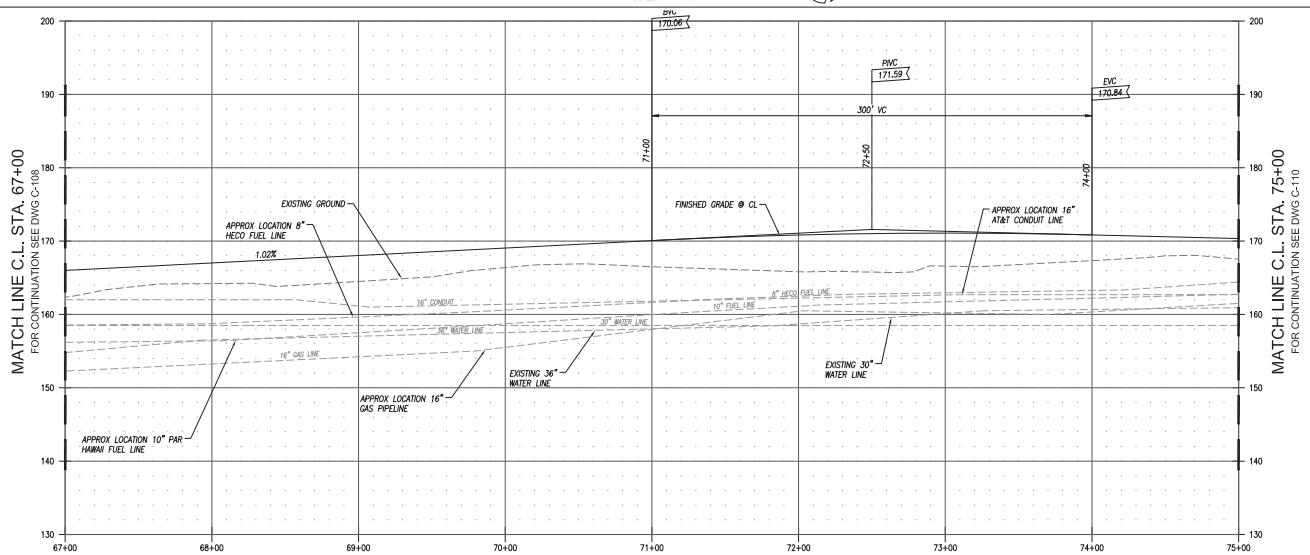
PLAN - C.L. STA. 67+00 TO 75+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
7	32°10'	16°05'	1,870.00	539.16	1,036.11	1,049.84

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 67+00 TO 75+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAWS UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

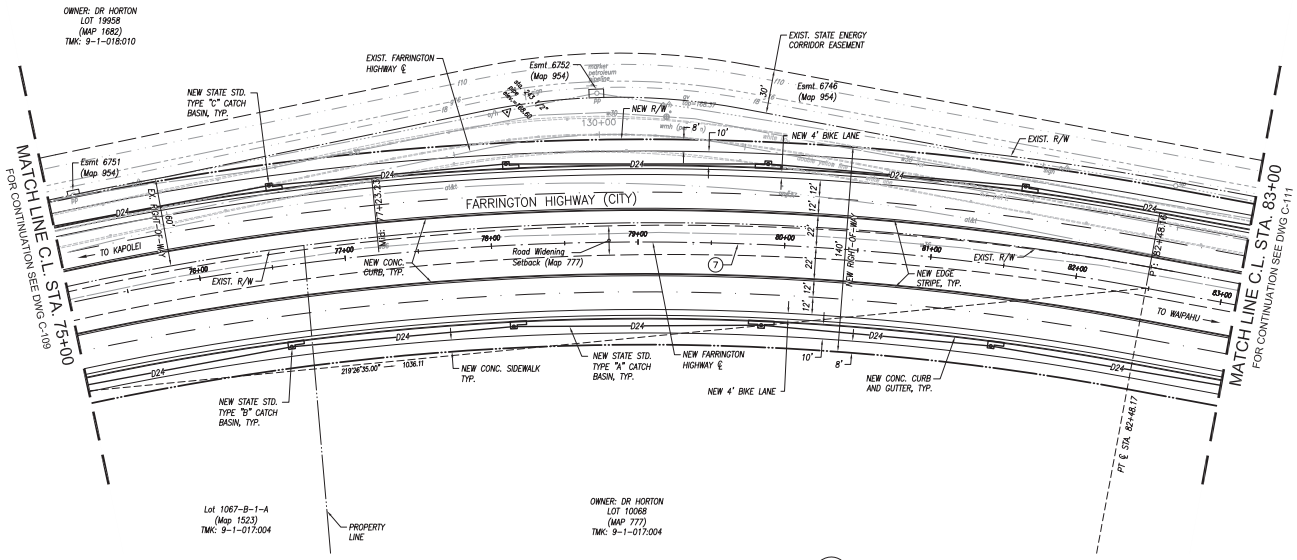
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 67+00 TO 75+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-109
SHEET 14 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT



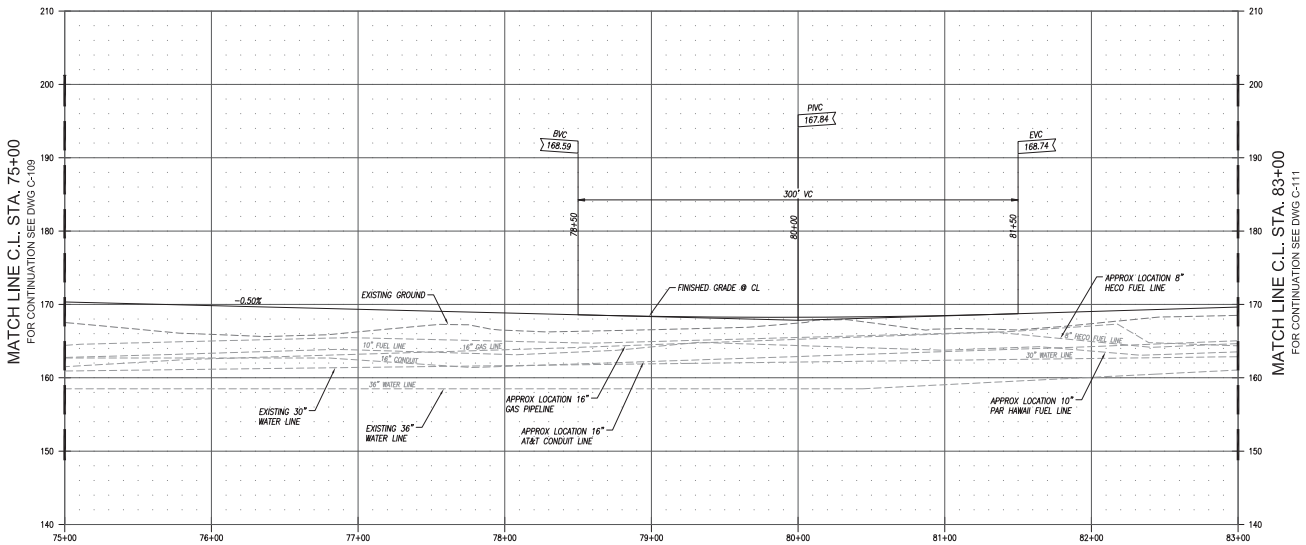
PLAN - C.L. STA. 75+00 TO 83+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
7	32°10'	16°05'	1,870.00	539.16	1,036.11	1,049.84

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 75+00 TO 83+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STANDARDS SET UNDER MY ORGANIZATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 75+00 TO 83+00

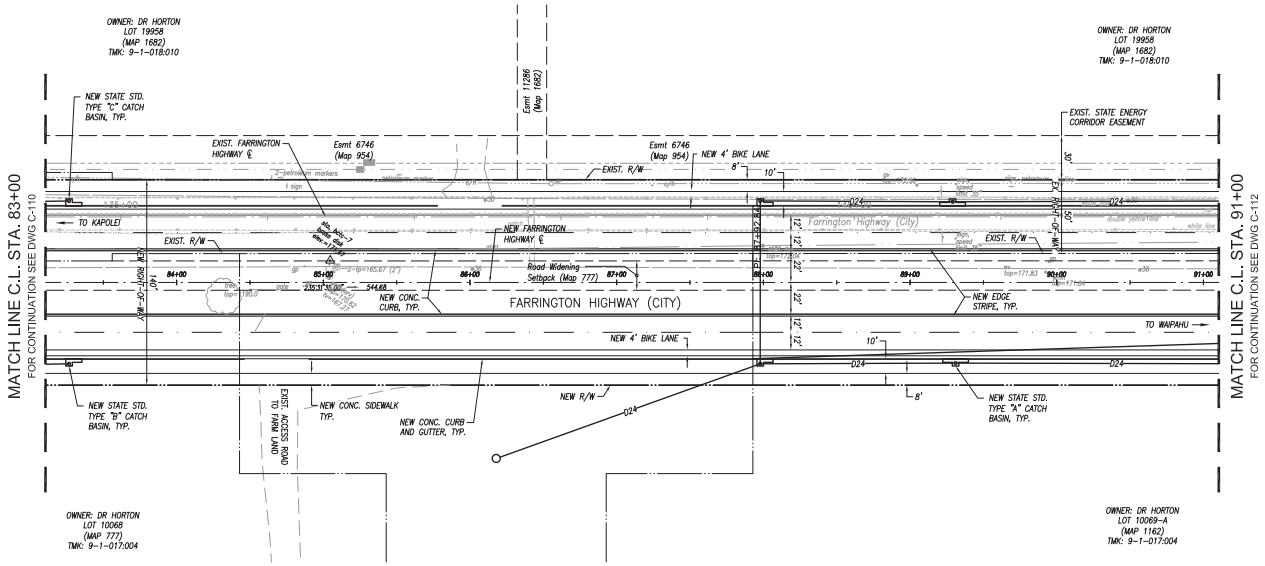
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE

DRAWING NO. C-110
SHEET 15 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT

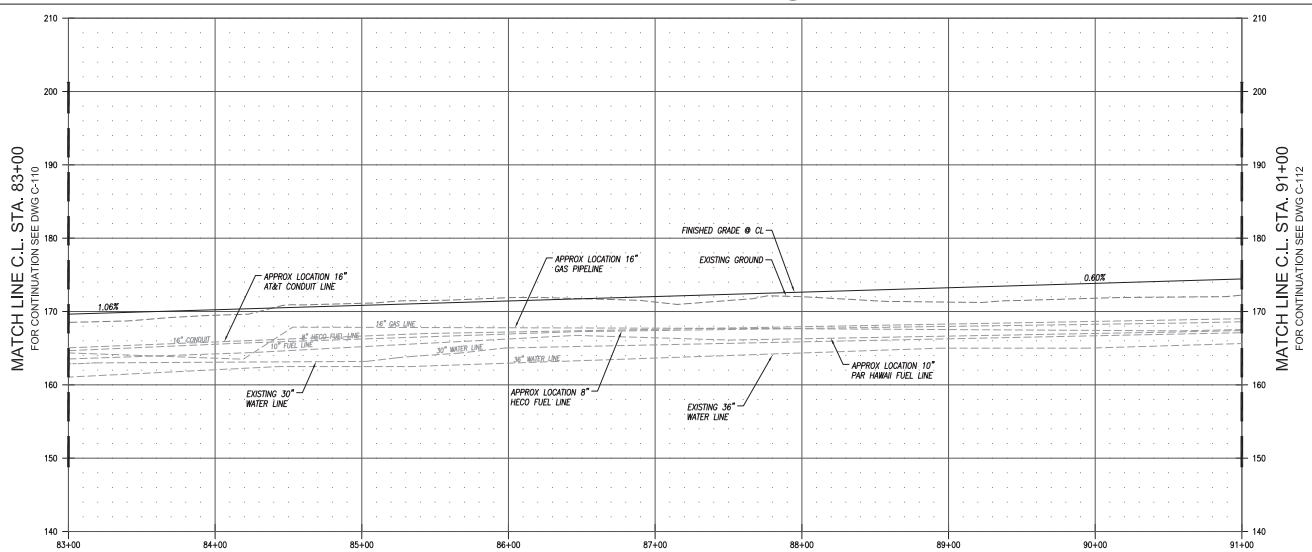


PLAN - C.L. STA. 83+00 TO 91+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 83+00 TO 91+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 83+00 TO 91+00

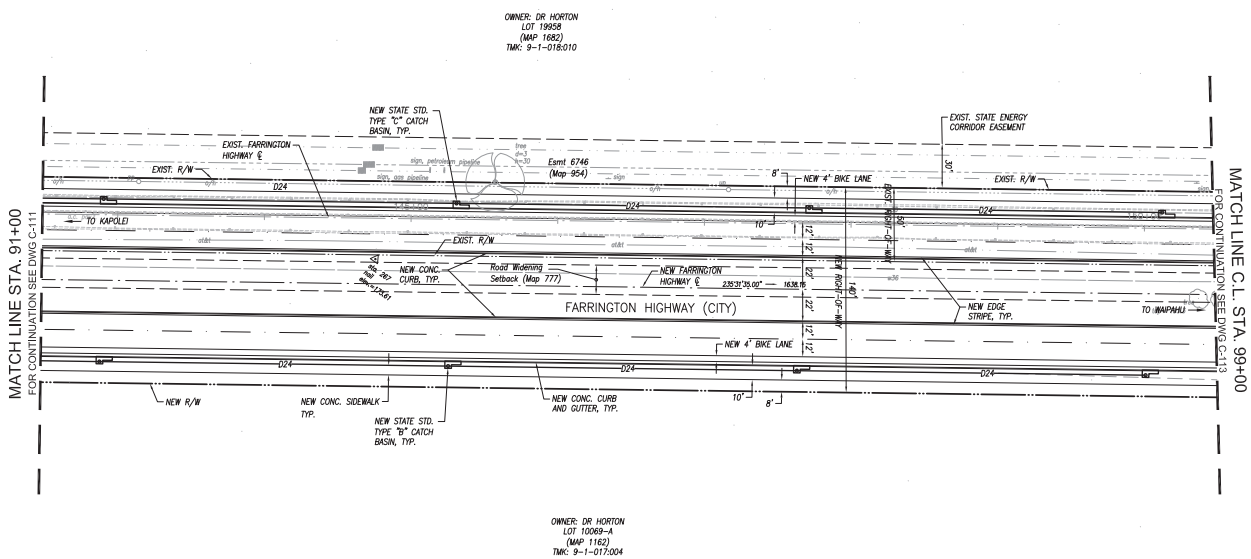
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE

DRAWING NO. C-111
SHEET 16 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-2_43+00-91+00.dwg

DRAFT DRAFT DRAFT

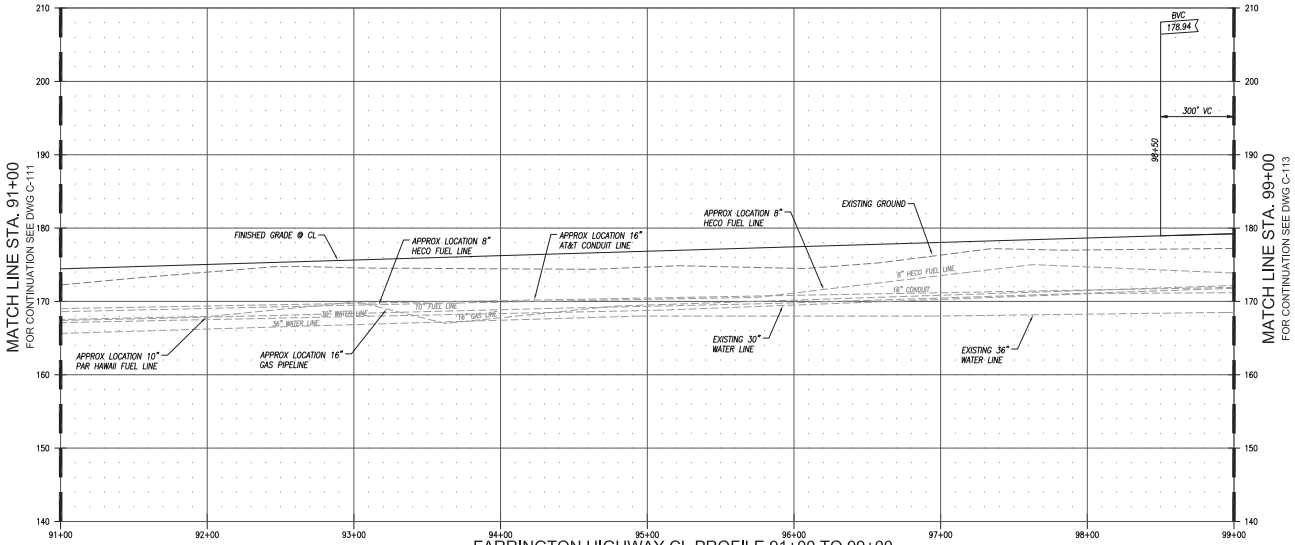


FARRINGTON HIGHWAY PLAN 91+00 TO 99+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



FARRINGTON HIGHWAY CL PROFILE 91+00 TO 99+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

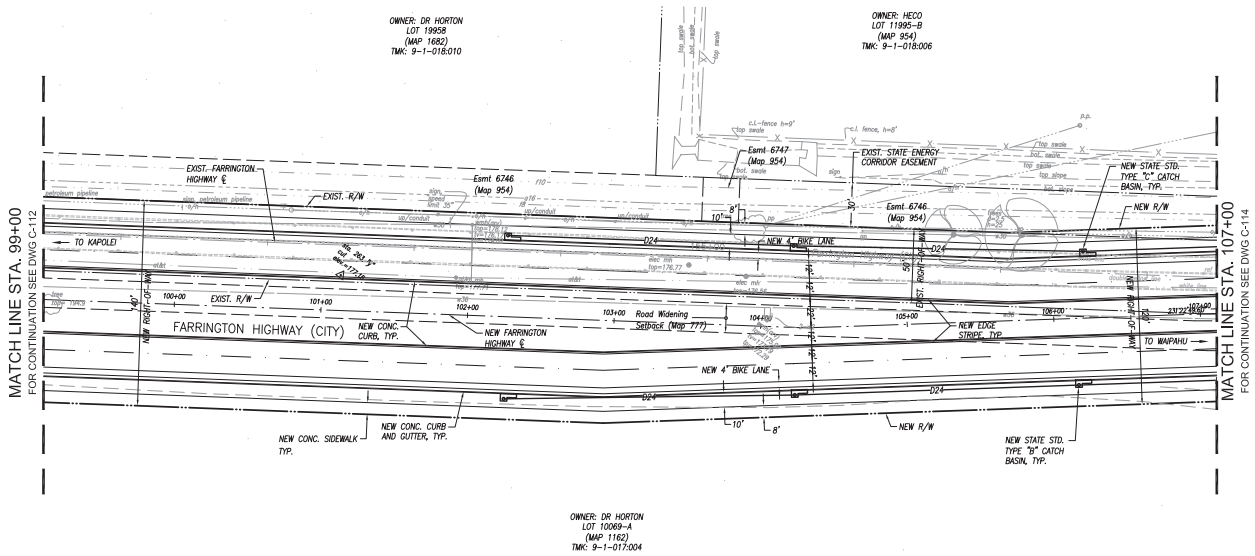
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 91+00 TO 99+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-112
SHEET 17 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-3_91+00-1311+00.dwg

DRAFT DRAFT DRAFT

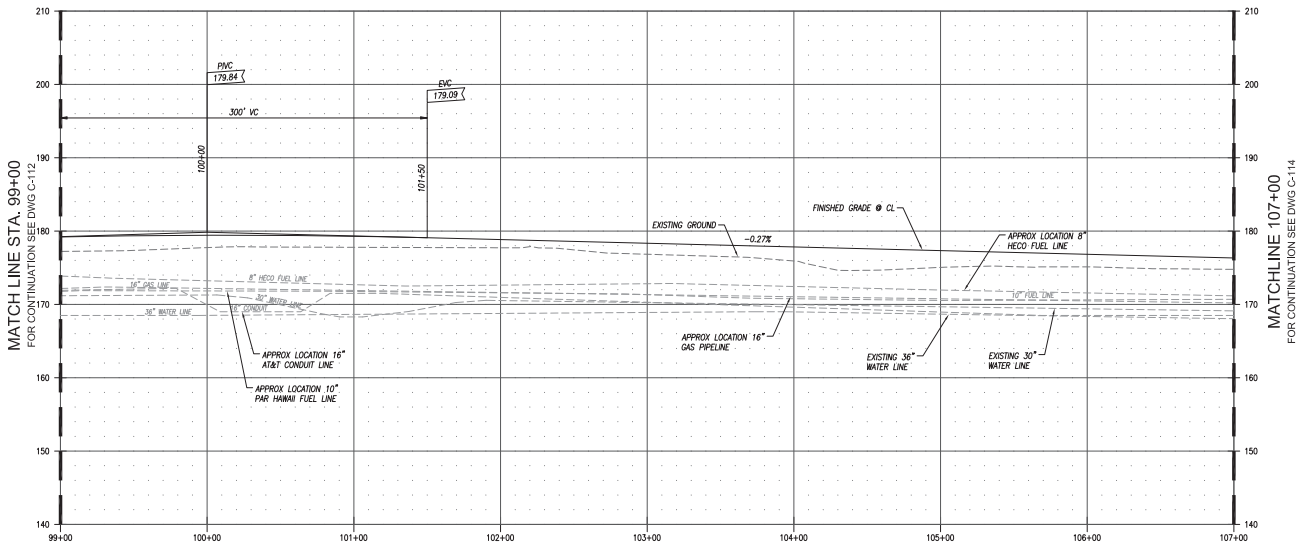


FARRINGTON HIGHWAY PLAN 99+00 TO 107+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



FARRINGTON HIGHWAY CL PROFILE 99+00 TO 107+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80

1" = 8' 8 0 8 16

GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF REGISTRATION OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI, 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 99+00 TO 107+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE

DRAWING NO. C-113
SHEET 18 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-3_91+00-131+00.dwg

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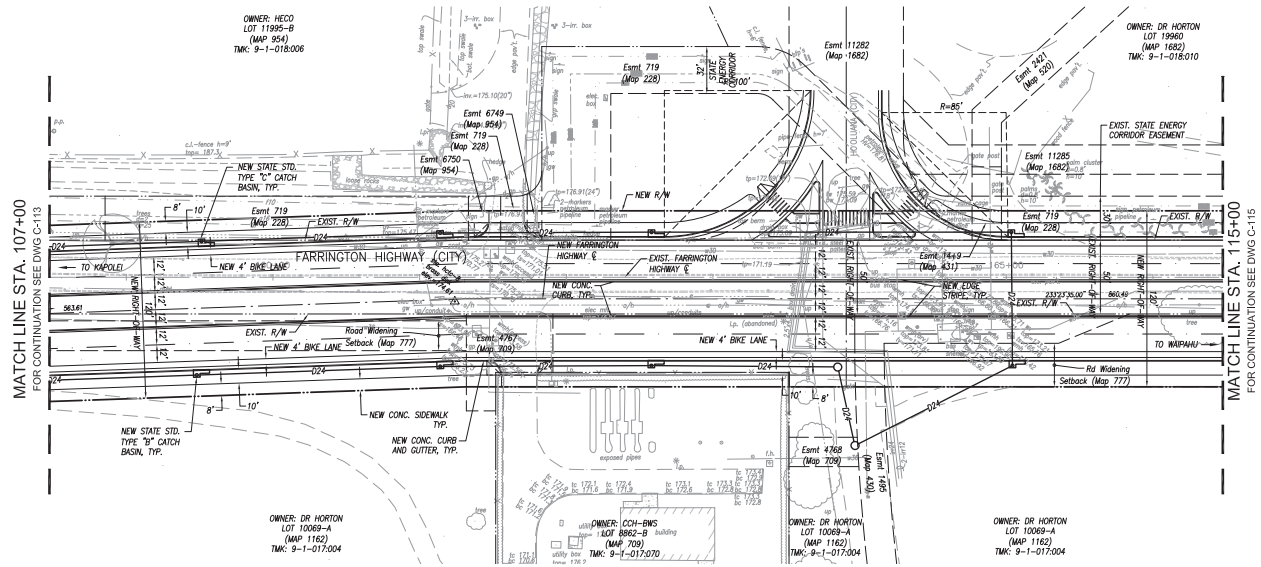
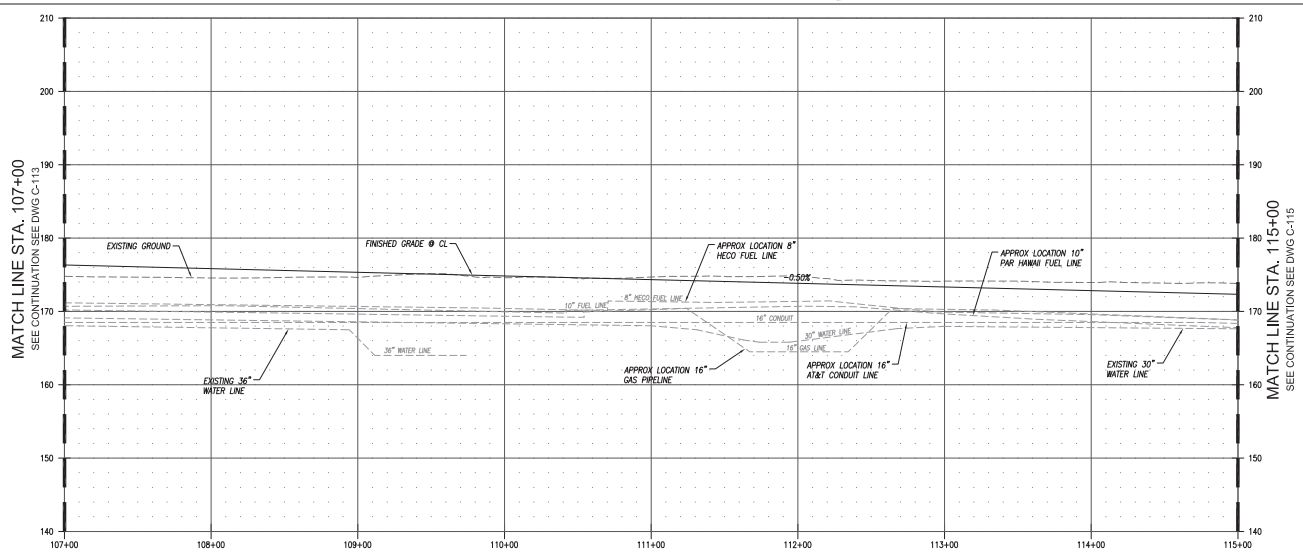


FARRINGTON HIGHWAY PLAN 107+00 TO 115+00

SCALE: 1" = 40'

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



FARRINGTON HIGHWAY CL PROFILE 107+00 TO 115+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 107+00 TO 115+00

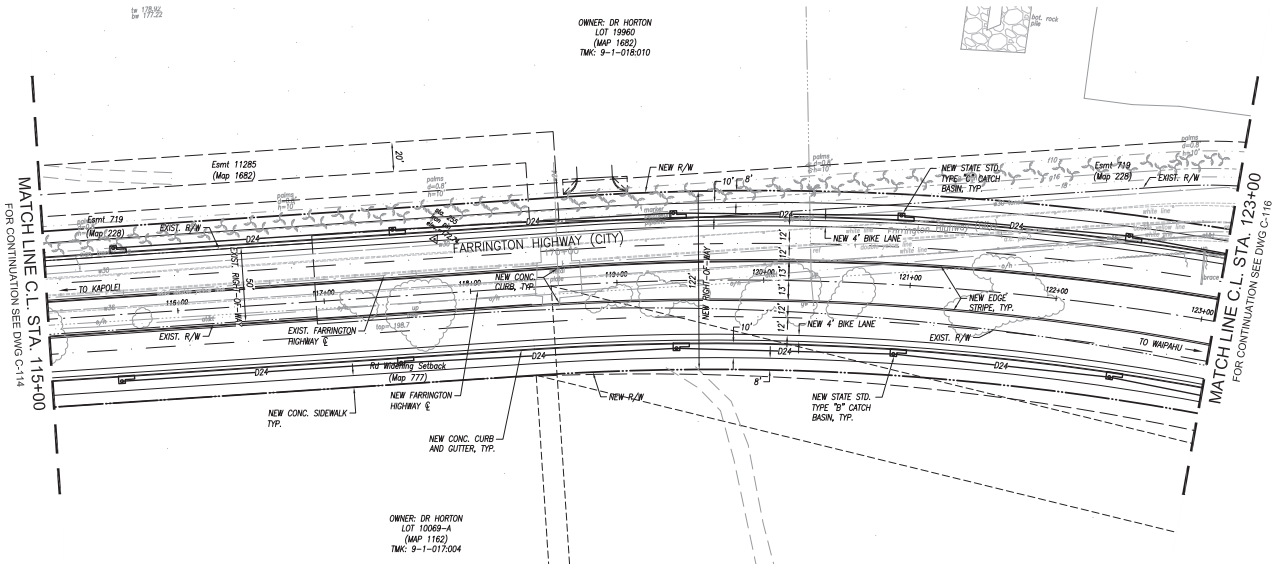
DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE

DRAWING NO. C-114
SHEET 19 OF 48 SHEETS

JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-3_9H+00-1311+00.dwg

DRAFT DRAFT DRAFT



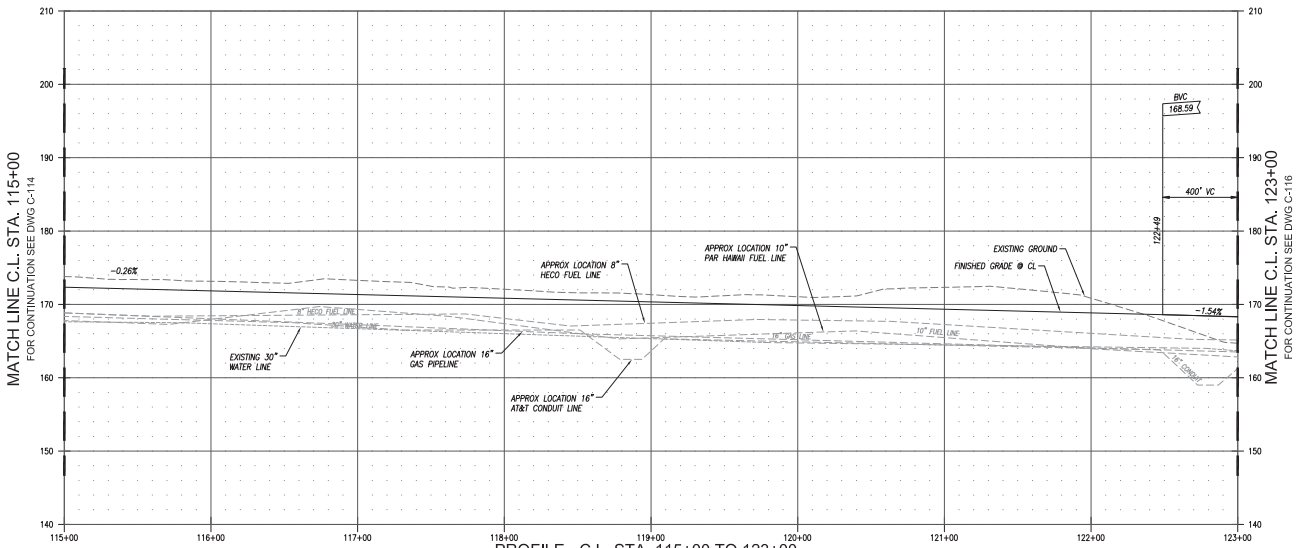
PLAN - C.L. STA. 115+00 TO 123+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
8	35°22'00"	17°41'00"	1,870.00	596.19	1,136.05	1,154.29

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 115+00 TO 123+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAW. UNDER MY OBSERVATION, CONSERVATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, ARE ADEQUATE TO CONFORM WITH THE RULES FOR PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

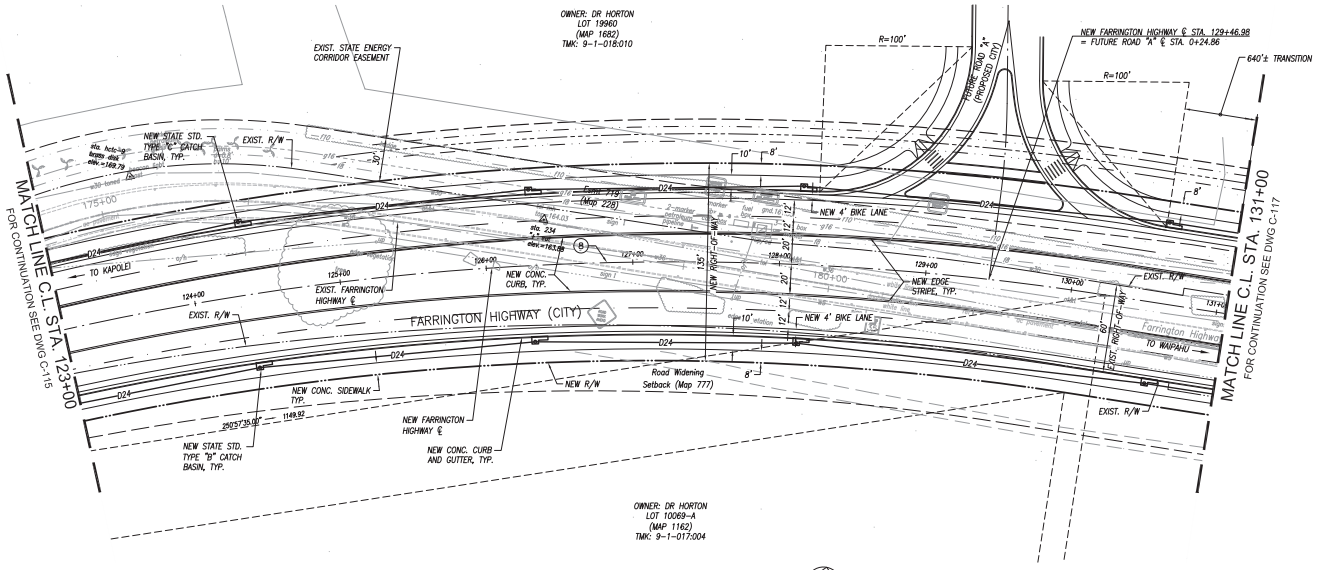
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 115+00 TO 123+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC DATE
DRAWING NO. C-115
SHEET 20 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-3_91+00-131+00.dwg

DRAFT DRAFT DRAFT



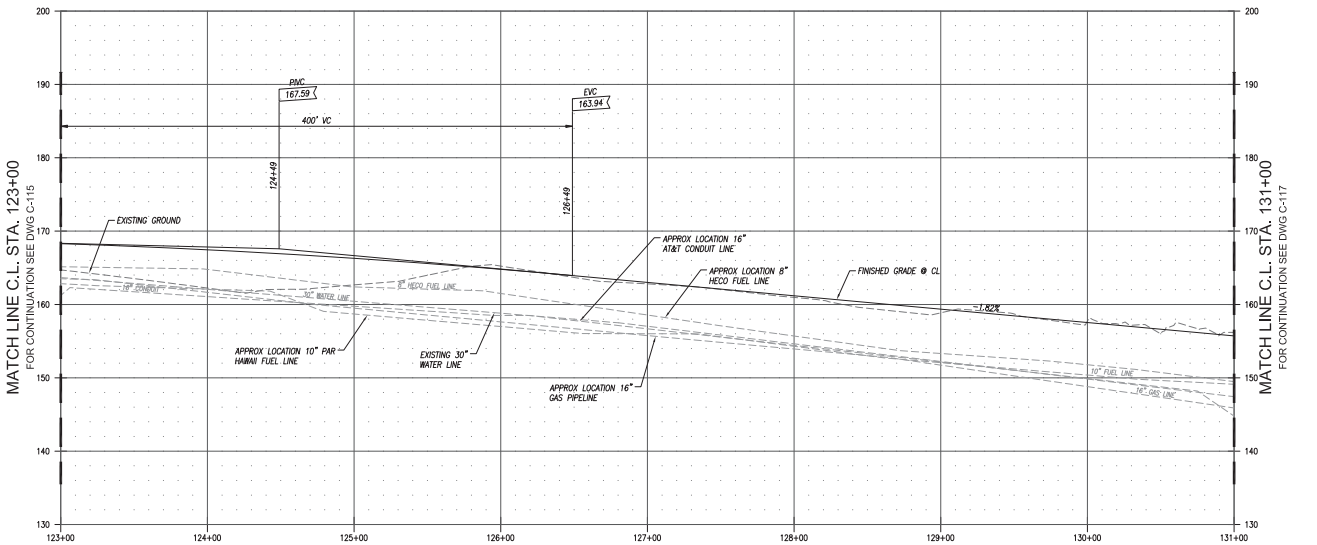
PLAN - C.L. STA. 123+00 TO 131+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
8	35°22'00"	17°41'00"	1,870.00	596.19	1,136.05	1,154.29

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 123+00 TO 131+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND COMPLIES WITH STATE OF HAWAII LAWS UNDER MY ORGANIZATION, CORPORATION OF CONSTRUCTION AS DEFINED IN SECTION 16-115-2 OF THE STATE OF HAWAII DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS, BOARD OF PROFESSIONAL ENGINEERS, ARCHITECTS, SURVEYORS, AND LANDSCAPE ARCHITECTS 8/29/94).

SIGNATURE
LICENSE EXP. DATE: APRIL 30, 2022

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
CIVIL DIVISION

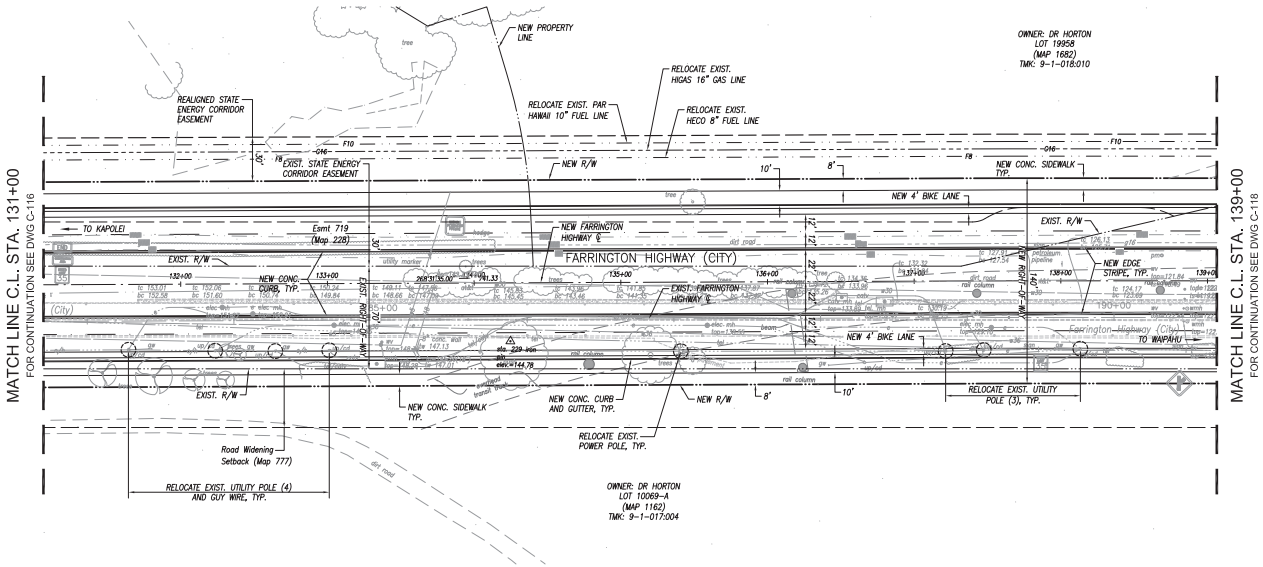
FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 123+00 TO 131+00

DESIGN:
DRAWN:
CHECKED:
DATE: 05/14/2020
APPROVED:
CHIEF, CIVIL DIVISION, DDC
DATE
DRAWING NO. C-116
SHEET 21 OF 48 SHEETS
JOB NO. 212009-01
FILE ____ DRAW ____ FOLDER ____ NUMBER ____

PROJECT NAME: 212009
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 PLAN PROFILE-3_91+00-131+00.dwg

DRAFT DRAFT DRAFT



PLAN - C.L. STA. 131+00 TO 138+00

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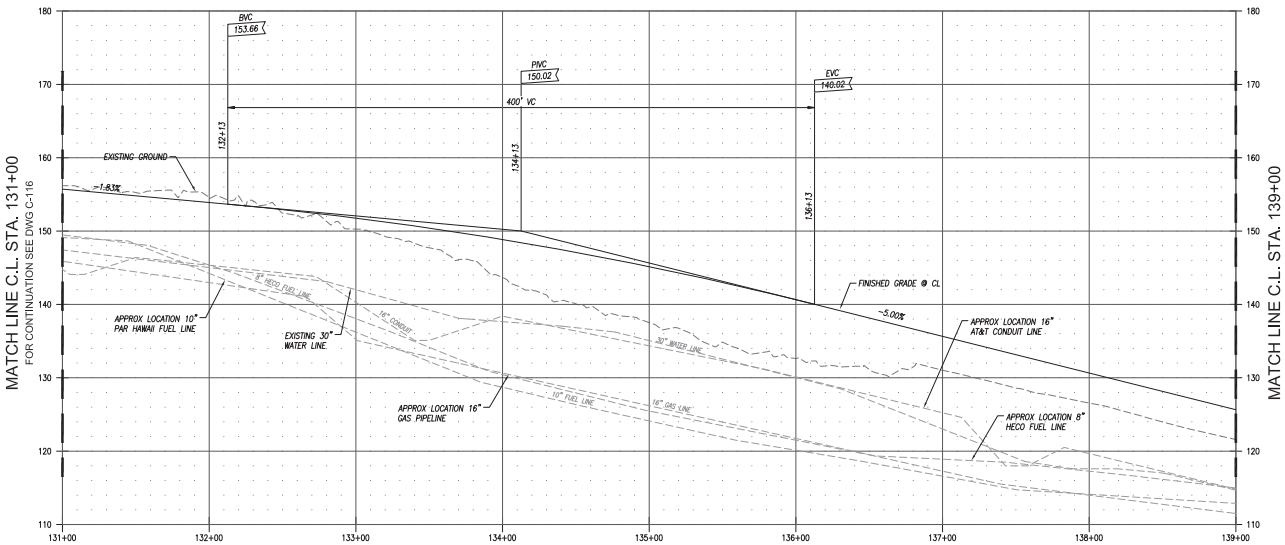

PROFILE - C.L. STA. 131+00 TO 138+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER

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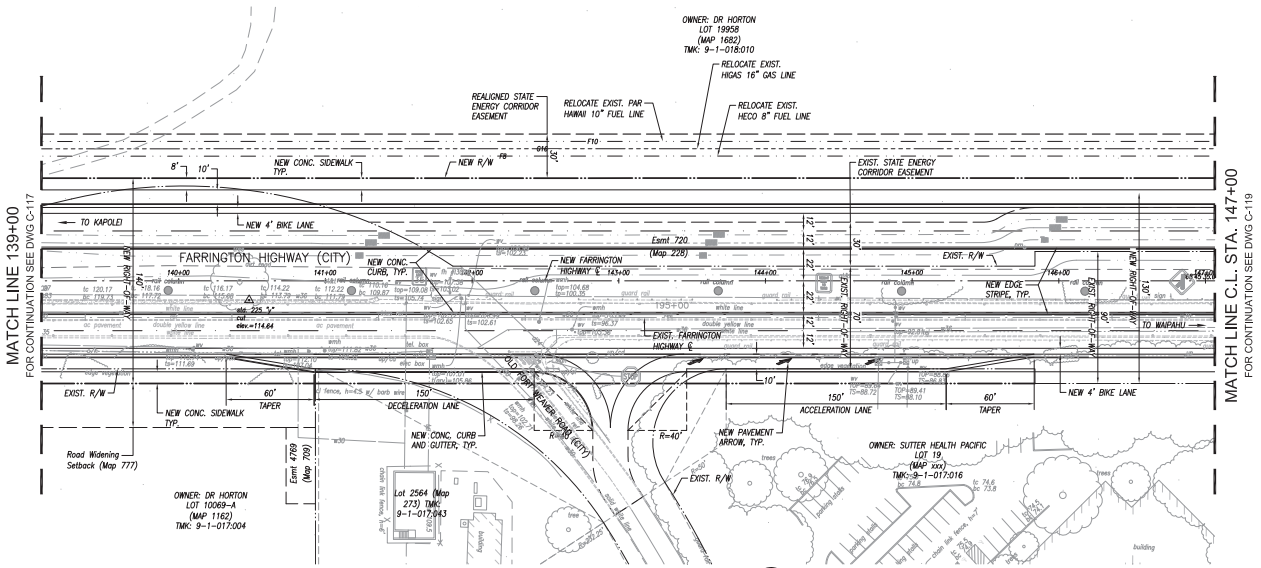

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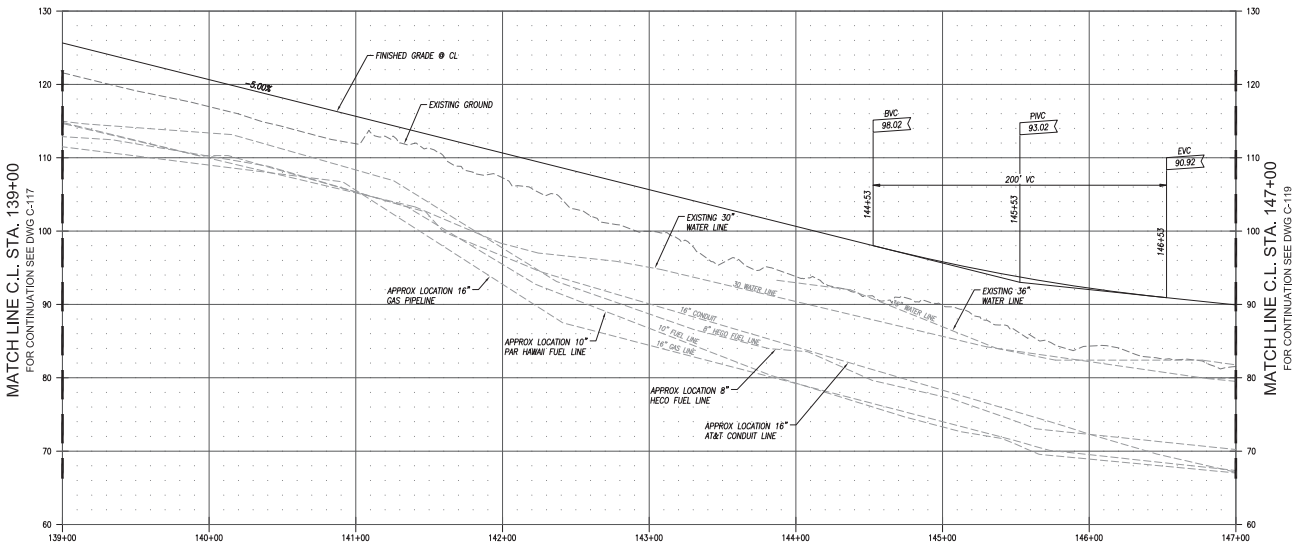

PROFILE - C.L. STA. 139+00 TO 147+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER

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HONOULIULI 'EWA, O'AHU, HAWAI'I

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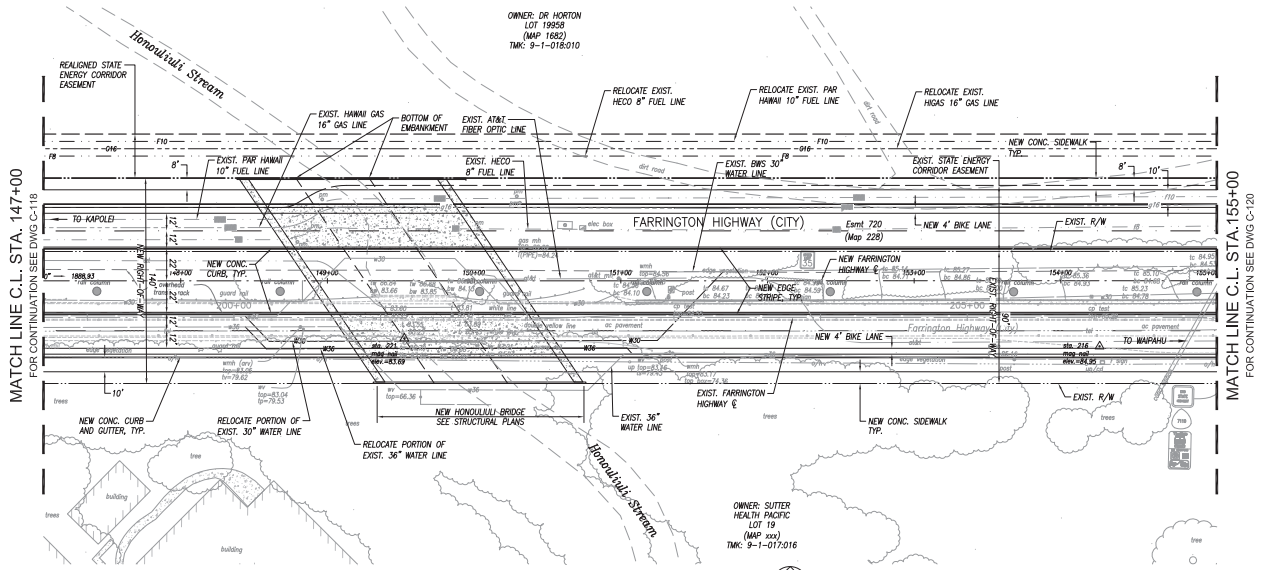

PLAN - C.L. STA. 147+00 TO 155+00

SCALE: 1" = 40'

LEGEND

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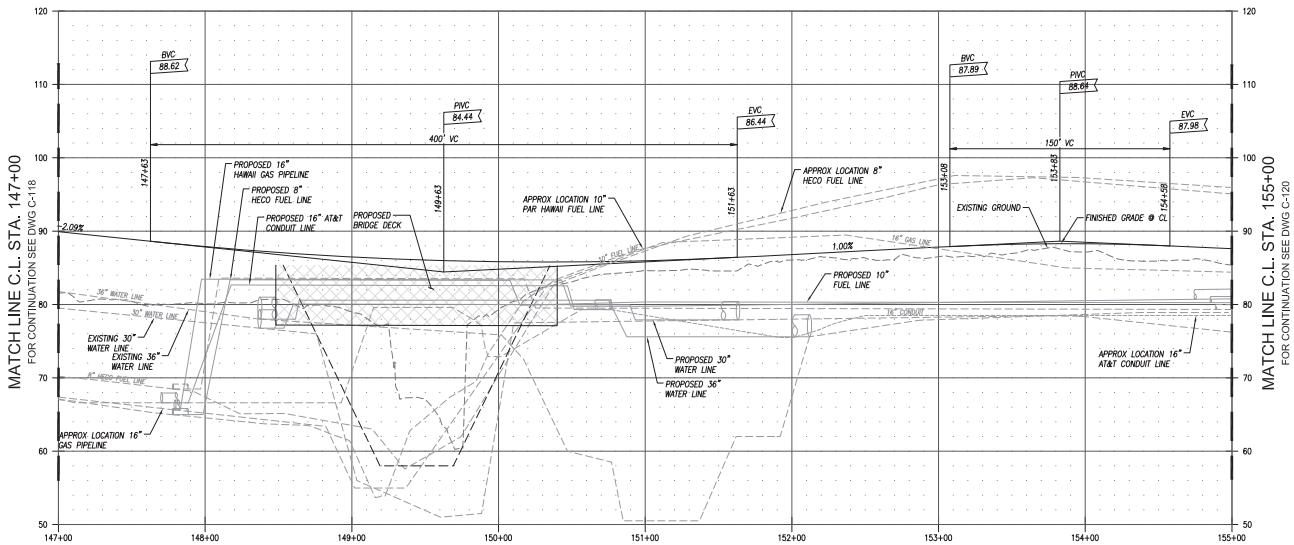
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 147+00 TO 155+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

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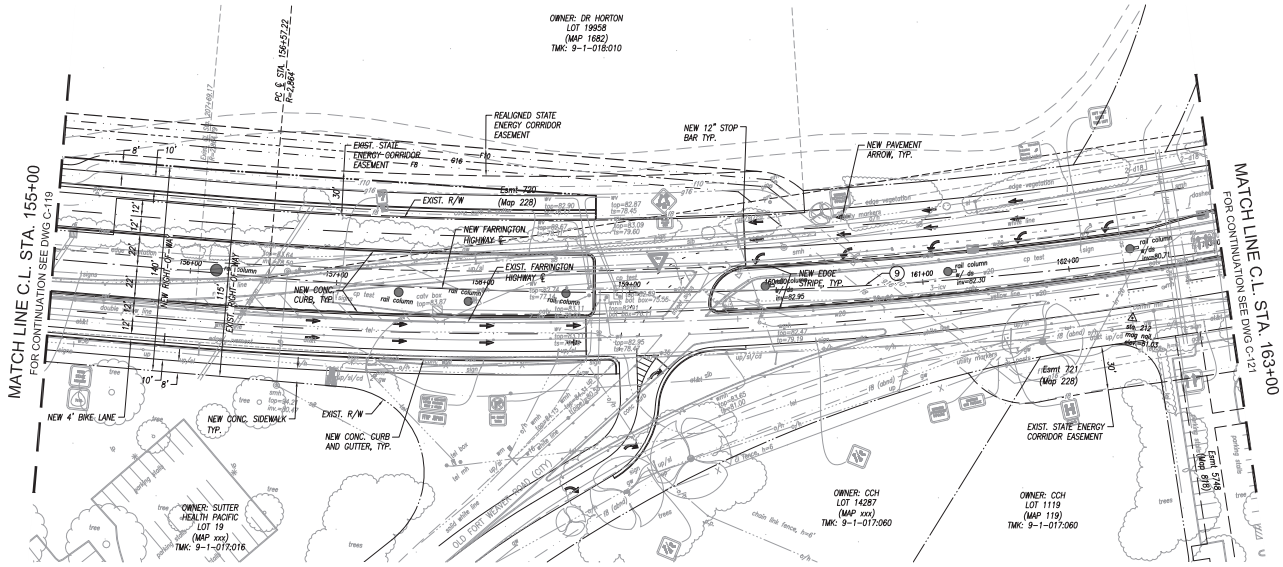


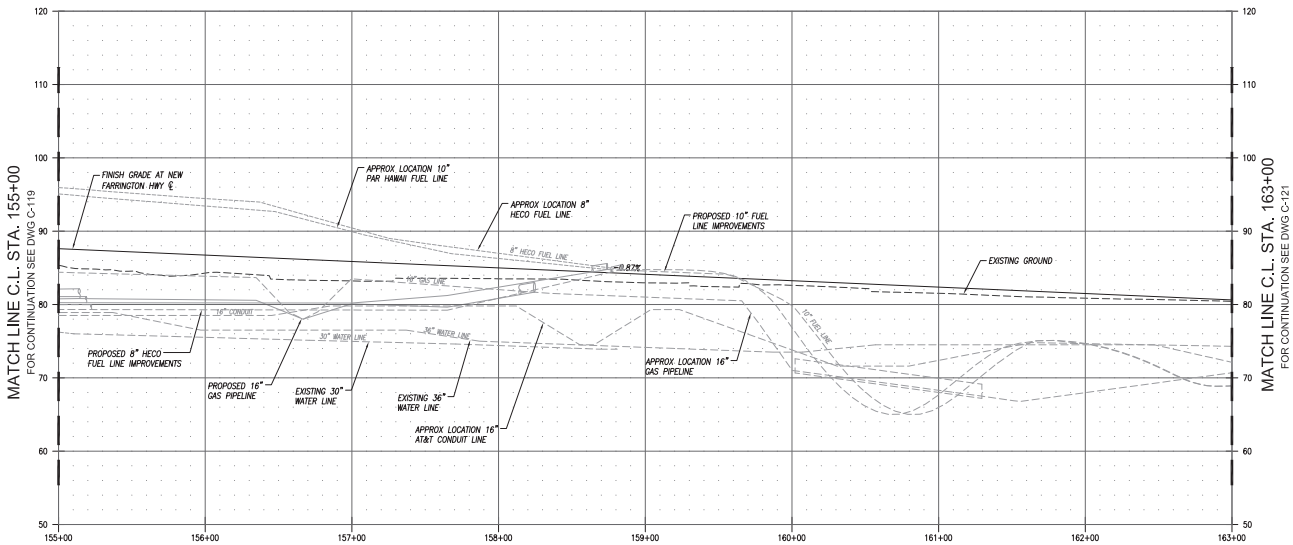
PLAN - C.L. STA. 155+00 TO 163+00

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
9	17°45'14"	8°52'37"	2300.00	359.22	709.83	712.68

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
- EXIST. EASEMENT
- EXIST. STATE ENERGY CORRIDOR EASEMENT
- EXIST. ROAD CENTERLINE
- NEW ROAD CENTERLINE
- EXIST. WATER
- EXIST. TELECOM
- EXIST. ELECTRICAL
- EXIST. NATURAL GAS
- EXIST. FUEL
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 155+00 TO 163+00

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

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CITY AND COUNTY OF HONOLULU
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FARRINGTON HIGHWAY WIDENING
FROM KAPOLEI GOLF COURSE ROAD TO FT. WEAVER ROAD
HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 155+00 TO 163+00

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SHEET 25 OF 48 SHEETS
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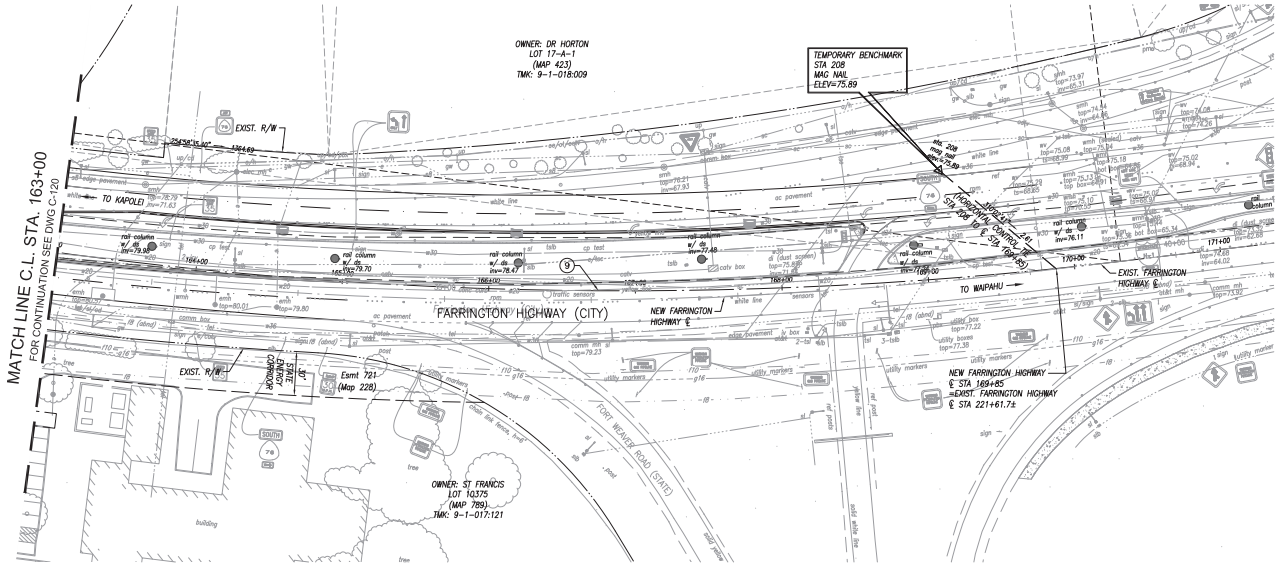

PLAN - C.L. STA. 163+00 TO END

SCALE: 1" = 40'

CURVE DATA						
CURVE NO	Δ	Δ/2	R	T	C	Lc
9	17°45'14"	8°52'37"	2,300.00	359.22	709.83	712.68

LEGEND

- EXIST. PROPERTY LINE
- EXIST. FARRINGTON HWY RIGHT-OF-WAY
- NEW FARRINGTON HWY RIGHT-OF-WAY
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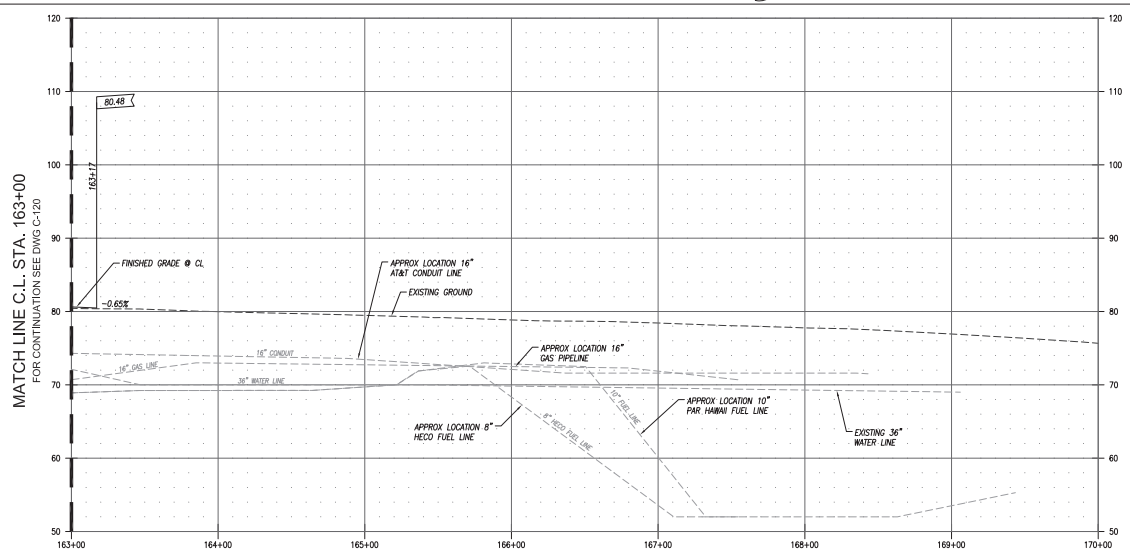
- EXIST. DRAIN
- EXIST. SEWER



PROFILE - C.L. STA. 163+00 TO END

SCALES: 1" = 40' HOR
1" = 8' VER

1" = 40' 40 20 0 40 80
1" = 8' 8 0 8 16
GRAPHIC SCALE IN FEET

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HONOULIULI 'EWA, O'AHU, HAWAI'I

PLAN AND PROFILE
CL STA 163+00 TO END

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SHEET 26 OF 48 SHEETS

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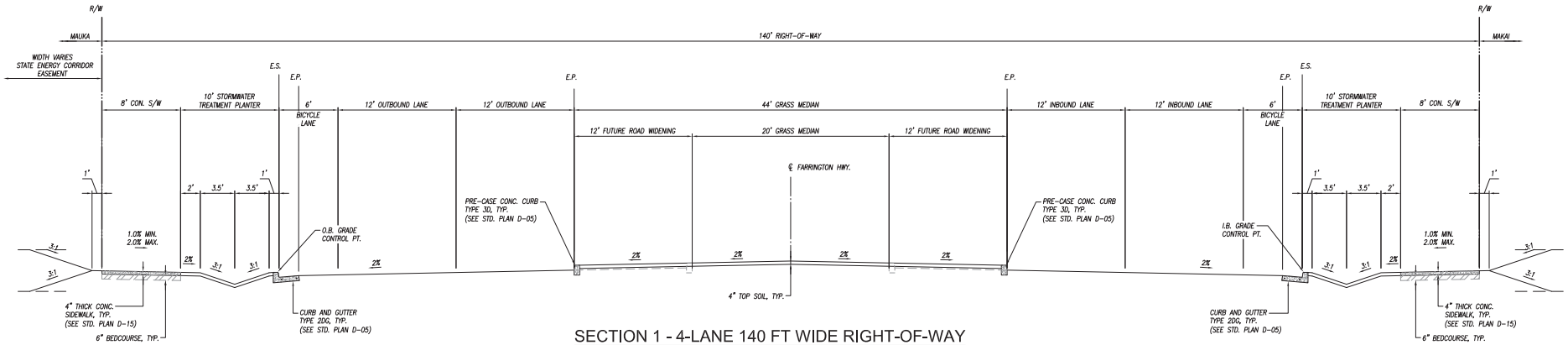
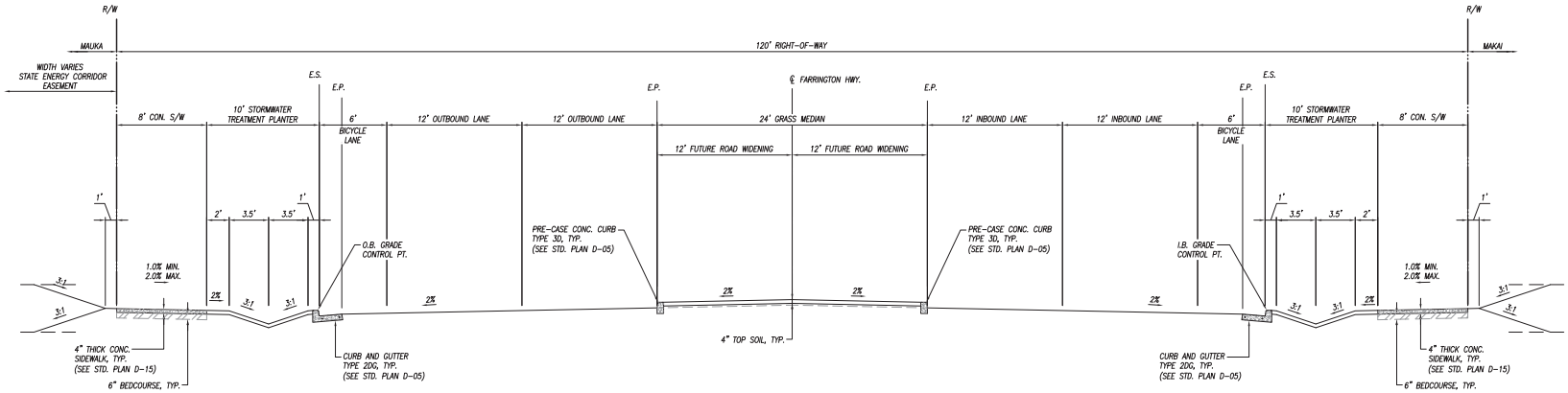


SECTION 1 - 4-LANE 140 FT WIDE RIGHT-OF-WAY

SCALE: 1" = 5'



SECTION 2 - 4-LANE TRANSITION FROM 140' R/W TO 120' R/W

SCALE: 1" = 5'

REVISION	DATE	DESCRIPTION	ENGR.	APPROVED

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TYPICAL SECTION 1 & 2

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SHEET
OF 48 SHEETS
JOB NO. 212009-01
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PROJECT NAME: 212009-01
CAD DWG NO.: P:\2012\212009-01 DDC Farrington EA Pre Design\Civil DWGS\212009-01 Typ Sections.dwg

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Appendix F

Archaeological Literature Review and Field Inspection

Draft

Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for Bridges in the Farrington Highway Improvements Project, Honouliuli Ahupuaʻa, ʻEwa District, Oʻahu TMKs: [1] 9-1-016, 017, and 018

Prepared for
Group 70 International, Inc.
and
City and County of Honolulu

Prepared by
Sara M. Blahut, M.A,
Michelle Pammer Clark, B.A.,
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawaiʻi, Inc.
Kailua, Hawaiʻi

(Job Code: HONOULIULI 152)

August 2019

Oʻahu Island	Maui Island	Hawaiʻi Island	Kauaʻi Island
P.O. Box 1114	1860 Main Street	399 Hualani St.	2970 Kele St
Kailua, HI 96734	Wailuku, HI 96793	Suite 124	Suite 114
Ph: (808) 262-9972	Ph: (808) 242-9882	Hilo, HI 96720	Līhuʻe, HI 96766
Fax: (808) 262-4950	Fax: (808) 244-1994	Ph. (866) 956-6478	Ph. (808) 245-9374

Management Summary

Reference	Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for Bridges in the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018 (Blahut et al. 2019)
Date	August 2019
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: HONOULIULI 152
Investigation Permit Number	CSH conducted the fieldwork component of this literature review and field inspection (LRFI) under archaeological fieldwork permit number 18-15, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-282.
Agencies	SHPD, City and County of Honolulu Department of Design and Construction (DDC), Federal Highway Administration (FHWA)
Project Proponent	City and County of Honolulu DDC
Project Funding	FHWA
Land Jurisdiction	City and County of Honolulu (City), State of Hawai‘i (State), United States of America, Grace Pacific Corporation, Ho‘opili (D.R. Horton), Honolulu Electric Company, Campbell Hawai‘i, Saint Francis Healthcare System, University of Hawai‘i West O‘ahu, and Hawaiian Golf Properties, LLC.
Project Location	The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of a 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) topographic quadrangle.
Project Description	The City DDC is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned/recent projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.
Project Acreage	The project area comprises approximately 149.7 acres (60.58 hectares) over 3.1 linear miles.
Area of Potential Effect (APE)	The APE is considered the entire 3.1-mile-long project area
Document Purpose	This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the

	project area—to determine the likelihood that cultural resources/historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project's planning and support the project's historic preservation and environmental review compliance. This investigation does not fulfill the requirements of an archaeological inventory survey investigation, per HAR §13-276, nor does it fulfill the requirements of Section 106 of the National Historic Preservation Act. Consequently, this report cannot be used to make formal recommendations for federal agency and SHPD review and acceptance.
Fieldwork Effort	CSH archaeologist, Sara Blahut, M.A., conducted the field inspection 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete.
Results Summary	Seven historic crossings (bridges and culverts) were identified during the field inspection. These consist of Palehua Stream Bridge, an unnamed culvert, two bridges at Hunehune Gulch, two bridges at Kaloi Gulch, and Honouliuli Stream Bridge. The Palehua Stream Bridge and the Honouliuli Stream Bridge have previously been assessed as eligible for the National Register of Historic Places (MKE Associates LLC/Fung Associates, Inc. 2013). For the completion of the proposed project it is anticipated that all crossings will need to be replaced.

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Section 1 Introduction

1.1 Project Background

At the request of Group 70 International, Inc. (G70), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this literature review and field inspection report (LRFI) to support consultation with the State Historic Preservation Division (SHPD) for the Farrington Highway Improvements project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018. The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of the 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 through Figure 4), and a 2013 aerial photograph (Figure 5).

The City and County of Honolulu, Department of Design and Construction (DDC), is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned/recent projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.

1.2 Document Purpose

This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project area—to determine the likelihood that historic properties may be affected by the project and based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project’s planning and support the project’s historic preservation and environmental review compliance. This investigation does not fulfill the requirements of an archaeological inventory survey investigation, per Hawai‘i Administrative Rules (HAR) §13-276. Consequently, this report cannot be used to make formal recommendations for SHPD review and acceptance.

1.1 Environmental Setting

1.1.1 Natural Environment

The project area extends through the ‘Ewa Plain, *makai* (seaward) of the Wai‘anae Mountains. The ‘Ewa Plain is a Pleistocene (>38,000 years old) reef platform overlain by alluvium. The terrain consists of limestone and alluvial deposits, which overlie flows of the Wai‘anae volcanic series (Macdonald et al. 1983:423). In pre-Contact Hawai‘i, the project area would have been covered by lowland dry shrub and grassland; however, the area has been extensively disturbed and transformed by human activity and is now dominated by a variety of exotic grasses, weeds, and shrubs.

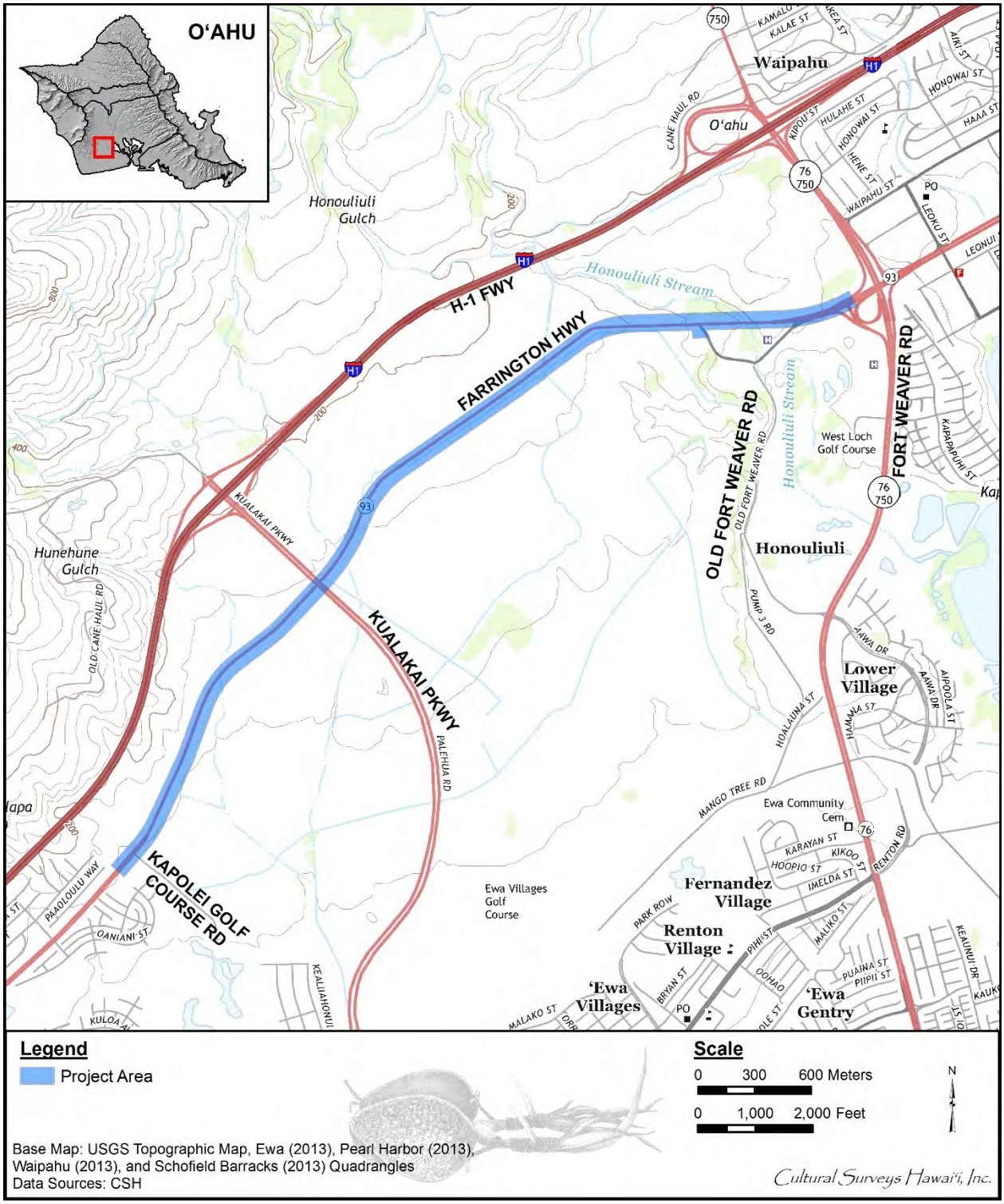


Figure 1. Portion of the 2013 USGS 7.5-minute topographic quadrangle showing the location of the project area

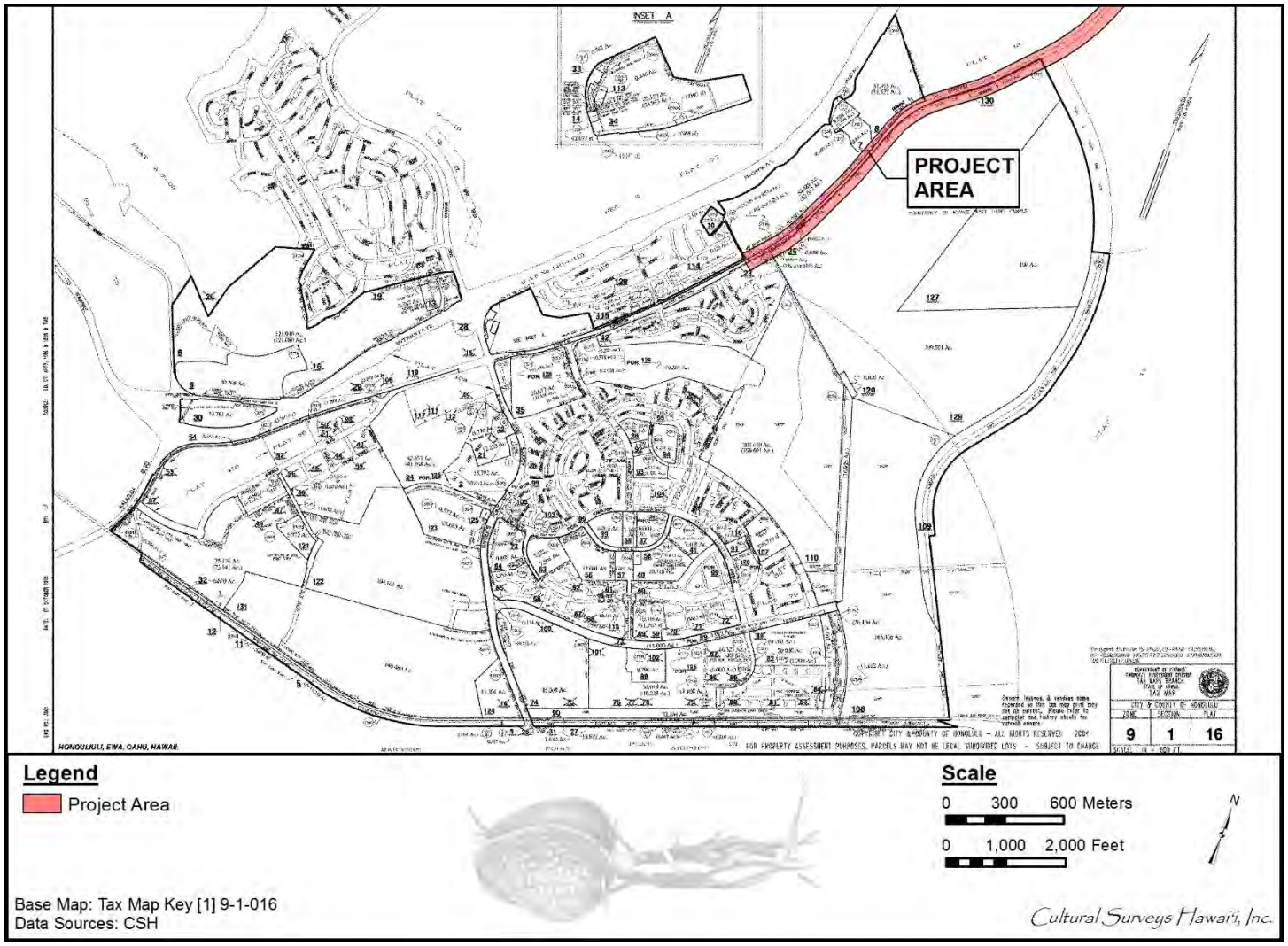


Figure 2. TMK: [1] 9-1-016 showing portion of the project area (Hawai‘i TMK Service 1996)

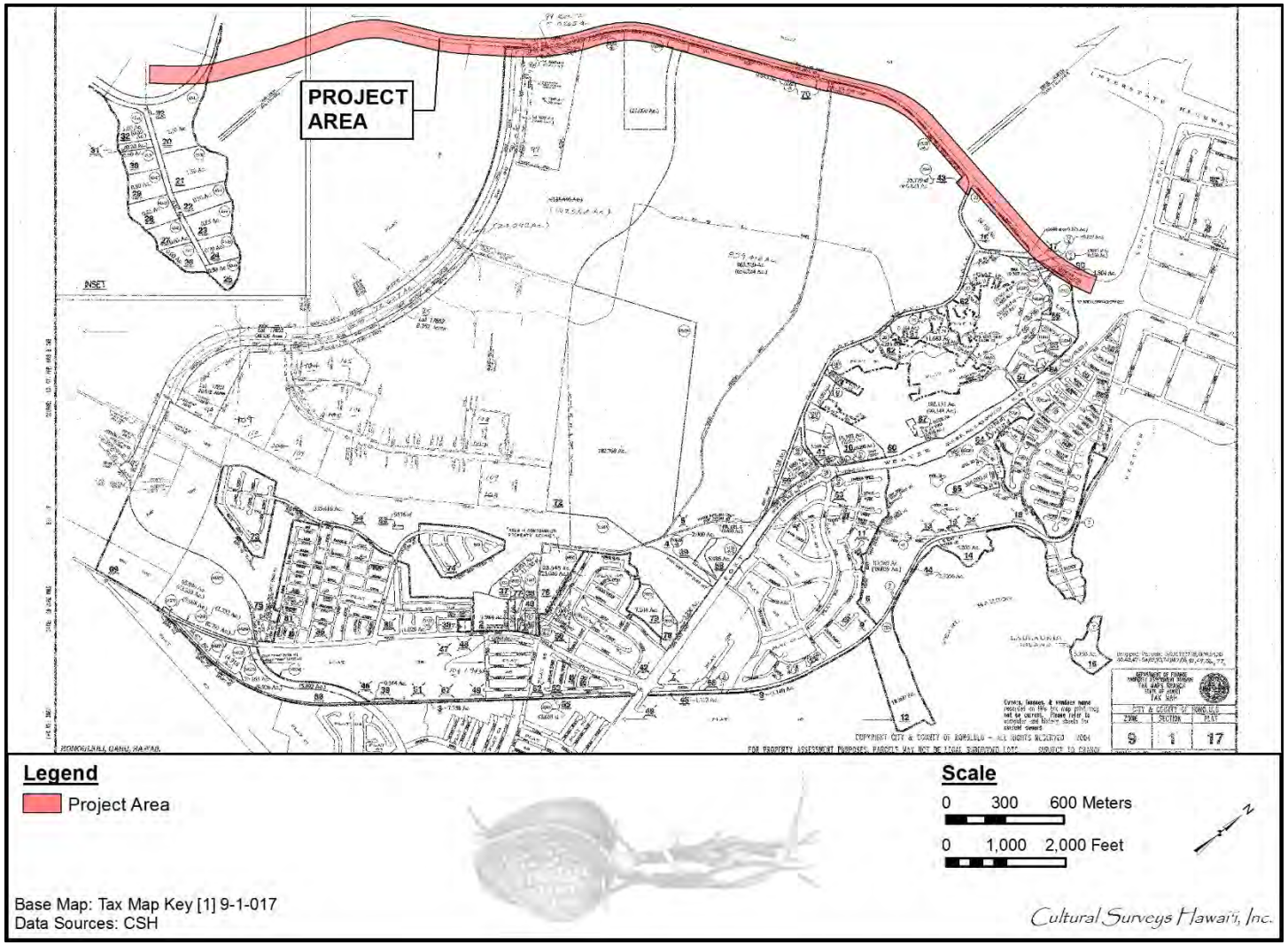


Figure 3. TMK: [1] 9-1-017 showing the project area (Hawai‘i TMK Service 1999)

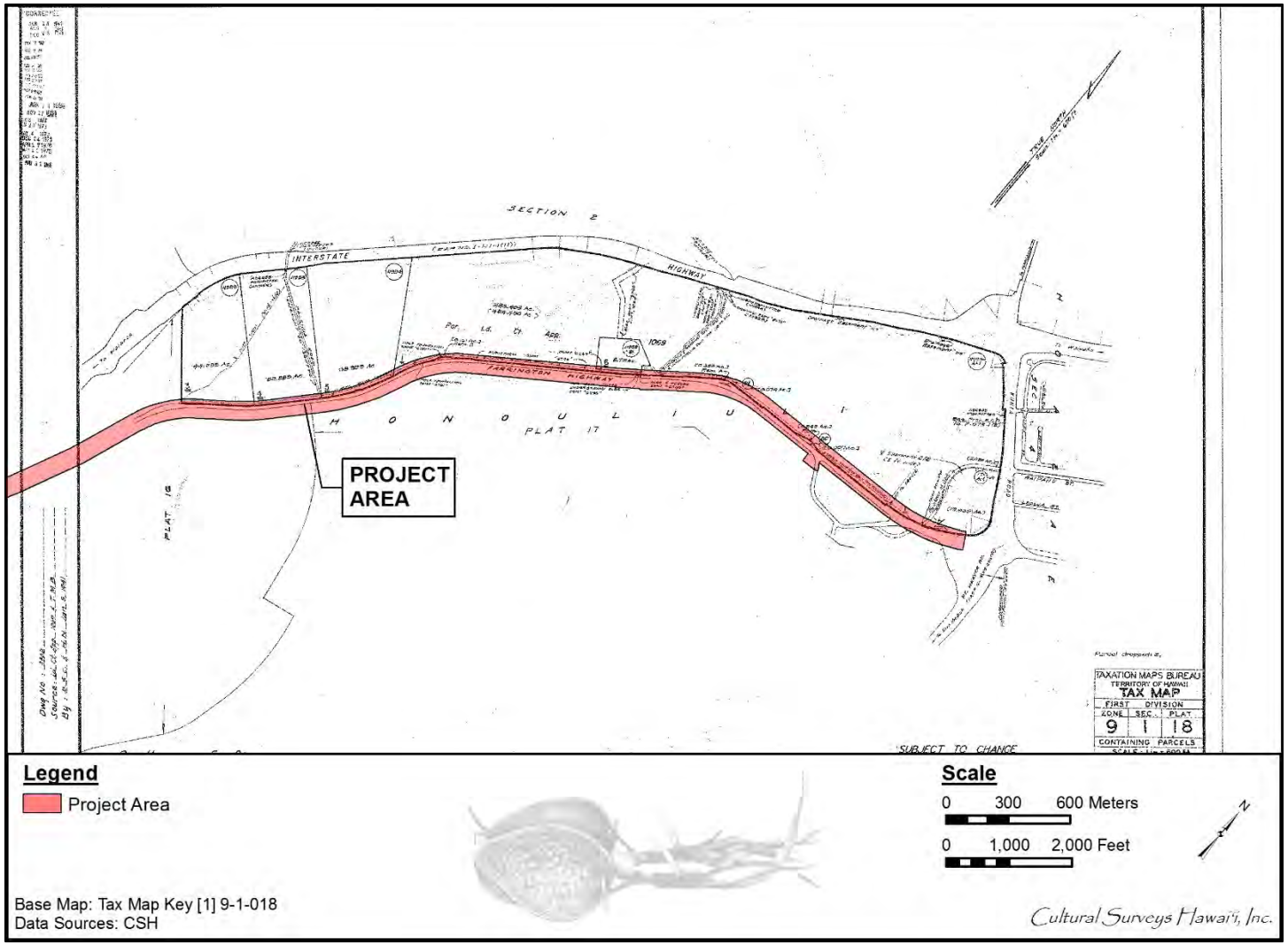


Figure 4. TMK: [1] 9-1-018 showing portion of the project area (Hawai‘i TMK Service 1996)

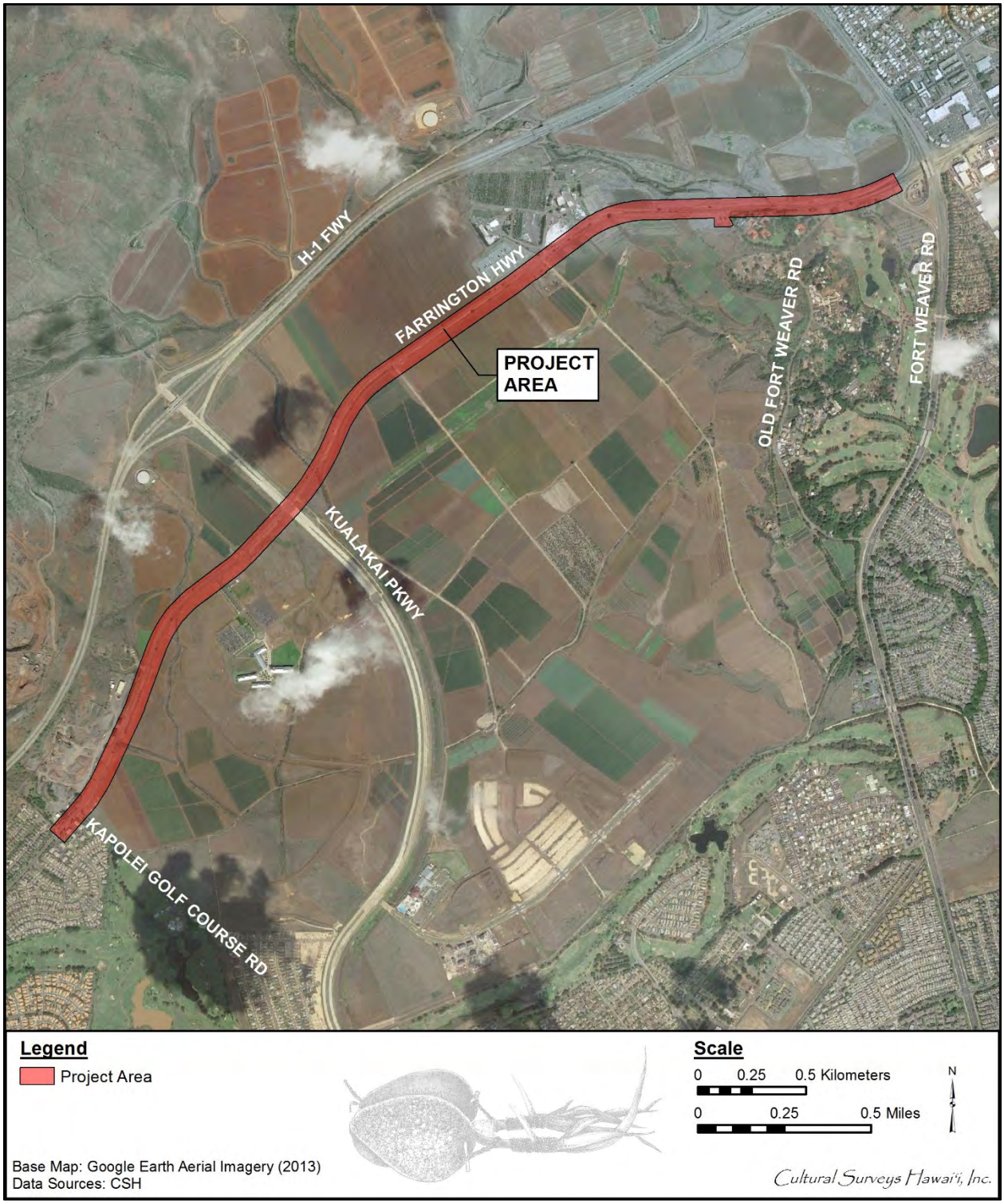


Figure 5. Aerial photograph of the project area (Google Earth Imagery 2013)

In the late nineteenth and early twentieth centuries, the Ewa Plantation Company installed ditches running from the lower slopes of the Wai‘anae Mountains to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17). These activities relocated sediments from the higher, soil-rich slopes of the Wai‘anae Mountains down to the soil-poor Pleistocene limestone plains of the Kalaeloa area. Portions of the agricultural lands in Honouliuli were developed from this arable land expansion program. In traditional Hawaiian times, the areas of exposed coral outcrop were undoubtedly more extensive.

The project area receives an average of 23–24 inches of annual rainfall (Giambelluca et al. 2013). Honouliuli Stream is the only major stream traversed by the project area. Elevations within the project area range from approximately 80 to 160 feet (ft) above mean sea level.

The vicinity of the project area is made up of various soils and sediments (Figure 6). The project area is composed of 12 soil types: Ewa silty clay loam (3 to 6% slopes, EaB), Ewa stony silty clay (6 to 12% slopes, EwC), Mahana silty clay loam (12 to 20% slopes, eroded, McD2), Honouliuli clay (0 to 2% slopes, HxA), Honouliuli clay (2 to 6% slopes, HxB), Kawaihapai clay loam (0 to 2% slopes, KIA), Kunia silty clay (0 to 3% slopes, KyA), Water (W), Waialua stony silty clay (3 to 8% slopes, WIB), Waialua silty clay (0 to 3% slopes, WkA), Waipahu silty clay (0 to 12% slopes, WzA), and Waipahu silty clay (6 to 12% slopes, WzC).

Soils of the Ewa Series are described as follows:

> This series consists of well-drained soils in basins and on alluvial fans on the islands of Maui and Oahu. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from near sea level to 150 feet. The annual rainfall amounts to 10 to 30 inches. Most of it occurs between November and April. The mean annual soil temperature is 73° F. Ewa soils are geographically associated with Honouliuli, Mamala, Molokai, Pulehu, and Waiakoa soils.
>
> These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of fingergrass, kiawe, koa haole, klu, and uhaloa. [Foote et al. 1972:29]

Soils of the Mahana Series are described as follows:

> This series consists of well-drained soils on uplands on the islands of Kauai and Oahu. These soils developed in volcanic ash. They are gently sloping to very steep. Elevations range from 1,000 to 3,000 feet. The annual rainfall amounts to 30 to 45 inches. The mean annual soil temperature is 67° F. Mahana soils are geographically associated with Oli and Puu Opae soils on Kauai and with Kolekole soils on Oahu.
>
> These soils are used for pasture, woodland, wildlife habitat, irrigated sugarcane, and water supply. The natural yegetation consists of puakeawe, aa1ii, ricegrass, molassesgrass, silver oak, yellow foxtail, lantana, joee, Japanese tea, passion flower, and associated plants. [Foote et al. 1972:85]

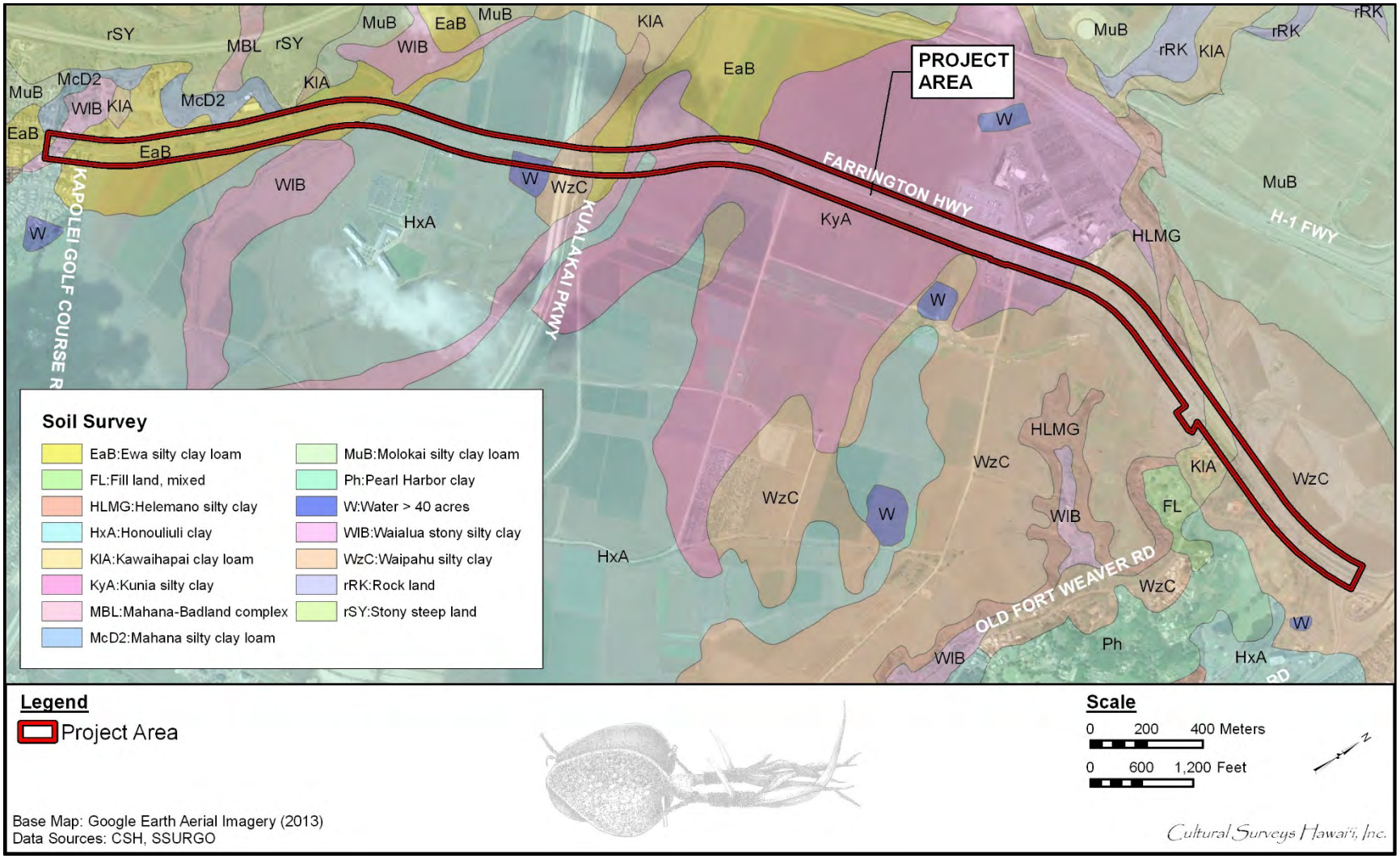


Figure 6. 2013 aerial image with overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the project area

Soils of Honouliuli Series are described as follows:

> This series consists of well-drained soils on coastal plains on the island of O‘ahu in the ‘Ewa area. These soils developed in alluvium derived from basic igneous material. They are nearly level and gently sloping. Elevations range from 15 to 125 feet. The annual rainfall amounts to 18 to 30 inches and occurs mainly between November and April. The mean annual soil temperature is 74° F. Honouliuli soils are geographically associated with ‘Ewa, Lualualei, Mamala, and Waialua soils.
>
> These soils are used for sugar cane, truck crops, orchards, and pasture. The natural vegetation consists of kiawe, koa haole, fingergrass, bristly foxtail, and bermudagrass. [Foote et al. 1972:43]

Soils of the Kawaihapai Series are described as follows:

> This series consists of well-drained soils in drainage ways and on alluvial fans on the coastal plains on the islands of O‘ahu and Moloka‘i. These soils formed in alluvium derived from basic igneous rock in humid uplands.
>
> They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. The mean annual soil temperature is 73° F. Kawaihapai soils are geographically associated with Haleiwa, Waialua, and Jaucas soils.
>
> These soils are used for sugar cane, truck crops, and pasture. The natural vegetation consists of *kiawe*, *koa haole*, lantana, and bermudagrass. [Foote et al. 1972:6364]

Soils of the Kunia Series are described as follows:

> This series consists of well-drained soils on upland terraces and fans on the island of Oahu. These soils developed in old alluvium. They are nearly level to moderately sloping. Elevations range from 700 to 1,000 feet. The mean annual rainfall amounts to 30 to 40 inches, most of which occurs from November to April. The mean annual soil temperature is 71° F. Kunia soils occur on the foot slopes of the Waianae Range, near Schofield Barracks. They are geographically associated with Kolekole, Lahaina, and Wahiawa soils.
>
> These soils are used for sugarcane, pineapple, home sites, and military reservations. Most areas are cultivated, and the natural vegetation is not significant. [Foote et al. 1972:77]

Soils of the Waialua Series are described as follows:

> This series consists of moderately well drained soils on alluvial fans on the island of Oahu. These soils developed in alluvium weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 100 feet. The annual rainfall amounts to 25 to 50 inches; most of it occurs between November and April. The mean annual soil temperature is 73° F. "Waialua soils are geographically associated with Honouliuli, Kaena, and Kawaihapai soils.
>
> These soils are used for sugarcane, truck crops, or- chards, and pasture. The natural vegetation is swollen fingergrass, koa haole, and uhaloa. [Foote et al. 1972:128]

Soils of the Waipahu Series are described as follows:

> This series consists of well-drained soils on marine terraces on the island of O‘ahu. These soils developed in old alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from nearly sea level to 125 feet. Rainfall amounts to 25 to 35 inches annually; most of it occurs between November and April. The mean annual soil temperature is 75° F. Waipahu soils are geographically associated with Hanalei, Honouliuli, and Waialua soils. [Foote et al. 1972:134]

The project area extends alongside a number of active agricultural fields. Vegetation outside the cultivated fields consists predominantly of introduced perennial grasses and weeds, along with *kiawe* (*Prosopis pallida*) and *koa haole* (*Leucaena leucocephala*).

1.1.2 Built Environment

The project area contains a 3.1-mile-long portion of Farrington Highway. The immediate vicinity of the project area has been drastically altered by historic and modern land use including, in particular, intensive commercial sugarcane cultivation. In recent years, a portion of the project area has also been altered by the construction of the Kualakai Parkway and related infrastructure improvement projects. Aside from Kualakai Parkway, development within the immediate vicinity of the project area includes the University of Hawai‘i West O‘ahu campus, Aloun Farm, and the Kahi Mohala Behavioral Health center. Generally, the vicinity of the project area consists of rural agricultural lands.

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this study under archaeological fieldwork permit number 18-15, issued by the SHPD pursuant to HAR §13-282. CSH archaeologist Sara M. Blahut, M.A., conducted fieldwork 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete

In general, fieldwork included a pedestrian inspection of the project area, GPS data collection, and photography.

A pedestrian inspection of the project area was undertaken for the purpose of identifying and documenting the historic crossings (bridges and culverts) present within the project area. A Garmin handheld GPS unit was used (GPSMAP 64s)—which has a horizontal accuracy of approximately 3 and 5 m—to record locations of these crossings. Each crossing was photographed.

2.2 Research Methods

Background research included a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2000).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of cultural resources in the project area.

Section 3 Background Research

Honouliuli Ahupua‘a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. Within Honouliuli Ahupua‘a there are 12 miles of coastline with continuous shallow fringing reef, which offers rich marine resources in addition to the 4 miles of waterfront along the west side of the West Loch of Pu‘uloa (commonly known as Pearl Harbor) that offered extensive fisheries (mullet, *awa* [*Chanos chanos;* milkfish], shellfish) as well as frontage suitable for development of fishponds (e.g., Laulaunui). The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua‘a* (traditional land division usually extending from the uplands to the sea) as a whole. A broad limestone plain with innumerable limestone sinkholes offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions to human settlement. The lower portion of Honouliuli Valley in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley, consisting of an extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. As Handy and Handy (1972:469) have pointed out, the forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the *ahupua‘a* contained biologically diverse forest with *kukui* (*Aleurites moluccana;* candlenut), *‘ōhi‘a lehua* (*Metrosideros macropus*), *‘iliahi* (*Santalum* spp.; sandalwood), *hau* (*Hibiscus tiliaceus;* beach hibiscus), tī (*Cordyline terminalis*), banana, etc. These valuable resources contribute to the richness of Honouliuli and the ‘Ewa *moku* (district).

Honouliuli is the largest *ahupua‘a* in the *moku* of ‘Ewa. Honouliuli means “dark water,” “dark bay,” or “blue harbor” and was named for the waters of Pu‘uloa (literally “long hill”) (Jarrett 1930:22), which marks the eastern boundary of the *ahupua‘a*.

3.1 Traditional Background

The traditions of Honouliuli Ahupua‘a have been published by numerous authors including Kamakau (1991a and 1991b), ‘Ī‘ī (1959), and Fornander (1917) and compiled and summarized numerous times by Charvet-Pond and Davis (1992), Hammatt and Folk (1981), Kelly (1991), Maly and Rosendahl (1993), Sterling and Summers (1978), and Tuggle and Tomonari-Tuggle (1997). Some of the themes of these traditions include connections with Kahiki (i.e., Tahiti, thought to be one of the primary sources of major migrations to Hawai‘i) and the special character and relationship of the places known as Pu‘uokapolei and Kūalaka‘i. There are several versions of the chief Kaha‘i leaving from Kalaeloa for Kahiki; on his return to the Hawaiian Islands he brought back the first breadfruit (Kamakau 1991b:110) and planted it at Pu‘uloa, near Pearl Harbor in ‘Ewa (Beckwith 1970:97).

3.1.1 Nā Ala Hele

John Papa ‘Ī‘ī described a network of Leeward O‘ahu *ala hele* (trails), which in historic times encircled and crossed the Wai‘anae Range, allowing passage from Lualualei to Honouliuli by three different trails (‘Ī‘ī 1959:96–98). The following description of the trails is provided by ‘Ī‘ī:

> The trail went down to the stream and up again, then went above the taro patches of Waiau, up to a makai field, to Waimano, to Manana, and to Waiawa; then to the

> stream of Kukehi and up to two other maika [ancient Hawaiian game suggesting bowling] fields, Pueohulunui and Haupuu. At Pueohulunui was the place where a trail branched off to go to Waialua and down to Honouliuli and on to Waianae. As mentioned before, there were three trails to Waianae, one by way of Pu‘u o Kapolei, another by way of Pohakea, and the third by way of Kolekole. [‘Ī‘ī 1959:97]

The cross-*ahupua‘a* (east-west) trail that skirted Pearl Harbor, passed north of Pu‘uokapolei, and continued along the coast to Wai‘anae, is depicted in an 1825 map of the South Coast of O‘ahu by Charles Malden of the British ship, the *Blonde* (Figure 7). The trail generally follows the route of the modern Farrington Highway. Malden's 1825 map also shows a *mauka-makai* (mountain-sea, north-south) trail with two spurs that extend from the cross-*ahupua‘a* (east-west) trail to settlements at the coast.

3.1.2 Place Names of Honouliuli

A Hawaiian *wahi pana* "physically and poetically describes an area while revealing its historical or legendary significance" (Landgraf 1994:v). *Wahi pana* are sacred places that include such cultural properties as *heiau* (Pre-Christian place of worship), *loko i‘a* (fishponds), *ala hele*, *ilina* (graves) and *iwi kūpuna* (ancestral bone remains), land divisions, and natural geographic locations such as streams, peaks, rock formations, ridges, and offshore islands and reefs associated with culturally significant beliefs or events. A *wahi pana* leaves an imprint on the landscape even if its tangible properties no longer exist, as the *mana* (divine power) of previous people and events associated with this space continues to manifest itself. Table 1 displays the McAllister (1933) site (if available), *wahi pana*, significance, and source. Figure 8 depicts the project area with *wahi pana* within Honouliuli Ahupua‘a.

3.1.3 *Mo‘olelo* and *‘Ōlelo No‘eau*

This section compiles *mo‘olelo* (stories) of Honouliuli Ahupua‘a through summaries, and when possible, quotations of the original stories. Archival research included previous compilations of *mo‘olelo* (Beckwith 1970; Fornander 1919; Sterling and Summers 1978; Westervelt 1923) and the writings of Native Hawaiians (Kamakau 1991a and 1991b).

3.1.3.1 Legend of Lepeamoa

Another explanation for the name Honouliuli comes from the "Legend of Lepeamoa," the *kupua* (demigod or cultural hero, especially a supernatural being possessing several forms) of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Westervelt 1923:164–184). One translation of the name for this district is given as "unequal" (*Saturday Press*, 11 August 1883). Others translate the word as "strayed" and associate it with the legends of the gods Kāne and Kanaloa.

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ewa. To mark boundaries of the land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere, in the Waimanalo section. When they went to find it, they could not locate the spot where it fell. So

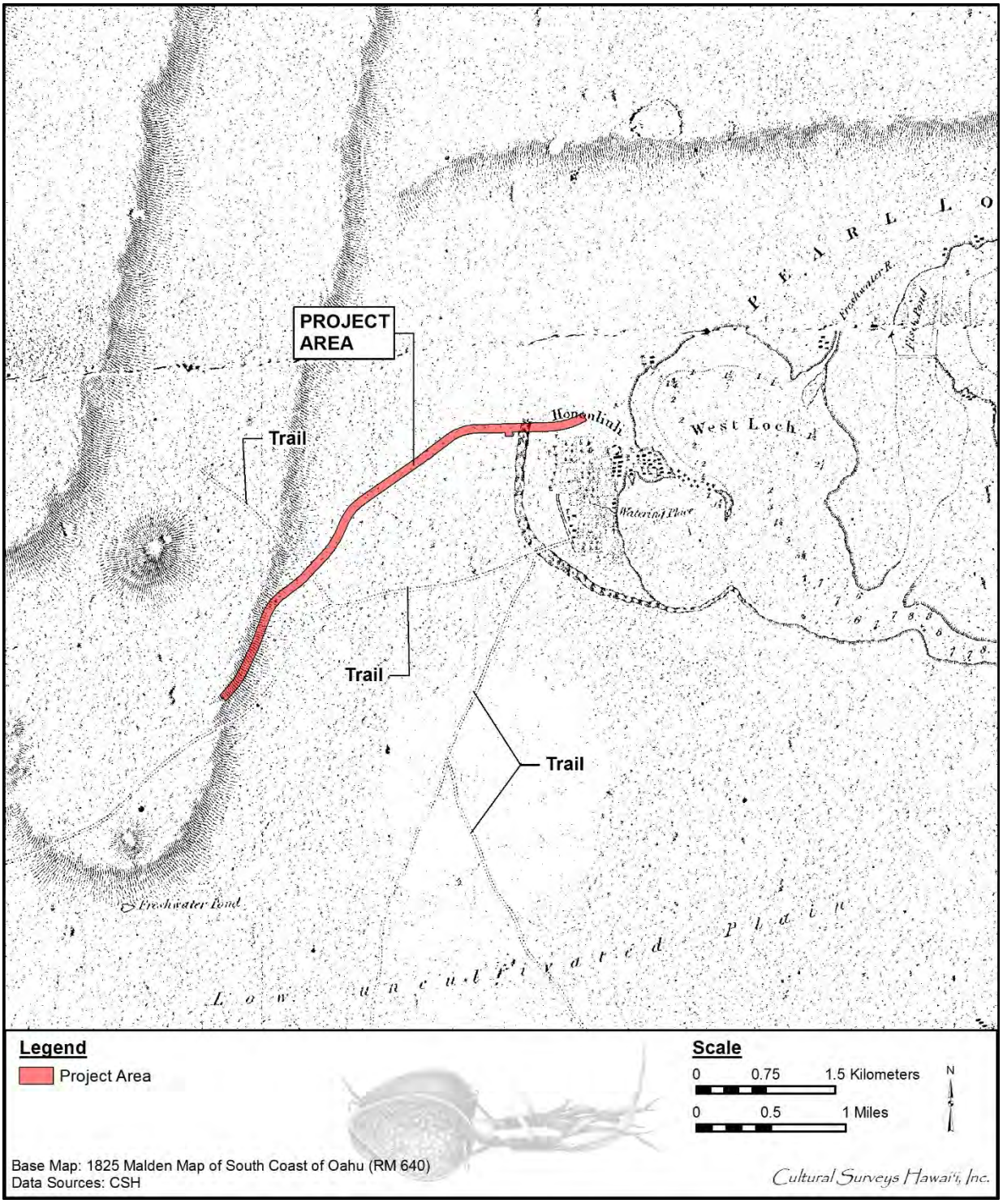


Figure 7. 1825 Malden map of the southern coast of O‘ahu with project area; note the faint lines from West Loch stretching northwest, west, and south depict ancient foot trails

Table 1. Place names with significance including McAllister site number (if available)

Site # (if available)	Place Name	Significance	Source
N/A	Awanui Gulch	Gulch located north of Pu‘u Pālailai	Sterling and Summers 1978
135	Enclosures	A number of enclosures sit inland from the old ranch house on the land of Kukuilua; leveled-off areas; the largest enclosure is 85 ft x 100 ft with low walls and facings; probably *kuleana* (land claim) sites	McAllister 1933
N/A	‘Ēkahanui Gulch	Gulch in Honouliuli; literally “large bird’s-nest fern”	Pukui et al. 1974
133	Heiau	A small enclosure said to be a *heiau* on a slight elevation in the gulch at the foot of Pu‘u Kanehoa; one of McAllister’s informants, Reiney, recalls old Hawaiians respecting the area; enclosure is approx. 25 ft x 30 ft; inside, walls are between 2-3 ft high with width ranging from 2-5 ft depending on the slope of the land; walls evenly faced with fill of smaller stones; site surrounded by lantana and thick grass; a few guava trees grow inside the *heiau*; possibly not a *heiau*, but a small enclosure	McAllister 1933
N/A	Honouliuli Stream	The stream passes through eastern portion of project area and Honouliuli Taro Lands eventually drain into West Loch	USGS Orthoimagery aerial photographs 2011
N/A	Honouliuli Taro Lands	See Section 3.2.2.2	N/A
N/A	Kahe, Kahe Point	Beach park (approx. 4.5 acres), ideal for diving; close to Nānākuli Ahupua‘a; also known as Electric Beach as it is adjacent to the Hawaiian Electric Company Power Plant; literally means “flow”	Clark 2002
N/A	Kalaeloa (Barbers Point)	Regional park consisting of approx. 120 acres; formerly Barbers Point Naval Air Station, turned over to the state on 2 July 1999; literally meaning “long point,” probably named for the view of the point from the east (Diamond Head) end of Māmala Bay, from which it appears to be an extremely long point	Clark 2002

Site # (if available)	Place Name	Significance	Source
139	Kalanamaihiki Fishing Shrine (*ko‘a*)	Located at Kapapapuhi, Honouliuli; two large rough stones near end of the small tongue of land that juts out opposite Laulaunui Island in West Loch; approx. 2.5 ft in size with six or seven smooth stones averaging 1 ft in size in a small pile adjoining the larger stones; entire site covered in *‘ākulikuli* (general name for succulent plants)	McAllister 1933
N/A	Kalo‘i Gulch	Gulch in Honouliuli; literally “the taro patch”	Pukui et al. 1974
N/A	Kānehili	An *‘ili* (land section; subdivision of an *ahupua‘a*) extending south of the project area to the shoreline	Sterling and Summers 1978
N/A	Kapapapuhi Point	Translates to “the numerous eels”; a land section southeast of the project area; point located on West Loch	Pukui and Elbert 1986
N/A	Kaupe‘a	Plain; where ghosts wandered to catch night moths and spiders for food; extending from the *wiliwili* (*Erythrina sandwicensis*; Hawaiian leguminous tree) trees of Kaupea to Kānehili	*Ke Au Hou*, 12 July 1911 in Sterling and Summers 1978
N/A	Ko‘olina	Beaches, man-made lagoons, private marina, gated community, and hotels; literally “delightful, lovely”	Clark 2002
N/A	Kualaka‘i	Area near Barbers Point; a spring here is called Hoaka-lei (“lei reflection”) because Hi‘iaka picked *‘ōhi‘a lehua* flowers here to make a lei (garland, wreath) and saw her reflection in the water; literally “Tethys” (a sea creature)	Pukui et al. 1974
N/A	Kupehau	Translates to “hibiscus canoe-rim,” this is an *‘ili* in the *mauka* section of Honouliuli Ahupua‘a	Pukui and Elbert 1986
N/A	Līhu‘e	Former land division near Schofield Barracks; literally “cold chill”	Pukui et al. 1974
N/A	Limaloa Gulch	Gulch located in Nānākuli; Limaloa is the name of a luckless lover in the Kamapua‘a legend; literally “long arm”	Pukui et al. 1974
N/A	Makaīwa Gulch	Gulch near Barbers Point; literally “mother-of-pearl eyes” (as an image)	Pukui et al. 1974
N/A	Mauna Kapu	Mountain in the Wai‘anae Range separating Nānākuli and Honouliuli forest reserves	Pukui et al. 1974

Site # (if available)	Place Name	Significance	Source
N/A	Maunauna	Hill in Honouliuli Ahupua‘a standing approx. 1,769 ft high; literally “mountain sent [on errands]”; the *mo‘olelo* behind this feature is of two servant *mo‘o* (lizard) who lived here and had no keepers to supply their needs	Pukui et al. 1974; Sterling and Summers 1978
N/A	Namo‘opuna	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2011
N/A	One‘ula	Beach park located in Honouliuli Ahupua‘a; literally “red sand”	Pukui et al. 1974
N/A	Pālehua	Land division, hill (elevation 2,566 ft), and road; literally “lehua flower enclosure”	Pukui et al. 1974
N/A	Palikea	Peak above Lualualei (approx. 3,098 ft high) in the Wai‘anae Mountains; literally “white cliff”	Pukui et al. 1974
N/A	Paupauwela	Northernmost *‘ili* within Honouliuli Ahupua‘a; near Wai‘anae Uka	Sterling and Summers 1978
N/A	Pili o Kahe	Land section; literally “clinging to Kahe”	Pukui et al. 1974
136	Platform	Located near Mauna Kapu on the ridge that divides ‘Ewa and Wai‘anae District	McAllister 1933
N/A	Pōhākea Pass	Mountain and pass (approx. 2,200 ft high) in the Wai‘anae Mountains; from this point, Hi‘iaka saw by cloud omens that her *lehua* groves on Hawai‘i Island had been burned by her sister Pele, and that her friend Hōpoe had been turned to stone; this is where Ka-uhi brutally murdered his wife, Ka-hala-o-Puna, because he thought she had been defiled; literally “white stone” (*pōhā* is short for *pōhaku*, which means stone or rock)	Pukui et al. 1974
N/A	Pouilihale	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2011
N/A	Pu‘u Hāpapa	Literally translates to “rock stratum,” this mountain converges at the border of the Honouliuli, Wahiawā, and Wai‘anae Districts	Sterling and Summers 1978

Site # (if available)	Place Name	Significance	Source
N/A	Pu‘u Kānehoa	Peak (approx. 2,728 ft high) in Honouliuli Ahupua‘a; named for native shrubs	Pukui et al. 1974
138	Pu‘u o Kapolei and Heiau	The stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side; formerly a rock shelter was on the *makai* side where Kamapua‘a is said to have lived with his grandmother; hill located in Honouliuli ; Kamapua‘a, the pig-man demigod, established his grandmother as queen here after conquering most of O‘ahu	McAllister 1933; Pukui et al. 1974
N/A	Pu‘u Kapua‘i	Hill (approx. 1,047 ft high); literally “foot print hill”	Pukui et al. 1974
137	Pu‘u Kaua	*Heiau* located on the ridge, overlooking Nānākuli, as well as Honouliuli, at the approx. height of 1,800 ft; most of the *heiau* stones used for a cattle pen located on sea side of the site; portion of the *heiau* not been cleared for pineapples has been planted in ironwoods; peak; literally “war hill” or “fort hill”; place where chiefs lived in ancient times; see Section 3.2.2.3 for an expanded account	McAllister 1933; Pukui et al. 1974
134	Pu‘u Ku‘ina Heiau	Aikukai, Honouliuli, located in a gulch at the foot of Mauna Kapu; suggestion of a terrace is about all that remains; no idea of size of the *heiau* or number of terraces can be obtained	McAllister 1933
N/A	Pu‘u Ku‘ua Heiau	Hill located in Honouliuli Ahupua‘a; Pele’s sister, Kapo, once left her flying vagina (*kohe lele*) there; literally “relinquished hill”	Pukui et al. 1974
N/A	Pu‘u Makakilo	Hill near Honouliuli Ahupua‘a; literally “observing eyes hill”	Pukui et al. 1974
N/A	Pu‘u Manawahua	Peak (approx. 2,401 ft high) located in Nānākuli Ahupua‘a; literally “great grief hill” or “nausea hill”	Pukui et al. 1974
N/A	Pu‘u Pālailai	Hill (approx. 492 ft high) located in ‘Ewa; literally “young lai fish hill”	Pukui et al. 1974
N/A	Waimānalo	Land division, road, gulch near Barbers Point; also the site of Chief Kākuhihewa’s home; literally “potable water”	Pukui et al. 1974

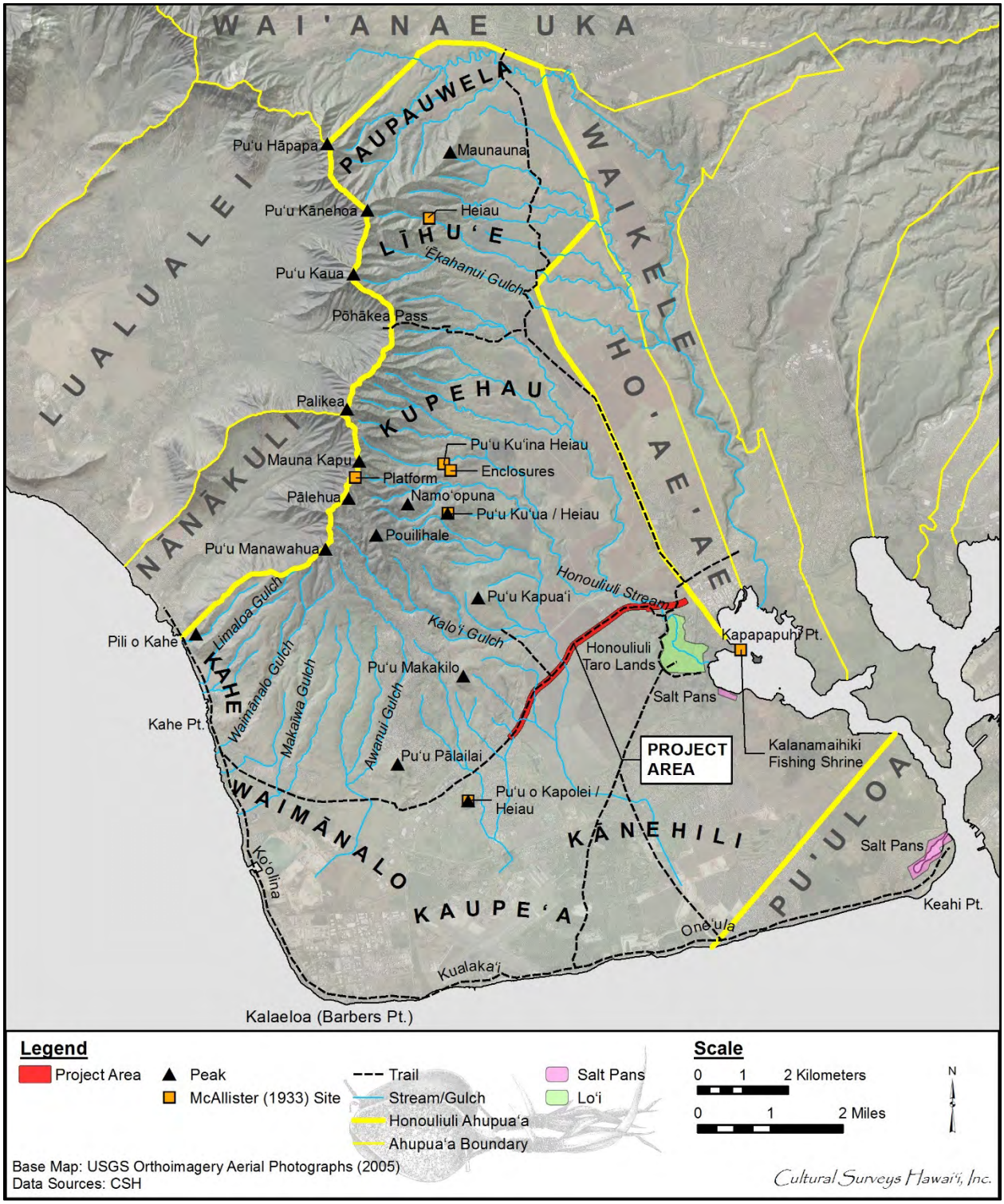


Figure 8. 2011 USGS Orthoimagery aerial photograph depicting project area with *wahi pana*

> Ewa (strayed) became known by the name. The stone that strayed [Told to E.S. by Simeon Nawaa, 22 March 1954, in Sterling and Summers 1978:1]

According to S.K. Nawaa (22 March 1954) in Sterling and Summers, the stone found at Pili o Kahe and that is the diving marker between two hills that run parallel, the hill on the ‘Ewa side was considered male and the hill on the Wai‘anae side marking the boundary between Nānākuli and Honouliuli was interpreted as female. The name “Pili o Kahe (Pili = cling to, Kahe = flow) refers, therefore, to the female or Wai‘anae side hill. And that is where the boundary between the two districts runs” (Sterling and Summers 1978:1). The boundaries of Honouliuli Ahupua‘a extend from Paupauwela in the north, Ho‘ae‘ae to the east, and Pu‘uloa to the south with the coastline on the southern border.

3.1.3.2 Kamapua‘a

Kamapua‘a, the pig god, is associated with Honouliuli:

> Kamapua‘a subsequently conquered most of the island of O‘ahu, and, installing his grandmother [Kamaunuaniho] as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Wai‘anae Mountain Range, and made her establish her court there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all. [Nakuina 1904:50]

Emma Nakuina goes on to note, “A very short time ago [prior to 1904] the foundations of Kamaunuaniho’s house could still be seen at Puuokapolei” (Nakuina 1904:50).

3.1.3.3 Pu‘uokapolei

Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor west to Wai‘anae (Sterling and Summers 1978:34). Pu‘u means “hill” and Kapolei means “beloved Kapo,” a reference to the sister of the Hawaiian volcano goddess, Pele.

Several places on the ‘Ewa coastal plain are associated with *ao kuewa*, the realm of the homeless souls. Samuel Kamakau explains Hawaiian beliefs in the afterlife:

> There were three realms (*ao*) for the spirits of the dead . . . There were, first, the realm of the homeless souls, the *ao kuewa*; second, the realm of the ancestral spirits, the *ao ‘aumakua*; and third, the realm of Milu, *ke ao o Milu* . . .
>
> The *ao kuewa*, the realm of homeless souls, was also called the *ao ‘auwana*, the realm of wandering souls. When a man who had no rightful place in the *‘aumakua* [family or personal gods] realm (*kanaka kuleana ‘ole*) died, his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Halawa, ‘Ewa near Red Hill], there he would find the breadfruit tree of Leiwalo, *ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, *the pō pau ‘olo o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend

> (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, a *leina a ka ‘uhane*.
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could not go far in the places mentioned earlier before they would be found catching spiders by *‘aumakua* souls, and be helped to escape. . . . [Kamakau 1991a:47–49]

The breadfruit tree, Leilono, was said to have been located on the ‘Ewa-Kona border, above Āliamanu. In another section of his account of the dead, Kamakau calls the plain of wandering souls the “plain at Pu‘uokapolei.”

> There are many who have died and have returned to say that they had no claim to an ‘aumakua [realm] (*kuleana‘ole*). These are the souls, it is said, who only wander upon the plain of Kama‘oma‘o on Maui or on the plain at Pu‘uokapolei on Oahu. Spiders and moths are their food. [Kamakau 1991b:29]

This association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu, who was killed by his father, Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

Go carefully lest you fall dead in the sun,	*E newa ai o hea make i ka lā,*
The god that dwells on Kapolei hill.	*Akua noho la i Pu‘uokapolei.*
The sun is wailing on account of the	*E hanehane mai ana ka lā i nā*
women of Kamao,	*wahine o Kamao*,
A hiding god, blossoming ohai of the banks,	*Akua pe‘e, pua ‘ohai o ke kaha*,
Contented among the stones-	*I walea wale i ke a-*
Among the breadfruit planted by Kahai.	*I ka ulu kanu a Kahai*.
Thou hast spoken of by the oo-	*Haina ‘oe e ka oo-*
By the bird of Kanehili.	*E ka manu o Kānehili.*

[Fornander 1919:6(2):297]

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association with wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919:6[2]:304).

Pukui (1983:180) offers this *‘ōlelo no‘eau*, or Hawaiian saying, which places the wandering souls in a *wiliwili* grove at Kaupe‘a.

The wiliwili grove of Kaupe‘a	*Ka wiliwili of Kaupe‘a*.

In ‘Ewa, O‘ahu. Said to be where homeless ghosts wander among the trees.

Beckwith (1970:154) has stressed that “the worst fate that could befall a soul was to be abandoned by its ‘aumakua and left to stray, a wandering spirit (kuewa) in some barren and

desolate place.” These wandering spirits were often malicious, so the places where they wandered were avoided.

In a chant by Hi‘iaka, the sister of the Hawaiian volcano goddess, Pele, several place names in ‘Ewa are mentioned as Hi‘iaka travels from Pu‘uokapolei toward the ‘Ewa coast. In the chant, Hi‘iaka is moving downhill from Kaupe‘a, probably the plains adjacent to Pu‘uokapolei, toward the coast, to the plains of Kānehili. The chant also refers to Pe‘e-kaua, which may be a variation of Kau-pe‘e or Kaupe‘a. Hi‘iaka sang this bitter chant addressed to Lohi‘au and Wahine‘ōma‘o, and it uses the association of the Plains of Kaupe‘a as a place for the wandering of lost souls. The name Kānehili also refers to wandering, as the word *hili* means “to go astray” (Emerson 1915:162).

Ku‘u aikana i ke awa lau o Pu‘uloa,

Mai ke kula o Pe‘e-kaua, ke noho oe,

E noho kaua e kui, e lei i ka pua o ke kauno‘a,

I ka pua o ke akuli-kuli, o ka wili-wili;

O ka iho‘na o Kau-pe‘e i K-hili,

Ua hili au; akahi no ka hili o ka la pomaika‘i;

E Lohiau ipo, e Wahine-oma‘o,

Hoe ‘a mai ka wa‘a i a‘e aku au.

We meet at Ewa’s leaf-shaped lagoon, friends;

Let us sit, if you will on this lea

And bedeck us with wreaths of Kauno‘a,

Of akuli-kuli and wili-wili,

My soul went astray in this solitude;

It lost the track for once, in spite of luck,

As I came down the road to Kau-pe‘a.

No nightmare dream was that which tricked my soul.

This way, dear friends; turn the canoe this way;

Paddle hither and let me embark.

[Emerson 1915:167–168]

Samuel Kamakau says that ancient Hawaiians also used Pu‘uokapolei as an astronomical marker to designate the seasons:

> . . . the O‘ahu people who reckoned the time (*O‘ahu po‘e helu*) called the season Kau [summer] for the setting of the sun from Pu‘uokapolei, a hill in Honouliuli, ‘Ewa, to the opening of Mahinaona (*i ke kawaha o Mahinaona*). When the sun moved south from Pu‘uokapolei—and during the season of the sun in the south—for the coming of coolness and for the sprouting of new buds on growing things—the season was called Ho‘oilo [winter, rainy, season]. [Kamakau 1976:14]

A *heiau* was once on Pu‘uokapolei, but it had been destroyed by the time of McAllister's (1933:108) survey of the island conducted in 1930. The hill was used as a point of solar reference or as a place for such observations (Fornander 1919:6[2]:297). Pu‘uokapolei may have been regarded as the gate of the setting sun, just as the eastern gate of Kumukahi in Puna is regarded as the gate of the rising sun; both places are associated with the Hawaiian goddess Kapo (Emerson 1915:41). This somewhat contradicts some Hawaiian cosmologies, in which Kū was the god of the rising sun, and Hina, the mother of Kamapua‘a, was associated with the setting of the sun. Fornander (1919:6[2]:292) states that Pu‘uokapolei may have been a jumping off point associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill.

A ceremony commemorating the changing of the seasons is still observed each year in the beginning of May at Waikīkī and Honouliuli. This ceremony was documented in a previous cultural impact assessment conducted by CSH (Genz et al. 2011). Sam ‘Ohukani‘ōhi‘a Gon III, Na Wa‘a Lalani Kahuna O Pu‘u Kohola, and the late Kumu Hula John Keola Lake's *hula hālau* (hula instruction) perform *‘oli* and *hula*, explaining that the *kilo hōkū* (astronomers) of O‘ahu observed how, from the perspective of Waikīkī, the sun sets in a southerly direction over the ocean during the winter solstice and in a northerly direction behind the ‘Ewa ridgeline during the summer solstice. During the springtime, the position of the setting sun marches steadily northward each day, and at the beginning of May, the sun sets behind Pu‘uokapolei, perfectly centered within its depression from the vantage point of Kūpalaha Heiau just west of the Waikīkī Aquarium. A coinciding ceremony at a *heiau* on Pu‘uokapolei similarly views the setting of the sun behind Pu‘ula‘ila‘i farther west, and a line of sight extending eastward from Pu‘ula‘ila‘i, Pu‘uokapolei, and the former site of Kūpalaha Heiau ends at the closely associated Papa‘ena‘ena Heiau. Mr. Gon suggests Papa‘ena‘ena Heiau may have been part of the ceremonies of this astronomical event.

3.1.3.4 The Traveling Mullet of Honouliuli

The story of (Ka) Ihuopala‘ai is also associated with the tradition of the *‘anae-holo* or traveling mullet (Thrum 1906:270–272):

> The home of the anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopalaai. They make periodical journeys around to the opposite side of the island, starting from Puuloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai, and so on, around to the Koolau side, ending at Laie, and then returning by the same course to their starting point. [Thrum 1907:271]

In Thrum's account, Ihuopala‘ai is a male who possesses a *kū‘ula*, or fish god, which supplied the large mullet known as *‘anae*. His sister lived in Lā‘ie and there came a time when there were no fish. She sent her husband to visit Ihuopala‘ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā‘ie.

This story is associated with a poetical saying documented by Mary Kawena Pukui (1983:145) about Honouliuli:

Ka i‘a hali a ka makani	The fish fetched by the wind.

Pukui explains, "The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong" (Pukui 1983:145).

3.2 **Historical Background**

3.2.1 ‘Ewa as a Political Center

There are many documented references to chiefs residing in ‘Ewa and to its being a political center in the past. These include oral accounts of chiefs and chiefesses recorded by noted Hawaiian historian Samuel Kamakau that date back to at least the twelfth century. He tells us that

> The chiefs of Līhu‘e, Wahiawā, and Halemano on O‘ahu were called lō ali‘i. Because the chiefs at these places lived there continually and guarded their kapu [taboo, prohibition], they were called lō ali‘i [from whom a ‘guaranteed’ chief might be obtained, loa‘a]. They were like gods, unseen, resembling men. [Kamakau 1991b:40]

By the early 1300s, ‘Ewa along with Kona and Ko‘olaupoko were the dominant political districts ruled by the sons of a chief named Māweke. It was during this time that the ‘Aha Ali‘i (council of chiefs) was also established (Cordy 2002:21). ‘Ewa at this time included the traditional districts of ‘Ewa, Wai‘anae, and Waialua (Fornander 1996:48). Around AD 1400, ‘Ewa was ruled by the *ali‘i* (chief, ruler) La‘akona of the senior Māweke-Kumuhonua genealogy and was recognized as the overall ruler of O‘ahu. Chiefs in this genealogy reigned until about AD 1520-1540, with their major royal center in Līhu‘e (Cordy 2002:24). Haka, the last chief of the Māweke-Kumuhonua line to hold this position, was deposed and slain by his men at the fortress of Waewae near Līhu‘e (Fornander 1996:88; Kamakau 1991a:54).

Then, with Haka being deposed as Ali‘i Nui (high chief), the ‘Aha Ali‘i chose Mā‘ilikūkahi, an Ali‘i Kapu (ruler of best bloodline) of the junior Māweke-Mō‘īkeha line. Mā‘ilikūkahi was born at Kūkaniloko and was to be the new Ali‘i Nui of O‘ahu. After Mā‘ilikūkahi’s dedication at the *heiau* of Kapukapuākea (Site 225; McAllister 1933:140) in central Waialua, there was a shift in political centers from ‘Ewa to Kona *moku* (district), specifically Waikīkī. However, Mā‘ilikūkahi did keep a presence in Līhu‘e. During this time, he instituted an explicit land division and administration structure. O‘ahu was divided into six *moku*—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olauloa, and Ko‘olaupoko—that were further divided into 86 *ahupua‘a* and smaller territorial units (Kirch 2010:84-90). In reference to the productivity of the land and the population during Mā‘ilikūkahi’s reign, Kamakau writes,

> In the time of Mā‘ili-kūkahi, the land was full of people. From the brow, lae, of Kulihemo to the brow of Maunauna in ‘Ewa, from the brow of Maunauna to the brow of Pu‘ukea [Pu‘u Ku‘ua] the land was full of chiefs and people. From Kānewai to Halemano in Wai‘alua, from Halemano to Paupali, from Paupali to Hālawa in ‘Ewa the land was filled with chiefs and people. [Kamakau 1991b:55]

The picture presented here is that the whole *moku* of ‘Ewa was one of prosperity and productivity in the land and its people.

According to Cordy (2002:31), the period following Mā‘ilikūkahi, specifically AD 1600-1700, was the peak of power for the O‘ahu Kingdom during the “times of these famed O‘ahu rulers: Kala‘imanuia (1600-1620), Kākuihihewa (1640-1660), Kūali‘i (1720-1740), and Peleioholani (1740-1779).” Power shifted between the chiefs of different districts until Kākuhihewa reunited the O‘ahu kingdom under one rule. He went on to become one of the famed rulers of O‘ahu and

also held a residence in Kailua, Ko‘olaupoko (Cordy 2002:31–33). Generations later, his descendent Kūali‘i achieved control of all of O‘ahu by defeating the O‘ahu district chiefs and expanding his control on the windward side of Kaua‘i. Peleiōholani was called to be the regent for his nephew following the death of Kapiho‘okalani, the heir of Kūali‘i. Peleiōhōlani later assumed control of O‘ahu and later conquered parts of Moloka‘i. “By 1778, the O‘ahu Kingdom stretched across O‘ahu, to parts of Kaua‘i” (Cordy 2002:31).

‘Ewa continued to be a political center until the eighteenth century when Kahahana, the nephew of Peleiōhōlani who was raised in the court of the Maui chief Kahekili, was appointed to be chief of O‘ahu. Kahahana was defeated by Kahekili and the Maui army shortly after the *kahuna* (priest, sorcerer) Ka‘opulupulu and his son were slain at Pu‘uloa and Wai‘anae respectively, which according to Cordy occurred about 1783 (Cordy 2002:36; Thrum 1907:203–214). Kahahana’s father, ‘Elani, along with other O‘ahu chiefs, plotted to kill Kahekili and his chiefs who were residing at Kailua, O‘ahu, as well as his chiefs residing in ‘Ewa and Waialua. The plot was discovered by Kahekili and a messenger was sent to warn Hū‘eu, another O‘ahu chief, who was at Waialua. For some reason, the messenger never reached Hū‘eu and he and his retinue were killed. Kahekili avenged the death of Hū‘eu by pillaging and destroying the districts of Kona and ‘Ewa. It is said that the streams of Makaho and Niuhelewai in Kona, as well as Hō‘ae‘ae in ‘Ewa were choked with the bodies of the slain (Fornander 1996:290).

‘Ewa and Waikīkī remained political centers and favorite playgrounds for the chiefs of Kona, and ‘Ewa until Kou (old name for Honolulu, used until about 1800) was established as a center for trade of foreign goods (Pukui et al. 1974:117). With the battle of Nu‘uanu in 1895 and the subsequent unification of the Hawaiian Islands by Kamehameha I, Hawai‘i began its national history. As attention shifted to Kou, which had a deep enough harbor for ships to pull in and anchor, this place became the center of activity and royalty moved away from the outer districts toward the center of commerce. Archibald Campbell writes about O‘ahu in 1809, “In consequence of this, and of the facility with which fresh provisions can be procured, almost every vessel that navigates the North Pacific puts in here to refit. This is probably the principal reason why the king has chosen it as his place of residence” (Campbell 1967:109–110).

Despite this shift in political importance, ‘Ewa is depicted as an abundant and populated land where chiefs of distinguished lineages were born and resided. The land was fertile and well fed by mountain streams that helped sustain the agricultural lifestyle needed to support the chiefs, their households, and their people. An examination of the place names reveals that water was a very important factor in this district. Six of the 12 *ahupua‘a* names begin with *wai*, the Hawaiian word for water (Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu). The fact that there were so many fishponds in the ‘Ewa District and in the Pu‘uloa area, more than any other district on O‘ahu, indicates agricultural and aquacultural intensification was a direct link to the political history and also to the increasing needs of the population.

3.2.2 Settlement Patterns of Honouliuli

Archaeological and traditional sources show a general pattern of three main areas of settlement within Honouliuli Ahupua‘a—the coastal zone, the Honouliuli taro lands, and the inland settlement at Pu‘u Ku‘ua.

3.2.2.1 The Coastal Zone (Kalaeloa, Barbers Point)

Archaeological research at Barbers Point has focused on the areas in and around the Deep Draft Harbor (Barrera 1975; Davis and Griffin 1978; Hammatt and Folk 1981). Series of small clustered shelters, enclosures, and platforms show limited but recurrent use at the shoreline zone for marine-oriented exploitation. This settlement covers much of the shoreline, with more concentrated features around small marshes and wet sinks. Immediately behind the shoreline, under a linear dune deposit, is a buried cultural layer believed to contain some of the earliest habitation evidence in the area.

The attraction of the area to early Hawaiians may have been the plentiful and easily exploited bird population. Particular evidence for the taking of petrel occurs at State Inventory Historic Places (SIHP) # 50-80-12-2763 (Hammatt and Folk 1981). Initial heavy exploitation of nesting seabirds and other species, in conjunction with habitat destruction, may have contributed to some avian extinctions.

There is some indication of limited agriculture in mulched sinkholes and limited soil areas. Considering the lack of rainfall, this activity would have been limited, but probably involved tree crops and roots (sweet potatoes). The archaeological content of the sites indicates a major focus on marine resources.

Davis and Griffin (1978) distinguish functional classes of sites based on surface area size and argue that the Barbers Point settlement consists of functionally integrated, multi-household residence groups. Density contours of midden (by weight) and artifacts (by numbers) plotted for residence sites by Hammatt and Folk (1981) generally indicate narrowly defined spatial foci of discard, possibly indicating continuous use, or at least with no refurbishing or additions to the structures over time. The focus is small habitation sites, typically lacking the full range of features found in large permanent residence complexes such as high platforms, complex enclosures, and conspicuous ceremonial sites.

3.2.2.2 The Honouliuli Taro Lands

Centered around the west side of Pu‘uloa at Honouliuli Stream and its broad outlet into the West Loch are the rich irrigated lands of the *‘ili* of Honouliuli, which give the *ahupua‘a* its name. The major archaeological reference to this area is Dicks et al. (1987), who documented remnants of a once widespread wetland system consisting of *lo‘i* (irrigated terrace) and fishponds, as well as dryland cultivation of the adjacent slopes (Figure 9).

According to Carol Silva’s “Historic Research Relative to the Land of Honouliuli” (in Dicks et al. 1987), the Honouliuli area bordering West Loch was clearly a major population center, a logical response to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomlands suitable for wetland taro cultivation. The earliest detailed map by Malden (from 1825; see Figure 7) shows all the roads of southwest O‘ahu coalescing and descending the *pali* (cliff) as they funnel into the area of Honouliuli Village. Dicks et al. (1987:78–79) conclude on the basis of 19 carbon isotope dates and three volcanic glass dates that “agricultural use of the area spans over 1,000 years.” Undoubtedly, Honouliuli was a locus of habitation for thousands of Hawaiians. ‘Ewa was also famous for a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marshy locations (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

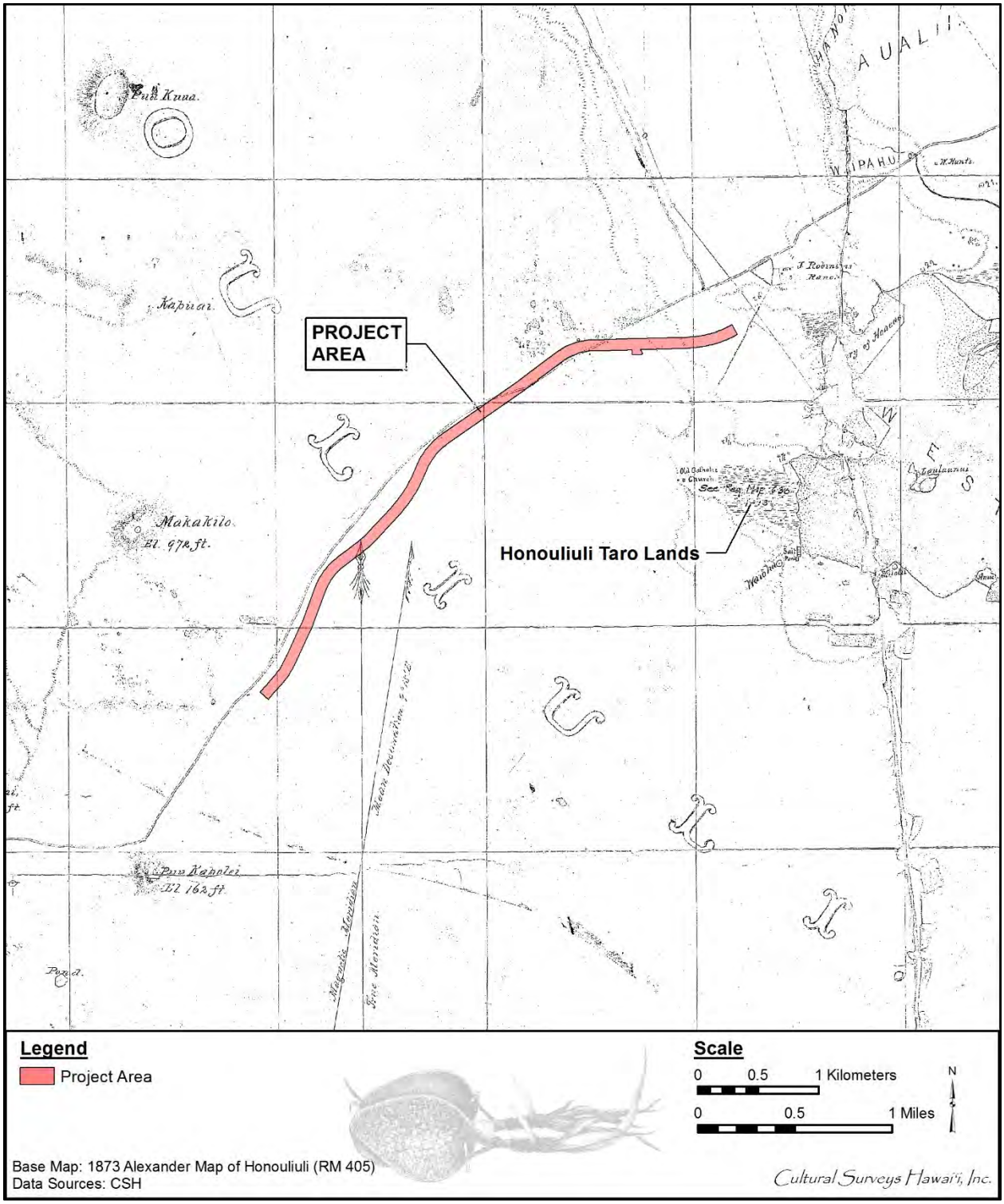


Figure 9. 1873 Alexander map of Honouliuli depicting project area; note the Honouliuli Taro Lands lie to the southeast of the project area

Ua ‘ai i ke kāī-koi o ‘Ewa.

He has eaten the Kāī-koi taro of ‘Ewa.

Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it.

Said of a youth of a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

According to Handy and Handy (1972), the irrigated lowlands were suitable for wetland taro cultivation, as well as the lower forest area of the mountain slopes for the procurement of forest resources. The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges with steep sides, but a very gradual increase of altitude. The lower part of the valley sides were excellent for cultivating yams and bananas. Farther inland grew the *‘awa* (*Piper methysticum*; kava) for which the area was famous (Handy and Handy 1972:429).

In addition, breadfruit, coconuts, *wauke* (*Broussonetia papyrifera*; paper mulberry), bananas, *olonā* (*Touchardia latifoldia*), and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (*Pipturus* spp.).

3.2.2.3 Pu‘u Ku‘ua: Inland Settlement

Documentation of inland settlement in Honouliuli Ahupua‘a is more problematic in that there are relatively few documented archaeological sources. However, it is probable the area around Pu‘u Ku‘ua, on the east side of the Wai‘anae Ridge, 7 miles inland of the coast, was a place of some importance for Hawaiians.

In 1899, the Hawaiian newspaper *Ka Loea Kalaiaina* relates a story of Pu‘u Ku‘ua as “a place where chiefs lived in ancient times” and a “battle field,” “thickly populated.” The article summarizes that “this place was entirely deserted and left uninhabited and it seems that this happened before the coming of righteousness to Hawai‘i Nei. Not an inhabitant is left” and that “the descendants of the people of this place were so mixed that they were all of one class. Here the gods became tired and returned to Kahiki” (Sterling and Summers 1978:33).

McAllister recorded three sites in this area, two *heiau* (Site 134, Pu‘u Kuina, and Site 137, Pu‘u Ku‘ua; both destroyed) and a series of enclosures in Kukuilua which he calls “kuleana sites” (McAllister 1933:107). On the opposite side of the Wai‘anae range, Cordy states “Kākuhihewa was said to have built (or rebuilt) Nīoi‘ula, a po‘okanaka [sacrificial] heiau (1,300 sq. m.) in Hālona in upper Lualualei, along the trail to Pōhākea Pass leading into ‘Ewa, circa A.D. 1640-1660” (Cordy 2002:36). There is no direct archaeological evidence available to the authors’ knowledge that intensive Hawaiian settlement occurred here, but it is considered as a place of high probability, based on the above indications. John Papa ‘Ī‘ī (1959) described a journey that Liholiho took which led him and an entourage through inland Honouliuli and over Pōhākea Pass. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources.

3.2.3 Observations of Honouliuli from Early Explorers

The first mission station in ‘Ewa was established in 1834 at Kalua‘aha near Pearl Harbor. Charles Wilkes, of the U.S. Exploring Expedition, visited the missionary enclave at Honouliuli town in 1840:

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them . . . The natives have made some advance in the arts of civilized life; there is a sugar-mill which, in the season, makes two hundred pounds of sugar a day . . . In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop’s church. [Wilkes 1970:80–81]

Early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Honouliuli Ahupua‘a indicate prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

The earliest detailed maps of the area show no substantial habitation closer to the project area than the western edge of West Loch, in the vicinity of Kapapapuhi Point (Hō‘ae‘ae Point on modern maps). The 1825 Malden map documents substantial settlement at the “Honouliuli Taro Lands” west of Kapapapuhi Point, and it seems clear that in early historic times, this was the population center for Honouliuli Ahupua‘a (Dicks et al. 1987). The amenities of that area, such as fishponds, taro *lo‘i*, shellfish collecting, and salt drying would have focused population there in pre-Contact times. Perhaps because of the significance of this *‘ili*, Honouliuli was also applied to the entire *ahupua‘a*.

Among the first historic accounts of Honoululi was one written by Captain Vancouver when he sailed by Kalaeloa (Barbers Point) in 1792 and recorded his impression of the small coastal village of Kūalaka‘i and the arid Honouliuli coast.

> The point is low flat land, with a reef round it . . . Not far from the S.W. point is a small grove of shabby cocoa-nut trees, and along these shores are a few struggling fishermen’s huts. [Vancouver 1798:1:167]

> . . . from the commencement of the high land to the westward of Opooroah [Pu‘uloa], was composed of one very barren rocky waste, nearly destitute of verdure, cultivation or inhabitants, with little variation all the way to the west point of the island . . . [Vancouver 1798:2:217]

> This tract of land was of some extent but did not seem to be populous, nor to possess any great degree of fertility; although we were told that at a little distance from the sea, the soil is rich, and all necessaries of life are abundantly produced. [Vancouver 1798:III:363]

Archibald Campbell, an English seaman who was given some land in Waimano Ahupua‘a by King Kamehameha in 1809, described his land around Pearl Harbor:

> In the month of November the king was pleased to grant me about sixty acres (ac) of land, situated upon the Wymummee [traditional Hawaiian name for Pearl River], or Pearl-water, an inlet of the sea about twelve mi to the west of Hanaroora [Honolulu] . . . We passed by footpaths, winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for the taro beds. Where there was not water, the land was under crops of yams and sweet potatoes. [Campbell 1967:103–104]
>
> Pearl and mother-of-pearl shells are found here in considerable quantity. Since the king has learned of their value, he has kept the fishing to himself, and employs divers for the purpose. [Campbell 1967:114–115]

3.2.4 Mid-Nineteenth Century and the Māhele

In the mid-nineteenth century, during the time of Kamehameha III, a series of legal and legislative changes were brought about in the name of "land reform" (Chinen 1958; Chinen 1971). Following the enactment of the Organic Acts of 1845 and 1846, the concept of private land ownership was introduced and all land in the Hawaiian Kingdom was divided into three main types: government (or Crown) land; *ali‘i* lands; and commoner lands, which *maka‘āinana* (commoner) could in principle obtain in fee simple, following passage of the Kuleana Act in 1850. This act allowed *maka‘āinana* to own land parcels at which they were currently and actively cultivating and/or residing. Of the hundreds of thousands of acres set aside as potential *kuleana* (land claims by *maka‘āinana*) parcels only about 10,000 claimants ultimately obtained some 30,000 acres, while 252 chiefs, for example, divided up about a million acres, leaving most Hawaiians disenfranchised.

In 1848, the crown and the *ali‘i* received their land titles. The common people began to receive their *kuleana* parcels in the beginning of 1850. During the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III. The 72 *kuleana* awards given to commoners were almost all made adjacent to Honouliuli Gulch, most within the "Honouliuli Taro Lands," which contained fishponds and irrigated taro fields (Tuggle and Tomonari-Tuggle 1997:34). No *kuleana* claims were made for land within the current study area. However, there were several claims in the vicinity of the project area, specifically near Honouliuli Stream.

In 1855, the Land Commission awarded all of unclaimed lands in Honouliuli, (43,250 acres), to Miriam Ke‘ahikuni Kekau‘ōnohi (Royal Patent 6971, Land Commission Award [LCA] 11216), granddaughter of Kamehameha I and the heir of Kalanimōkū. Kalanimōkū had been given the land by Kamehameha after the conquest of O‘ahu (Kame‘eleihiwa 1992; Waihona ‘Aina 2000). Kekau‘ōnohi was one of Liholiho's (Kamehameha II's) wives. After his death, she lived with her half-brother, Luanu‘u Kahalai‘a, who was governor of Kaua‘i (Kelly 1985:21). Subsequently, Kekau‘ōnohi ran away with Queen Ka‘ahumanu's stepson, Keli‘iahonui, and then became the wife of Chief Levi Ha‘alelea. Upon her death on 2 June 1851, all her property was passed on to her husband and his heirs. In 1863, the owners of the *kuleana* lands deeded their lands back to Ha‘alelea to pay off debts owed to him (Frierson 1972:12). In 1864, Ha‘alelea died, and his second wife, Anadelia Amoe, transferred ownership of the land to her sister's husband, John Coney.

Table 2 displays Land Commission Awards awarded in the vicinity of the project area. Details include LCA number, claimant, *‘ili*, and a brief description of the parcels (if available). Figure 10 depicts the project area and LCAs found in the vicinity.

Table 2. Land Commission Awards in the vicinity of the project area

LCA Number	Claimant	*‘Ili*	Notes
831	Kaekuna	Poohilo	*‘Āpana* (parcel) 2: House lot *‘Āpana* 3: Not available *‘Āpana* 4: Not available
834	Oni	Poohilo, Kailikahi	*‘Āpana* 2: Loko Kumuulio
847	Hinaa	Poohilo	*‘Āpana* 1: *Mo‘o‘āina* (land parcel) *‘Āpana* 2: *Kahua hale* (house foundation or site) called Aihonu
848	Kapule	Poohilo	*‘Āpana* 4: *Loko* (fishpond) *‘Āpana* 5: *Kula ‘āina* (plain) of banana
911	Kauhailepa	Poohilo	*‘Āpana* 1: Four *lo‘i* (irrigated terrace) and a small strip of *kula* *‘Āpana* 2: One *lo‘i*
1570	Kekua	Poohilo	*‘Āpana* 1: One *lo‘i* and *kula* called Aihonu *‘Āpana* 2: One *lo‘i* called Haaleluunui

3.2.5 Shifting Landscape

Much of the *mauka* lands in western Honouliuli including ridges and deep gulches were unsuitable for commercial sugar cultivation and remained pastureland for grazing livestock. By 1920, however, many of the lands of Honouliuli were used for commercial sugarcane cultivation (Frierson 1972:18). By 1919, reservoirs had been established throughout the region. In the late 1920s, the main residential communities were at the northeast edge of the ‘Ewa Plain. The largest community was still at Honouliuli Village. ‘Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese school. Additional settlement was in Waipahu, centered on the Waipahu Sugar Mill, operated by the Oahu Sugar Company. Historic maps of the Makakilo area indicate a lack of any other significant development in the area into the 1940s.

3.2.5.1 Early Ranching on the ‘Ewa Plain

John Coney rented land to James Dowsett and John Meek in 1871, who used it for cattle grazing. In 1877 this land in Honouliuli, except for the *‘ili* of Pu‘uloa, was sold to James Campbell for $95,000. Campbell then drove away 32,237 head of cattle belonging to Dowsett, Meek, and James Robinson, and constructed a fence around the outer boundary of his property (Bordner and Silva 1983: C-12). He let the land rest for one year and then began to restock the ranch, so that he had 5,500 head after a few years (Dillingham 1885 in Frierson 1972:14).

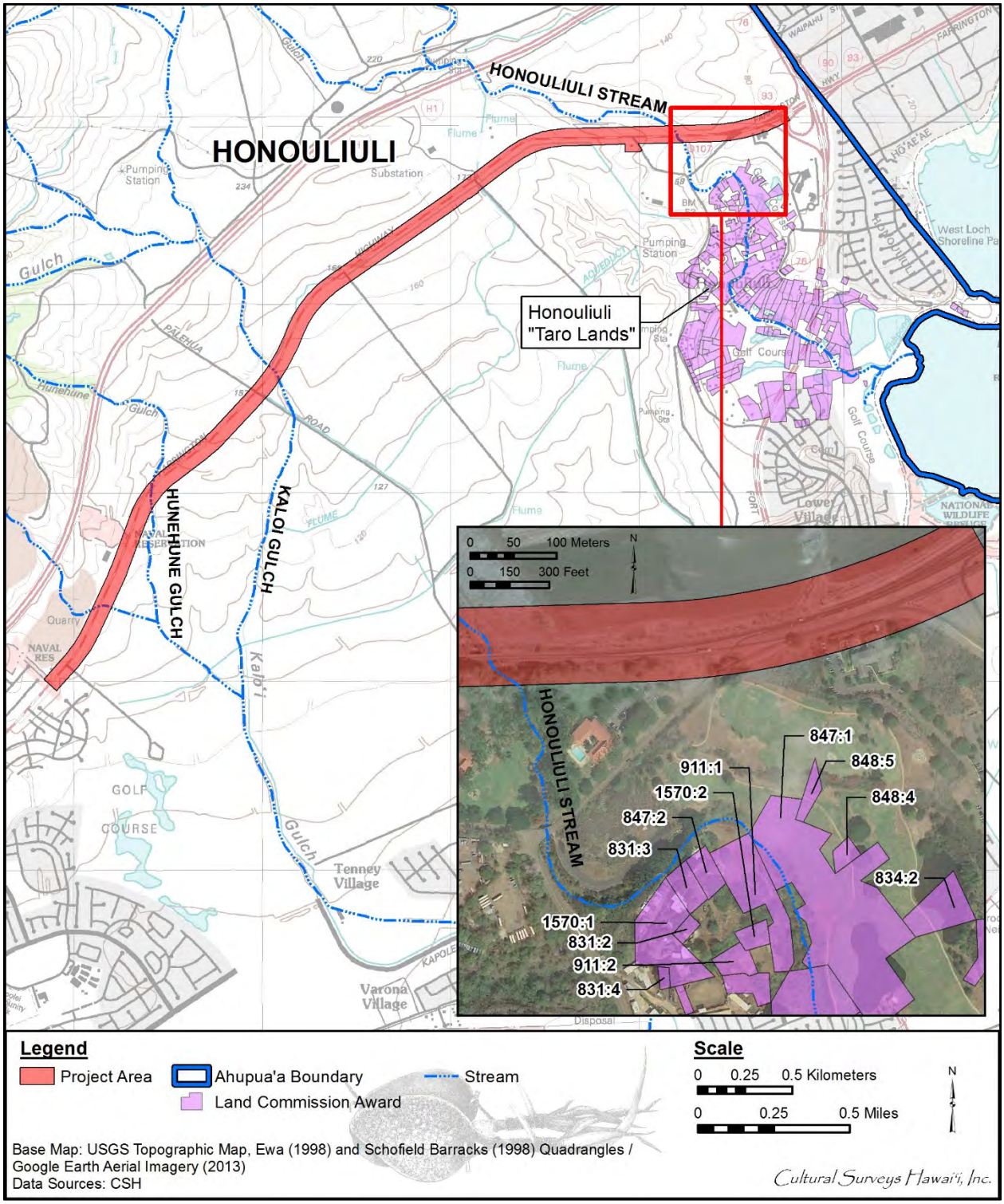


Figure 10. Portion of 1998 Ewa and Schofield Barracks USGS topographic quadrangles, depicting project area with Land Commission Awards in the vicinity

In 1880-1881, the Honouliuli ranch was described as follows:

> . . . acreage, 43,250, all in pasture, but possessing fertile soils suitable for agriculture; affords grazing for such valuable stock. The length of this estate is no less than 18 mi. It extends to within less than a mi of the sea coast, to the westward of the Pearl River inlet . . . There are valuable fisheries attached to this estate . . . [Bowser 1880:489]
>
> From Mr. Campbell's veranda, looking eastward, you have one of the most splendid sights imaginable. Below the house there are two lochs, or lagoons, covered with water fowl, and celebrated for their plentiful supply of fish, chiefly mullet . . . Besides Mr. Campbell's residence, which is pleasantly situated and surrounded with ornamental and shade trees, there are at Honouliuli two churches and a school house, with a little village of native huts. [Bowser 1880:495]

In 1881, a medical student, touring the island to provide smallpox vaccinations to the population, viewed Campbell's property, called the Honouliuli Ranch:

> I took a ride over the Honouliuli Ranch which is quite romantic. The soil is a deep, reddish loam, up to the highest peaks, and the country is well-grassed. Springs of water abound. The ilima, which grows in endless quantities on the plains of this ranch, is considered excellent for feeding cattle; beside it grows the indigo plant, whose young shoots are also good fodder, of which the cattle are fond. Beneath these grows the manieizie grass, and Spanish clover and native grasses grow in the open; so there is abundant pasturage of various kinds here. As I rode, to the left were towering mountains and gaping gorges; ahead, undulating plains, and to the right, creeks and indentations from the sea. A wide valley of fertile land extends between the Nuuanu Range and the Waianae Mountains and thence to the coast of Waialua. There are many wild goats in this valley, which are left more or less undisturbed because they kill the growth of mimosa bushes, which would otherwise overrun the country and destroy the pasturage for cattle. [Briggs 1926:62–63]

Most of Campbell's lands in Honouliuli were used exclusively for cattle ranching. At that time, one planter remarked "the country was so dry and full of bottomless cracks and fissures that water would all be lost and irrigation impracticable" (Ewa Plantation Company 1923:6–7). In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water. The well, drilled to a depth of 240 ft near Campbell's home in ‘Ewa, resulted in "a sheet of pure water flowing like a dome of glass from all sides of the well casing" (*The Legacy of James Campbell* in Pagliaro 1987:3). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource.

3.2.5.2 Other Enterprises on Campbell Lands

As noted above, part of Mr. Campbell's lands were also used to grow rice. These rice fields were planted in former taro fields or in undeveloped swamps (Figure 11). The rice fields in 1882 were described by Frank Damon, during a tour of the area:

> Towards evening we reached Honouliuli, where the whole valley is leased to rice planters . . . This was one of the largest rice plantations we visited. Sometimes two

Figure 11. Photo of rice fields in Honouliuli Ahupua‘a (Hawai‘i State Archives n.d.)

> or three men only, have a few fields which they cultivate for themselves, and we often too came upon houses where there were eight or ten men working their own land. But the larger plantations are owned by merchants in Honolulu, who have a manager acting for them . . . [Damon 1882:37]

In 1890, Dillingham leased all land below 200 ft to William Castle, who used most of it for sugarcane, but also leased some for rice cultivation, pasture, wood lots, bee-keeping, garden crops, and quarries. Some land above 650 ft was also leased for the cultivation of canaigre, an herbal source of tannin used in leather production (Frierson 1972:15–16).

An additional agricultural trial was conducted in the Honouliuli area for the cultivation of sisal, a plant used to make fibers for rope and other material. Some sisal was planted before 1898 and production continued until the 1920s (Frierson 1972:16). This was grown mainly on the coastal plain of Honouliuli in Kānehili, just *mauka* of Kualaka‘i Beach (now Nimitz Beach).

Into the early twentieth century, some Hawaiian families continued to live in Honouliuli and preserved the traditional lifestyle, including at the fishing village of Kūalaka‘i. One resident, Mrs. Eli Williamson, recalled,

> In the Honouliuli area the train stopped among the *kiawe* (algaraboa) trees and *malina* (sisal) thickets. We disembarked with the assorted food bundles and water containers. Some of the Kualaka‘i *‘ohana* (family) met us to help carry the *‘ukana* (bundles) along a sandstone pathway through the *kiawe* and *malina*. The distance to the frame house near the shore seemed long. When we departed our *‘ukana* contained fresh lobsters, *limu* (seaweed), fish and *i‘a malo‘o* (dried fish) . . . [Williamson in Kelly 1985:160]

3.2.5.3 Pineapple Cultivation

In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation (Figure 12). There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893. Later attempts were made in Waiawa and Honouliuli. James Dole founded the Hawaiian Pineapple Company in 1901. The previous year, Dole had purchased 61 acres of land in Wahiawa for growing pineapple. Prior to 1913, most of the upland plateau areas in Waiawa were planted in pineapple (Goodman and Nees 1991:59) and small plots along gullies, those not appropriate for sugarcane cultivation, in several ‘Ewa *ahupua‘a* were planted in pineapple. Many of these small plots were cultivated by independent farmers, who sold the crops at markets or to larger companies. In 1901, the Hawaiian Pineapple Company obtained 61 acres in Waiawa through public auction. Initially, most pineapple was shipped to California for packing. In an attempt to speed up processing, save money and produce a fresher product, a cannery was constructed in Waiawa. This cannery was constructed by the Pearl City Fruit Company but became a part of the Hawaiian Pineapple Company operations after the Pearl City Fruit Company went bankrupt. The cannery was in operation from 1905 to 1935.

3.2.5.4 The Oahu Railway and Land Company (OR&L)

In 1886, Campbell and B.F. Dillingham put together the “Colonization Project,” which was an attempt to sell Honouliuli land to homesteaders (Thrum 1886:64). This homestead project failed, largely due to the lack of water and the distance from ‘Ewa to Honolulu. The water problem was

Figure 12. Photo of first pineapple plantation in Kunia ca. 1900 (University of Hawai‘i at Mānoa Digital Collection)

solved by the drilling of artesian wells, and Dillingham decided the area could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was to be solved by the construction of a railroad, which B. Franklin Dillingham soon began to finance under the company name of the Oahu Railway and Land Company (OR&L).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the OR&L in 1890. To attract business to his new railroad, Dillingham subleased all land below a 200 ft elevation to William Castle who in turn sublet the area to the Ewa Plantation Company for sugarcane cultivation (Frierson 1972:15). Throughout this time, and continuing into modern times, cattle ranching continued in the area, and Honouliuli Ranch—established by Dillingham—was the "fattening" area for other ranches (Frierson 1972:15).

During the last decade of the nineteenth century, the railroad traveled from Honolulu to Pearl City in 1890, eventually making its way to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:III, 100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields.

Dillingham's *mauka* lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892 the Ranch Department of the OR&L Company tapped plantation flumes and searched for alternative sources of water. Ida von Holt leaves this account of her husband Harry's (Superintendent of the OR&L Ranch Department) search for water in the foothills of the Wai‘anae Range:

> One of those places is on the old trail to Pālehua, and had evidently been a place of which the Hawaiians had known, for its name is Kalo‘i (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. [Von Holt 1985:136]

The spring was located along the upper slopes of the southern face of Kalo‘i Gulch. A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo‘i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring. [Von Holt 1985:138]

Following the discovery, two old Hawaiians began to ask Von Holt about the spring.

> Finally he [Harry von Holt] got them to explain that the spring, called ‘Waihuna' (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840 . . . A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. [Von Holt 1985:138–140]

Operations at the OR&L began to slow down in the 1920s, when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families

for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around, as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted that one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The Navy base at Pearl Harbor had its own rail lines that connected to the OR&L rail lines.

In August 1945 the war ended and so did the OR&L's operation as a military transport line:

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

There was no choice but to abandon the OR&L main line, and in 1946 Water F. Dillingham, son of B.F. Dillingham, wrote,

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and the shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Walter Dillingham in Chiddix and Simpson 2004:257]

After the war, most of the 150 miles of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track for their own use, to transport bombs, ammunition, and torpedoes from the ammunition magazines at Lualualei, West Loch in Pearl Harbor, and Waikele on OR&L's Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968.

In 1970, the Hawaiian Railway Society was formed to save and restore the remaining OR&L railway tracks and stock. The federal government donated the tracks and right-of-way to the State of Hawai‘i in 1974, and the Society was able to place the Navy's Lualualei-Pearl Harbor track on the National Register of Historic Places on 1 December 1975. The Highway Railway Society has currently restored about 6.5 miles of this track, on which they run weekly tourist train rides from Ewa Station to Nānākuli, pulled by restored OR&L locomotives (Chiddix and Simpson 2004:273).

3.2.5.5 Ewa Plantation Company

The Ewa Plantation Company (Figure 13) was incorporated in 1890 for sugarcane cultivation. Ewa Plantation's first crop, 2,849 tons of sugar, was harvested in 1892. Ewa Plantation was the first all-artesian plantation, and it gave an impressive demonstration of the role artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:III, 69). As a means

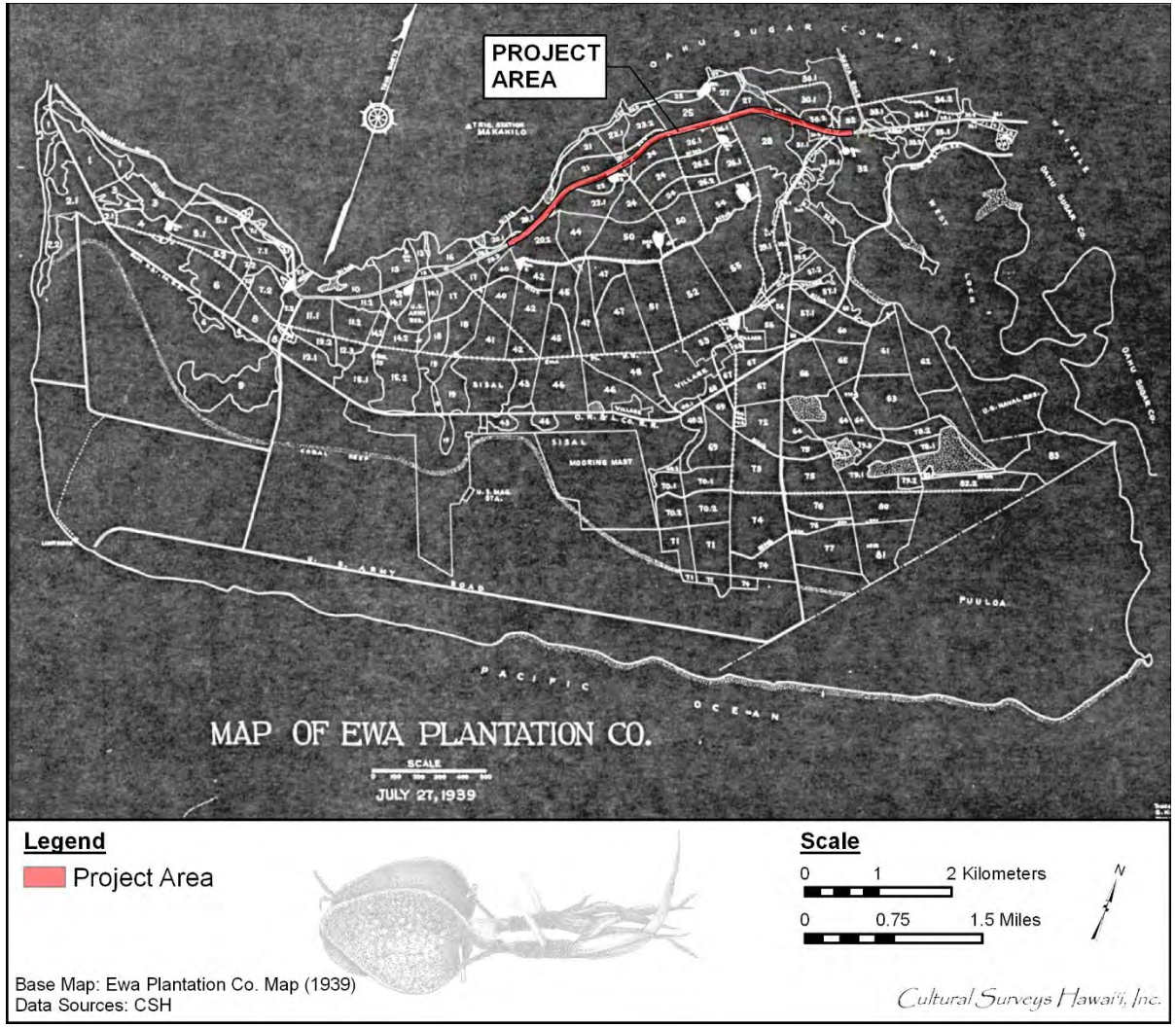


Figure 13. 1939 Ewa Planation Company map with project area location (Condé and Best 1973:285)

to generate soil deposition on the coral plain and increase arable land in the lowlands, the Ewa Plantation Company installed ditches running from the lower slopes of the mountain range to the lowlands. When the rainy season began, they plowed ground perpendicular to the slope so that soil would be carried down the drainage ditches into the lower coral plain. After a few years, about 373 acres of coral wasteland were reclaimed in this manner (Immisch 1964). By the 1920s, Ewa Plantation was generating large profits and was the "richest sugar plantation in the world" (*Paradise of the Pacific,* December 1902:19–22 in Kelly 1985:171).

Just north of Ewa Plantation was the equally sprawling Oahu Sugar Company, which "covered some 20 square mi . . . ranging in elevation from 10 feet at the Waipio Peninsula . . . to 700 feet at the Waiahole Ditch" (Condé and Best 1973:313). The Oahu Sugar Company lands were described as being "of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project" (Condé and Best 1973:313). The Oahu Sugar Company took control of the Ewa Plantation lands in 1970 and continued operations until 1995, when they decided to shut down sugarcane production in the combined plantation area (Dorrance and Morgan 2000:45, 50).

3.2.5.6 Plantation Worker Housing: ‘Ewa Villages

In 1890, construction began on housing for over 500 Ewa Plantation workers (Hammatt et al. 1990:13). Eight main plantation camps, collectively known as ‘Ewa Villages, were constructed in the vicinity of Ewa Plantation sugar mill. These villages included (from northeast to southwest) Lower Village, Middle Village (also called Korean Village), Fernandez Village, Renton Village, Tenney Village, Mill Village, Varona Village, and "C" Village. The mill and plantation camps are located at junctions of major plantation transportation corridors, including the Ewa Plantation railway, the OR&L railway, and plantation roads (Figure 14).

In 1928, probably the year with the greatest number of workers, the census bureau counted 4,967 people living on and associated with the Ewa Plantation (Hammatt et al. 1990:13). These workers were Japanese, Chinese, Okinawan, Korean, Portuguese, Spanish, Hawaiian, Filipino, and European, who usually lived in segregated camps or housing areas (Figure 15). The plantation houses were described by George F. Renton, the plantation manager from 1899 to 1920:

> Each of these dwellings is enclosed by a fence and supplied with water. It is pleasant to note the eagerness with which these homes have been taken up, and how much the premises have been improved. This is especially noticeable among the Japanese . . . At present writing there are 451 dwellings on this estate. These are actual houses exclusive of restaurants, bath houses, cook houses, work shops, schools or churches. [Pagliaro 1987:17]

With the onset of World War II in the 1940s, the U.S. military drew from the plantation workforce to support the war effort. To cope with the loss of plantation laborers, Ewa Plantation came to rely on mechanical harvesting. This led to the overall decline in the large, multi-racial plantation workforce that had characterized the early history of the plantation (Hammatt et al. 1990:13). The Ewa Plantation Mill closed in the mid-1970s, following the sale of Ewa Plantation to Oahu Sugar Company. Sugarcane cultivation continued in ‘Ewa until the mid-1990s.

3.2.5.7 World War II and the Military in ‘Ewa

By 1941, Pacific Naval Air Bases expenditures for new construction at Pearl Harbor were in the hundreds of millions of dollars. The Japanese attack on Pearl Harbor on 7 December 1941

Figure 14. Photo of the Ewa Plantation train ca. 1950s (Hawaii Aviation 1950)

Figure 15. Photo of Ewa Plantation ca. 1925 at the Filipino Laborers Village (University of Hawai‘i at Mānoa Digital Collection)

damaged or destroyed much of the new construction. Reconstruction was instituted to double Pearl Harbor’s war capacity. Military planners approved a new ammunition depot in the mountainside of Waipahu, a large new hospital in ‘Aiea, and thousands of additional changes to the Navy yard to accommodate the new aircraft carrier task forces (Woodbury 1946:342–343). During World War II, the military used the sugarcane rail system to “haul large quantities of ammunition” (Condé and Best 1973:315).

Before the war, the main Pearl Harbor Naval yard was a sufficient staging and storage area for the Pacific fleet, but after the Japanese attack and the beginning of World War II, additional areas were needed for supply depots and warehouses. The government procured additional land after the beginning of World War II to expand the functionality of the military bases. The Navy took all of the coastline area in eastern ‘Ewa District from the coast inland of the OR&L railroad tracks (Ching 1996:24). Waipi‘o Point, Waiawa Gulch, Pearl City (Mānana) Peninsula, Iroquois Point in Hālawa, and small areas in Honouliuli and Hō‘ae‘ae were taken over as supply depots and storage areas. The OR&L railroad had built a spur from the coast to Wahiawa in 1905, to haul cane and pineapples down to the coast and later to haul men and supplies from Pearl Harbor to Schofield Barracks in Wahiawa through Waikakalaua Gulch in Waikele. During the war, the military built a “secret railroad” from the railroad terminus at Waikakalaua Gulch to join the OR&L railroad coming around Ka‘ena Point at Hale‘iwa, thus providing a short cut from Pearl Harbor to Army facilities at Kahuku on the north shore of O‘ahu (Kneiss 1957:11–12). By 1944, the Navy had claimed close to 2,400 acres of land in the Pearl Harbor and Pearl City areas within Mānana, Waiawa, and Hālawa for use as military staging areas in the war effort (Allen 1999:234).

To this day, much of the Pearl City peninsula remains in the custody of the U.S. Navy; however, in the late 1990s, much of the rest of the previous Pearl City regions were released to the state for public use (Allen 1999:239).

3.2.5.8 Residential and Commercial Development in Honouliuli

A series of historic topographic maps shows the gradual residential and commercial development of Honouliuli. On the 1919 U.S. Army War Department fire control map (Figure 16), residential areas are limited to a cluster at Honouliuli near the old taro lands, adjacent to West Loch, and the Ewa Plantation Villages *makai* of Honouliuli. On the 1930s USGS map (Figure 17), both Honouliuli and the Ewa Plantation villages are expanding with new and improved roads. On the 1943 U.S. Army War Department map (Figure 18) Ewa Villages has expanded with additional “ethnic camps,” while Honouliuli has become a smaller residential area, rather than a separate “village.” On the 1953 U.S. Army Mapping Service map (Figure 19), residential subdivisions are spreading to the shore of Pearl Harbor. However, the lands surrounding the current project area remain almost exclusively under commercial sugarcane cultivation until the end of the twentieth century (Figure 20).

3.2.6 History of Farrington Highway

Farrington Highway was originally constructed in the 1930s. Its predecessor was variously termed the “Government Road” or “Wai‘anae Road” and provided less than ideal travel and transport conditions. These precursor roads generally followed the path of a pre-Contact trail that crossed several *ahupua‘a* and connected Honolulu to Wai‘anae. An 1873 map by W.D. Alexander (Registered Map 405; see Figure 9) depicts the road and labels it as “Road.” A copy of Alexander’s 1873 map (Registered Map 618) has a handwritten label for the road, “Govt Road.”

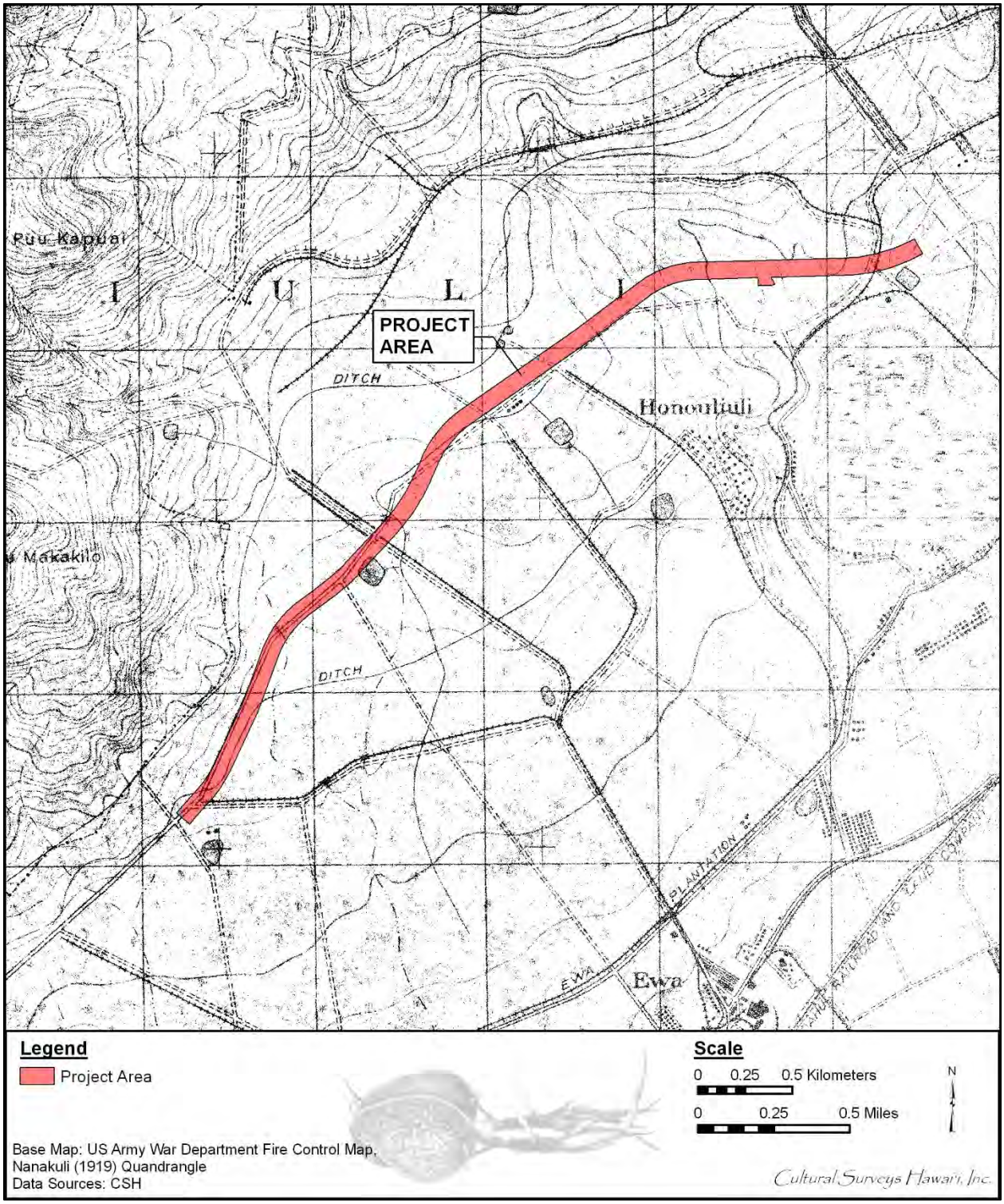


Figure 16. 1919 U.S. War Department fire control map, Nanakuli and Pearl Harbor quadrangles showing project area

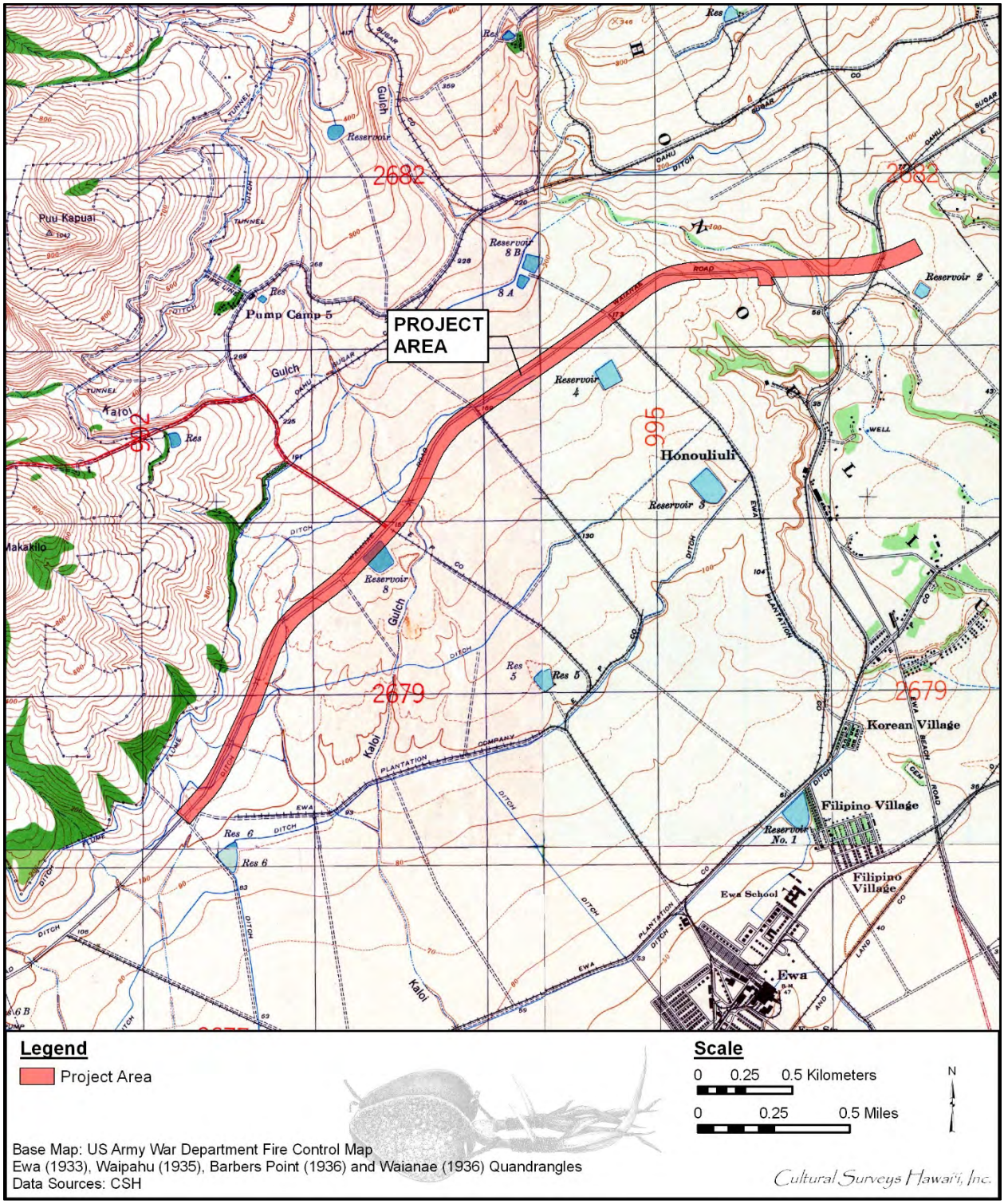


Figure 17. 1930s U.S. War Department terrain map showing project area, note plantation reservoir located in central project area

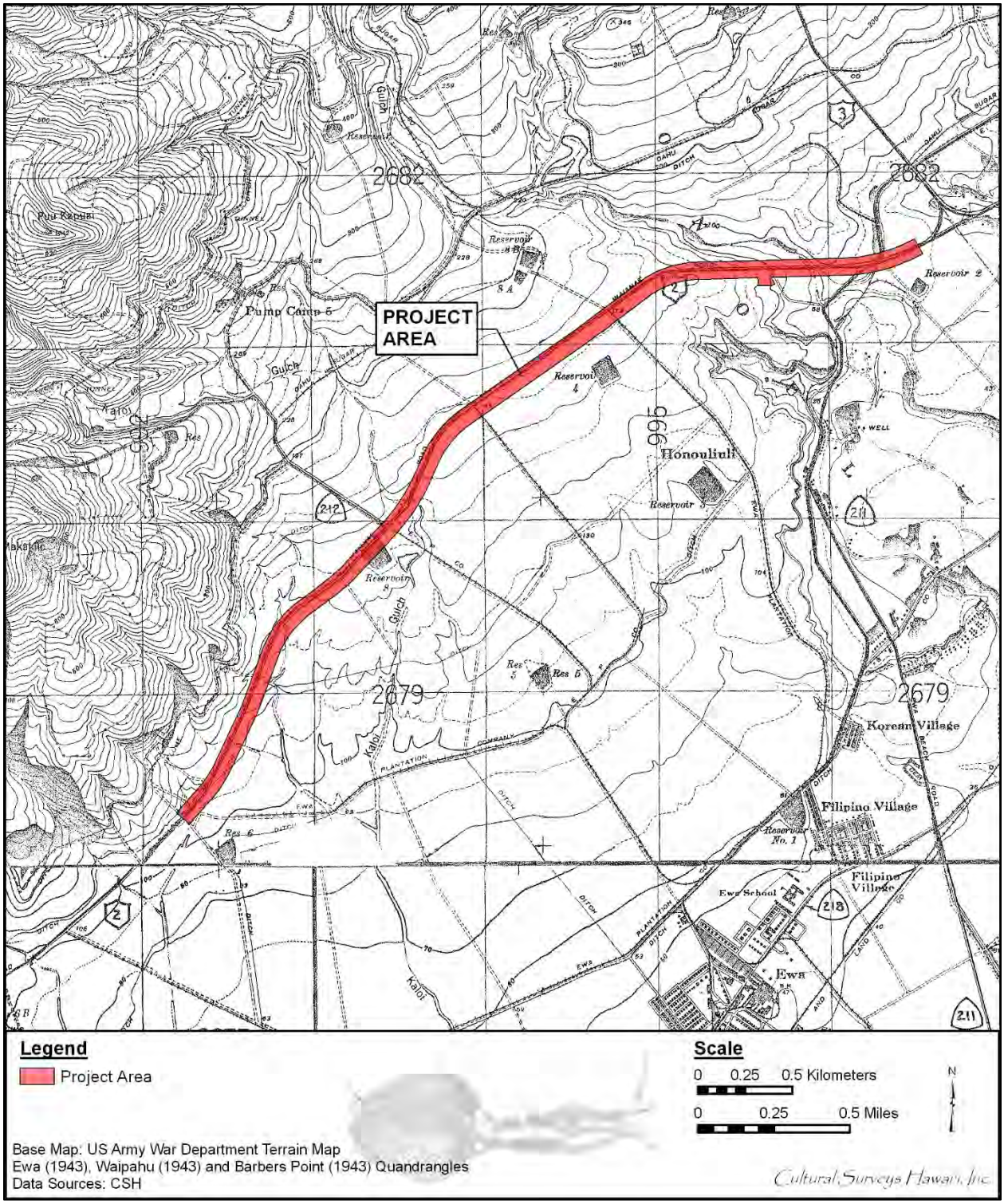
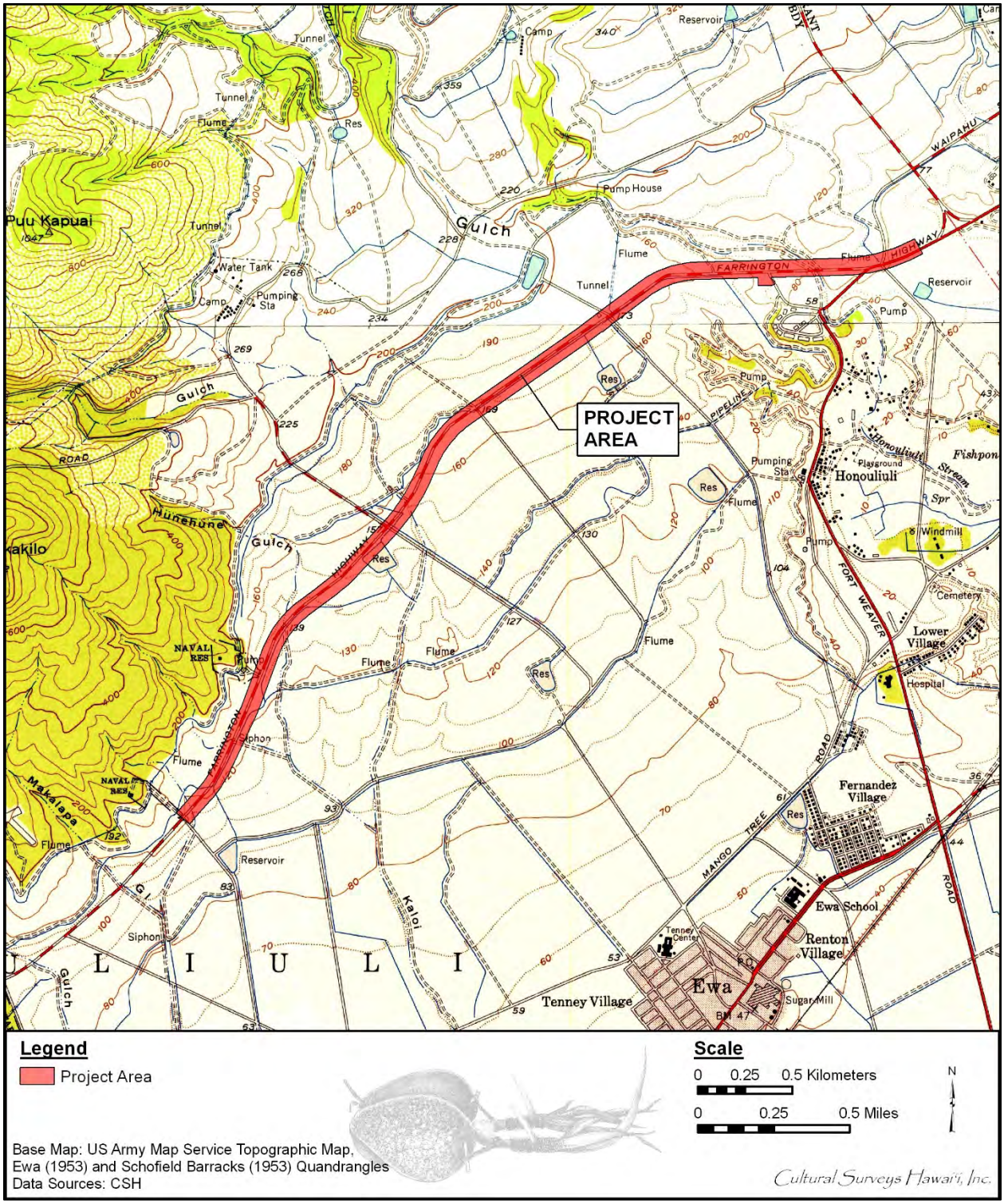


Figure 18. 1943 U.S. War Department terrain map showing project area



Legend

Project Area

Scale

0 0.25 0.5 Kilometers

0 0.25 0.5 Miles

N

Base Map: US Army Map Service Topographic Map, Ewa (1953) and Schofield Barracks (1953) Quandrangles
Data Sources: CSH

Cultural Surveys Hawai'i, Inc.

Figure 19. 1953 Ewa and Schofield Barracks USGS topographic quadrangles, showing project area

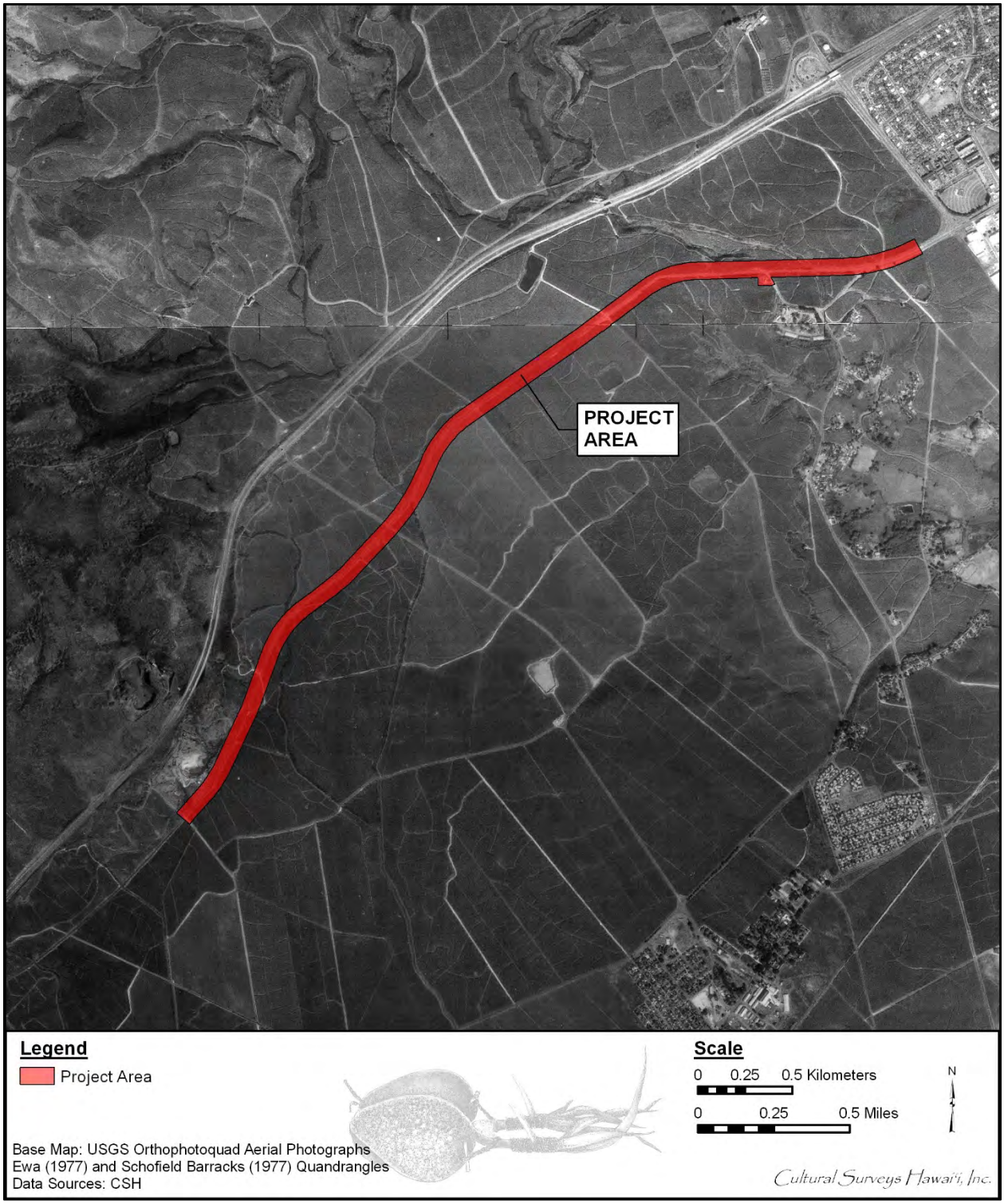


Figure 20. 1977 USGS aerial photograph showing project area still under sugarcane cultivation

It is not known at what date this label was added. In 1902, the road is referred to as the Government Road (Condé and Best 1973). The 1930s USGS map (see Figure 17), as well as the 1943 U.S. Army War Department map (see Figure 18), label the road as Waianae Road. The 1953 USGS map (see Figure 19) has the road labeled as Farrington Highway.

A section of Farrington Highway's predecessor in the Wai‘anae District was described as a "mud hole in the winter and billowed dust in the summer" (McGrath et al. 1973:51). The Wai‘anae Road was not paved. Because of the transport limitations over the Wai‘anae Road, most transport and travel between Wai‘anae and Honolulu, prior to the construction of Farrington Highway, was made using the OR&L Railroad or steamer ship (McGrath et al. 1973).

The construction of Farrington Highway was a component of the overall Territorial Highway System. It was only after 1925 that Territorial officials made use of available federal funding assistance for road and bridge construction. This led to abundant bridge and road construction after 1925 in Hawai‘i. Further federal assistance became available in the 1930s as part of the Works Progress Administration and National Reclamation Association programs; this funding lead to additional standardization and improvement of the Territorial Highway System (Thompson 1983:III–15). These improvements were significant events that greatly facilitated intra-island travel, transportation, and communication. Farrington Highway was eventually named after Wallace Rider Farrington (1871–1933), a former Honolulu newspaper man, mayor of Honolulu, and Territorial Governor of Hawaii (1921–1929), who was influential in expanding Hawai‘i's roadways.

3.2.7 Farrington Highway Bridges

There are a number of gulch and stream crossings within the current project area. Bridges are marked at the locations of Kaloi Gulch and Hunehune Gulch on the 1919 U.S. War Department map (see Figure 16). By the 1930s there are bridges marked at Palehua Stream, an unnamed drainage, Hunehune Gulch, and Kaloi Gulch (see Figure 17). The 1943 U.S. Army War Department map (see Figure 18) shows Farrington Highway to have been expanded (to create a bypass) in the eastern portion of the project area. Though the 1943 figure does not specifically mark any bridge locations, all currently existing bridges are thought to have been in place by this time. Present day bridge locations are shown on Figure 21.

Previous studies have identified as many as six bridges associated with these crossings. *The Historic Bridge Inventory, Island of Oahu* (Thompson 1983) lists two bridges within the project area: Honouliuli Stream Bridge and Kaloi Gulch Bridge. These were evaluated as not significant based on builder, construction date, technology, geometric configuration, aesthetics, history, and integrity (Thompson 1983 in Magnuson 1999:24).

Magnuson (1999) identified six bridges within the current project area. From west to east these include a bridge "near Hawaiian Cement," two bridges at Hunehune Gulch (one in-use and one inactive), two bridges at Kaloi Gulch (one in-use and one inactive), and the Honouliuli Stream Bridge. The bridges are summarized:

> The six bridges exhibit three bridge types: span reinforced concrete T-beam, reinforced concrete single arch, and simple concrete slab. They provide an important transportation link between ‘Ewa and Wai‘anae. Three of the bridges

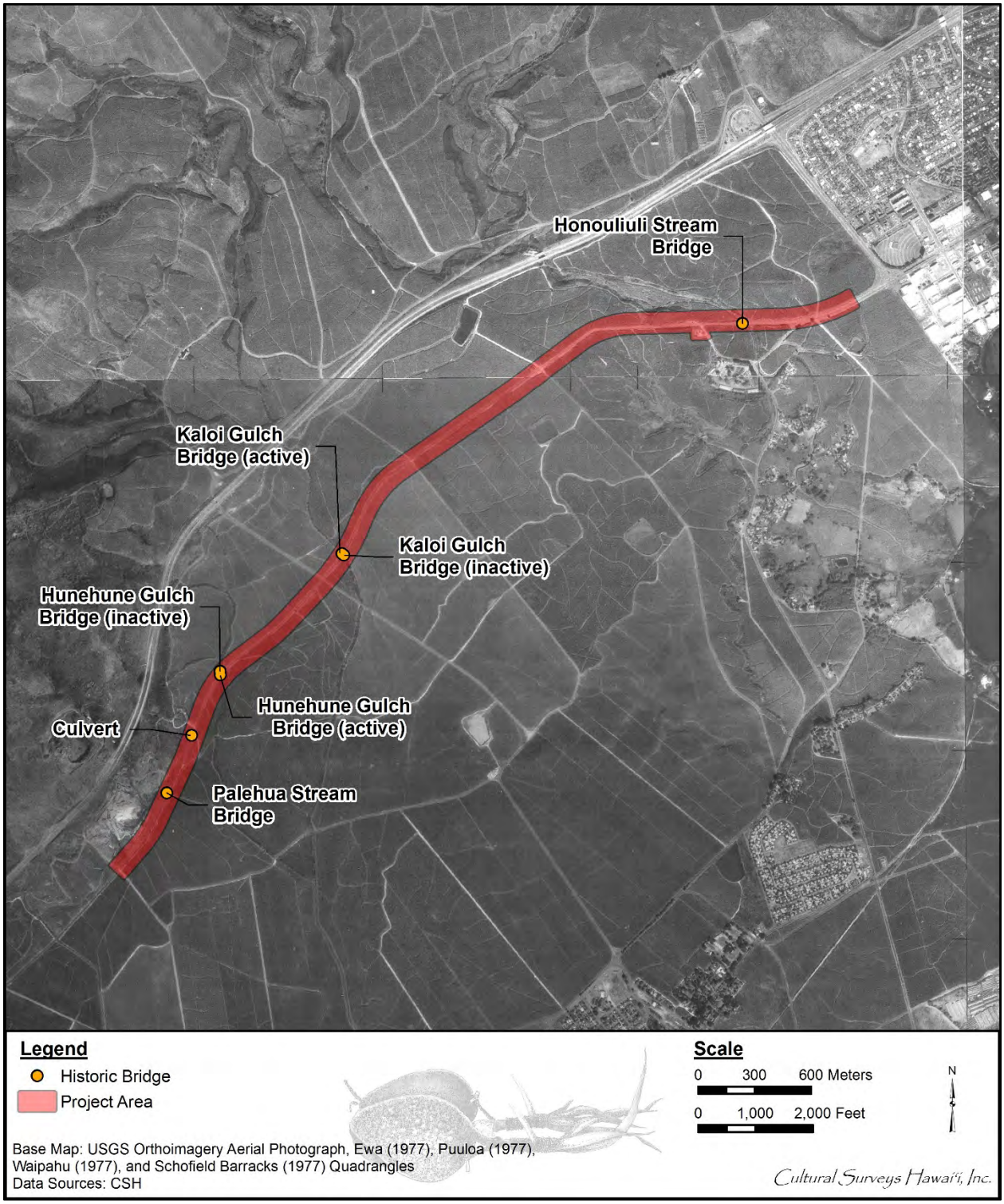


Figure 21. 1977 USGS aerial photograph with locations of crossings identified within the project area

> date between 1920 and 1939. Dates of the remaining three bridges are unknown, but appear to be of the same period. [Magnusson 1999:23]

Although the bridges appear to be of adequate age, Magnuson (1999) states that they do not meet the significance requirements for eligibility for listing on the National Register of Historic Places (NRHP) or the Hawai‘i Register of Historic Places (HRHP). This is based on the Thompson (1983) study that evaluated the Honouliuli Stream Bridge and Kaloi Gulch Bridge as not significant and the fact that Thompson excluded the remaining bridges from the inventory because "it is not possible they are significant" (Magnuson 1999:25).

In 2012, Mason Architects completed a Historic American Engineering Record (HAER No. HI-99, Ruzicka 2012) for Honouliuli Bridge (Honouliuli Stream Bridge) as part of the process for documenting historic properties adversely affected by the Honolulu Rail Transit Project (HRTP). The bridge was built in 1939, engineered by William R. Bartels, and built by E.E. Black:

> The Honouliuli Bridge is a single-span, reinforced concrete tee-beam bridge carrying two lanes of traffic over Honouliuli Stream. The bridge has concrete parapets and end stanchions that were typical for the time of its construction in Hawaii. [Ruzicka 2012:2]

Honouliuli Bridge was assessed as significant:

> The Honouliuli Bridge is a significant resource in the history of Oahu's road transportation system. It is significant at the local level for its contribution to the development of the Farrington Highway segment, an important connector in Oahu's belt road system. The bridge facilitated passage along the highway across the Honouliuli and Waipahu areas, providing a better linkage for the Ewa and Waianae areas in the west to the urban center and main port of Honolulu. [Ruzicka 2012:1]

The most recently updated *Hawaii State Historic Bridge Inventory and Evaluation* (MKE Associates, LLC/Fung Associate, Inc. 2013) lists four bridges within the current project area. These consist of Farrington Highway Bridge No. 1-Kaloi Gulch, Farrington Highway Bridge No. 2-Hunehune Stream, Farrington Highway Bridge No. 3-Palehua Stream, and Farrington Highway Bridge-Honouliuli Stream.

Both the Farrington Highway Bridge No. 1-Kaloi Gulch and the Farrington Highway Bridge No. 2-Hunehune Stream were built in 1941 and consist of concrete slab bridge type with concrete solid parapets. These two bridges have been evaluated as "not eligible" for the NRHP:

> This bridge has lost integrity due to thrie beams that have been bolted in front of the solid concrete parapet such that the concrete is not visible. The bridge does not have distinctive engineering or architectural features that depart from standard bridge design. [MKE Associates, LLC/Fung Associates, Inc. 2013:4-19]

Farrington Highway Bridge No. 3-Palehua Stream was built in 1922 and consists of a concrete slab bridge type with concrete solid panel with cap parapets. This bridge has been evaluated as eligible for the NRHP:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1920's

> concrete slab bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates, LLC/Fung Associates, Inc. 2013:4-319]

Farrington Highway Bridge-Honouliuli Stream was built in 1939 and consists of a concrete tee-beam bridge type with concrete open Greek cross parapets. This bridge has been evaluated as eligible for the NRHP:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1930's concrete tee beam bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates, LLC/Fung Associates, Inc. 2013:4-322]

3.3 Previous Archaeological Research

Numerous previous archaeological studies have been conducted in the vicinity of the project area. These studies are depicted in Figure 22 and Figure 23 and summarized in Table 3. A summary of each archaeological study follows.

3.3.1 McAllister 1933; Thrum 1906, 1907

The earliest attempt to record archaeological remains in Honouliuli Ahupua‘a was made by Thomas Thrum (1906). He reported the existence of a *heiau* located on Pu‘uokapolei, west of the present project area. In a second monograph on *heiau*, Thrum (1907) called this *heiau* Palole‘i (Kapolei).

During a survey of the island in 1930, J. Gilbert McAllister recorded the specific locations of important sites and the general locations of less important sites (at least at Honouliuli). He recorded 14 specific sites in Honouliuli, Sites 133–146 (McAllister 1933:107–108), none of which are located in the immediate vicinity of the project area. Site 138, Puu Kapolei Heiau, is located approximately 2 km to the west of the project area.

3.3.2 Dicks et al. 1987; Wolforth et al. 1998

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted an archaeological reconnaissance survey (ARS) for the West Loch Estates Golf Course and Parks (Dicks et al 1987). The study addressed an approximately 220-acre project area bisected by Fort Weaver Road, extending from the coast of the West Loch of Pearl Harbor to Farrington Highway. The project area included only a very narrow frontage along the current project area along Farrington Highway near the intersection of old Fort Weaver Road.

The study identified seven new sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3323 (a historic fishpond), and -3324 (a pre- through post-Contact buried pond-field system).

A follow-up archaeological data recovery study (Wolforth et al. 1998) was conducted in 1988 and 1989 and included excavations of SIHP #s -3319, -3320, -3321, and backhoe trenching at SIHP #s -3322 and -3324. Radiocarbon dates from SIHP # -3321 indicated the pond-fields were

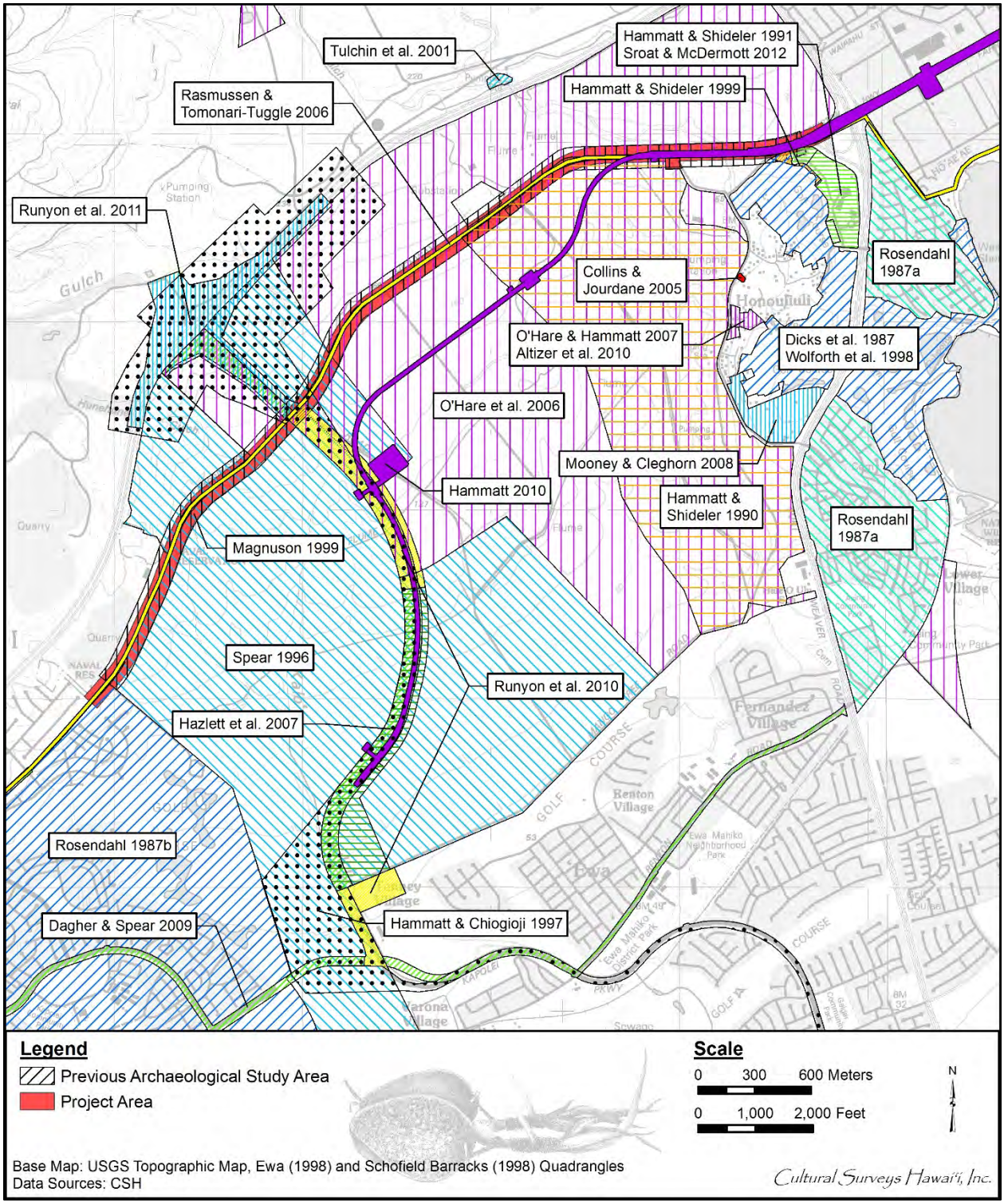


Figure 22. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previous archaeological research in the vicinity of the project area

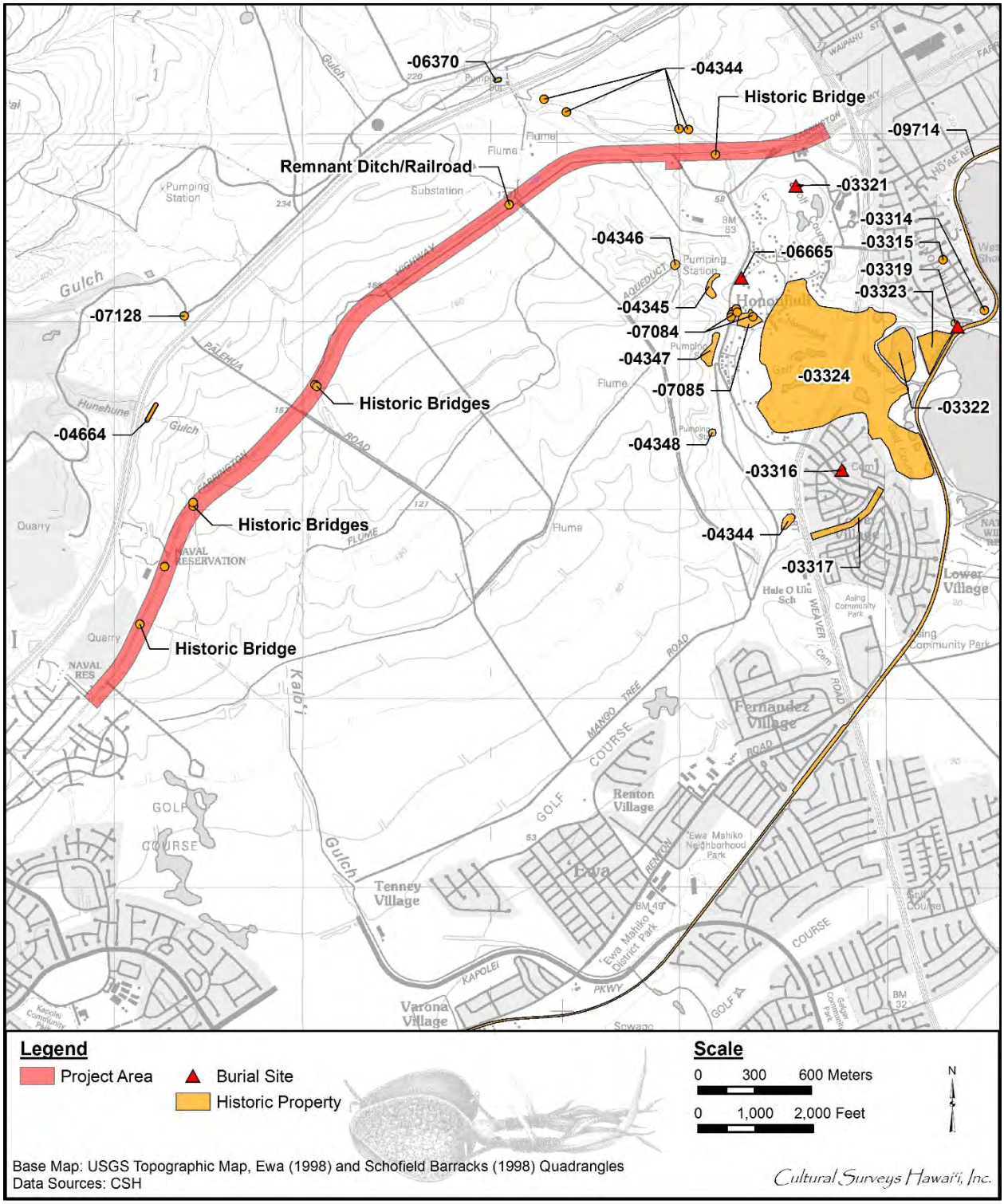


Figure 23. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previously identified archaeological sites in the vicinity of the project area

Table 3. Previous archaeological studies in the vicinity of the project area

Reference	Nature of Study	Project/Location	Results
Thrum 1906, 1907	*Heiau* studies	Island-wide	Reported existence of Pu‘uokapolei in 1906; in 1917, called the *heiau* Palole‘i (Kapolei)
McAllister 1933	Archaeological survey	Island-wide	Recorded 14 sites in Honouliuli, including Puu Kapolei Heiau (Site 138)
Dicks et al. 1987	Archaeological reconnaissance survey	West Loch Estates – Golf Course and Parks	Identified seven sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3233 (a historic fishpond), and -3324 (a pre- through post-Contact buried pondfield system)
Rosendahl 1987a	Archaeological reconnaissance survey	West Loch Estates – Residential Increments I and II	Documented four sites: T-1, a midden deposit; T-2, a historic surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern surface artifact scatter related to Lower Village plantation settlement
Rosendahl 1987b	Archaeological reconnaissance survey	Kapolei Village Master Plan project	No archaeological sites identified; noted that entire project area had been extensively modified by sugarcane cultivation
Hammatt and Shideler 1990	Archaeological inventory survey	West Loch Bluffs project	Recorded four surface features: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (northern pumping station), -4347 (central pumping station), and -4348 (southern pumping station)

Reference	Nature of Study	Project/Location	Results
Hammatt and Shideler 1991	Archaeological inventory survey	Saint Francis Medical Center West	Project area had been extensively disturbed and contained no surface archaeological sites
Spear 1996	Archaeological reconnaissance survey and assessment	East Kapolei Development project	No archaeological sites identified; reported Kalo‘i and Hunehune Gulches modified for sugarcane irrigation
Hammatt and Chiogioji 1997	Archaeological reconnaissance survey	North-South Rd	Documented that entire area had been extensively graded in association with sugarcane cultivation and construction of plantation infrastructure
Wolforth et al. 1998	Archaeological data recovery	West Loch Estates Residential Increment I, Golf Course and Shoreline Park project	Consisted of excavations of SIHP #s 50-80-12-3319, -3320, -3321, -3322, and -3324; radiocarbon dates for -3321 indicate pond-fields used from tenth to seventeenth centuries
Hammatt and Shideler 1999	Archaeological assessment (no finds archaeological inventory survey)	Saint Francis Medical Center West	No cultural resources identified
Magnuson 1999	Archaeological reconnaissance survey	Farrington Hwy between Fort Weaver and Kapolei Golf Course roads	Documented eight historic sites: six bridges, a section of railroad track, and an irrigation ditch; all sites considered not significant and not designated SIHP numbers
Tulchin et al. 2001	Archaeological inventory survey	‘Ewa Shaft Renovation project	Identified one surface site, SIHP #50-80-08-6370, a historic stone wall alignment
Collins and Jourdane 2005	Burial report	Old Fort Weaver Rd	Partial remains of a possibly Native Hawaiian, adult female found eroding out of ground surface after heavy rains; burial believed to be historic in age

Reference	Nature of Study	Project/Location	Results
O’Hare et al. 2006	Archaeological inventory survey	Ho‘opili project	Documented four additional features associated with SIHP # 50-80-12-4344, plantation infrastructure; concluded sugarcane cultivation, irrigation, flood control, railroad construction, road construction, demolition and movement of workers camps, and other factors obliterated all, or almost all, traces of archaeological cultural resources
Rasmussen and Tomonari-Tuggle 2006	Archaeological monitoring	Waiau Fuel Pipeline	Project area along Farrington Hwy not monitored as area determined to not be archaeologically sensitive
Hazlett et al. 2007	Archaeological monitoring	North-South Rd	No cultural materials encountered, with exception of a portion of plantation-era road and associated ditch removed during road construction
O’Hare and Hammatt 2007	Archaeological literature review and field inspection	Old Fort Weaver Rd	Observed one site, complex of concrete curbs likely associated with Ewa Plantation Co.
Mooney and Cleghorn 2008	Archaeological assessment	Proposed development of two parcels between Fort Weaver Rd and Old Fort Weaver Rd	No cultural materials encountered, no further work recommended
Dagher and Spear 2009	Literature review and field inspection	Kapolei Computerized Traffic Control System project	No cultural material idenitifed, no further work recommended
Altizer et al. 2010	Archaeological inventory survey	Hale Kipa project, Old Fort Weaver Rd	Documented two sites: SIHP #s 50-80-12-7084 (historic features including house foundations, a cesspool, and water control features) and -7085 (a subsurface pre-Contact *lo‘i* terrace)
Hammatt 2010	Archaeological inventory survey	Construction Phase I for Honolulu High-Capacity Transit Corridor Project	Identified one site in Waikele Ahupua‘a: SIHP # 50-80-09-7751, *lo‘i* sediments

Reference	Nature of Study	Project/Location	Results
Runyon et al. 2010	Archaeological monitoring	North-South Rd	No cultural materials identified
Runyon et al. 2011	Archaeological monitoring	North-South Rd	Documented two historic-era sites: SIHP #s 50-80-14-4664 (a water diversion structure) and -7128 (burnt trash fill layer used in construction of Pālehua Rd)
Sroat and McDermott 2012	Archaeological literature review and field inspection	Hawaii Medical Center West project	No historic properties identified; area extensively modified in historic and modern times

in use from the tenth to seventeenth centuries. SIHP # -3321 was documented approximately 160 m south of the current project area. It was described as a subsurface cultural layer that included a human burial, artifacts, midden, subsurface features, and structural remains. This site relates to a complex of LCAs that lies in the Honouliuli Stream bottomlands, approximately 80 vertical ft below Farrington Highway and the project area. Thus, although the cultural resource is only approximately 160 m south of the project area, it is ecologically distant.

3.3.3 Rosendahl 1987a

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted a combined surface and subsurface survey of approximately 260 acres in two discontinuous parcels east of Fort Weaver Road for the West Loch Estates Residential Increments I and II project (Rosendahl 1987a). The northern of the two parcels extended *mauka* to the intersection of Fort Weaver Road and Farrington Highway, adjacent to the current project area. This study documented four sites: T-1, a midden deposit (possibly non-cultural); T-2, a historic (pre-1900) surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern (both pre- and post-1900) surface artifact scatter related to the Lower Village plantation settlement.

3.3.4 Rosendahl 1987b

In 1987, PHRI conducted an archaeological reconnaissance survey (ARS) for the 850-acre Kapolei Village Master Plan project, located immediately to the southwest of the current project area (Rosendahl 1987b). It was documented that the entire project area had been extensively modified by sugarcane cultivation in historic/modern times, and no archaeological sites were identified.

3.3.5 Hammatt and Shideler 1990

In 1990, CSH conducted an ARS of a 546-acre parcel south of Farrington Highway, then called West Loch Bluffs (Hammatt and Shideler 1990). The northern boundary of the project area extended along Farrington Highway and the current project area. During the survey, four surface features were recorded: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Preservation of the railroad berm and the pumping stations was recommended.

3.3.6 Hammatt and Shideler 1991

In 1991, CSH conducted an archaeological assessment (AA; no finds archaeological inventory survey) for a proposed expansion of Saint Francis Medical Center West on an approximately 24-acre parcel *makai* of Farrington Highway and west of Fort Weaver Road, fronting the current project area (Hammatt and Shideler 1991). A pedestrian survey and background research revealed the entire study area, located on a bluff northeast of the flood plain of Honouliuli Stream, had been extensively disturbed, contained no surface structures or other remains, and was unlikely to contain any subsurface historic properties. The entire project area had been under sugarcane cultivation for several decades.

3.3.7 Spear 1996

In 1996, Scientific Consultant Services, Inc. (SCS) conducted an archaeological reconnaissance and assessment for the East Kapolei Development project, *makai* of the H-1 Freeway, in the

vicinity of the North-South Road corridor (previously known as Pālehua Road, now called Kualakai Parkway) and including portions of Kalo‘i and Hunehune gulches. The project area was located along and surrounding the western half of the current project area. The limited field inspection documented in the Spear (1996) letter report did not identify any cultural resources, but noted that Kalo‘i and Hunehune gulches appeared to have been modified for sugarcane irrigation. The study cited a 1994 SHPD letter (Doc No. 9408TD01) that "clearly indicates that most of the present [Spear 1996] project area has been declared to have 'no effect' on historic sites due to the many years of commercial sugarcane production on these lands" (Spear 1996:1). The study concluded, on the basis of the SHPD letter and the field inspection, "that future development on these land parcels will have 'no effect' on historic sites, and that no further cultural resource work is required" (Spear 1996:1).

3.3.8 Hammatt and Chiogioji 1997; Hazlett et al. 2007; Runyon et al. 2010; Runyon et al. 2011

In 1997, CSH conducted an ARS of a 4.5 km-long corridor that would become the North-South Road project (Hammatt and Chiogioji 1997). An earlier version of the project area extended an additional 4.4 km from the project's southern end at the OR&L right-of-way (SIHP # 50-80-12-9714). It is believed that the project area was revised in order to avoid two previously identified areas of archaeological and historical concern: 1) the 'Ewa Villages Historic District (SIHP # -9786), which was nominated for National Historic Landmark status; and 2) the OR&L right-of-way (SIHP # -9714), which was placed on the NRHP. The North-South Road corridor runs perpendicular through the current project area.

Background research and a pedestrian survey of the study area revealed that the entire area had been extensively graded by the Ewa Plantation Company in association with sugarcane cultivation and the construction of plantation infrastructure. Some remnant plantation structures—flumes, ditches, and roads—were observed in the project area, but were not considered of historic value and not classified as sites.

Archaeological monitoring for a southern portion (Phase 1A) of the North-South Road project was conducted by CSH intermittently from 2005 through 2007 (Hazlett et al. 2007). This phase of the project involved construction of a 1.4-km section of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring, with the exception of a portion of a plantation-era road and associated ditch that were removed during road construction.

Archaeological monitoring for the central portion and southern end (Phase 1B) of the North-South Road project was conducted by CSH intermittently from 2007 through 2010 (Runyon et al. 2010). This phase of the project involved the construction of two sections of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring.

CSH conducted archaeological monitoring for the northern portion (Phase 1C) of the North-South Road project intermittently from 2007 through 2009 (Runyon et al. 2011). This phase of the North-South Road project consisted of the construction of a new highway interchange and roadway, including two on-ramps and two off-ramps connecting the H-1 Freeway to the North-South Road. During monitoring, two historic-era cultural resources were documented: SIHP #s 50-80-14-4664 and -7128. SIHP # -4664 was a concrete plantation-era water diversion structure containing two sluice gates. A portion of this site located a significant distance to the west of the

Runyon et al. (2011) project area was first identified by Nakamura et al. (1993). SIHP # -7128 was a burnt trash fill layer used in the construction of Pālehua Road (a precursor to the North-South Road). This site was newly identified during the Runyon et al. 2011 project. No further work was recommended for these sites.

3.3.9 Hammatt and Shideler 1999

In 1999, CSH conducted an AA for the proposed expansion of Saint Francis Medical Center West, located *makai* of Farrington Highway and west of Fort Weaver Road (Hammatt and Shideler 1999). This study lies adjacent to the current project area along Farrington Highway for approximately 300 ft. The study included a limited field inspection of the study area. No cultural resources were identified. Due to the presence of a subsurface cultural layer (SIHP # 50-80-13-3321) east of the study area, an archaeological inventory survey with a focus on subsurface testing was recommended for the southern portion of the study area prior to any development involving ground disturbance.

3.3.10 Magnuson 1999

In 1999, International Archaeological Research Institute, Inc. (IARII) conducted an ARS along Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road for the Farrington Highway Expansion project (i.e., the current project). The survey revealed eight historic sites, but none of them were considered significant and they were not designated with SIHP numbers. The sites included six bridges (one spanning Honouliuli Stream, two spanning Kalo‘i Gulch, two spanning Hunehune Gulch, and one bridge spanning a separate section of Kalo‘i Gulch), a section of railroad track, and an irrigation ditch. Two of the bridges, the one over Honouliuli Stream and one over Kalo‘i Gulch, were inventoried by Bethany Thompson (1983) for nomination to the NRHP; both bridges were evaluated as not significant and were not recommended for preservation. The other four bridges were not inventoried by Thompson (1983) as they did not meet her criteria of possible significance. Magnuson recommended that the remaining sites— the railroad track and the irrigation ditch—lacked integrity and, therefore, were not significant and did not meet standards for inclusion on the Hawai‘i or National Registers of Historic Places.

3.3.11 Tulchin et al. 2001

In 2001, CSH conducted an archaeological inventory survey (AIS) in support of the proposed ‘Ewa Shaft Renovation project, located in Honouliuli Gulch, adjacent to and *mauka* of the H-1 Freeway (Tulchin et al. 2001). One surface site was identified, SIHP # 50-80-08-6370, a historic stone wall alignment. The wall was believed to have been constructed in association with cattle ranching or a water pumping station. The study noted that all lands outside Honouliuli Gulch had been extensively and repeatedly graded over the past century by the Ewa Plantation Company in association with sugar cultivation and the construction of plantation infrastructure.

3.3.12 Collins and Jourdane 2005

In 2004, the SHPD conducted the disinterment of a burial found eroding out of the ground surface at 91-2168 Old Fort Weaver Road (Collins and Jourdane 2005). The remains had apparently been exposed by heavy rains. The remains were in a flexed/semi-flexed burial position and appeared to be those of a partial adult female. The report concluded the burial was possibly of Native Hawaiian ethnicity and was of historic age.

3.3.13 O'Hare et al. 2006

In 2005 and 2006, CSH conducted an AIS of some 1,630 acres for the East Kapolei project, subsequently known as the Ho‘opili project (O'Hare et al. 2006). The project area was bounded on the east by Fort Weaver Road, on the *makai* side by Mango Tree Road, on the north or *mauka* side by the H-1 Freeway, and on the west side by the Spear (1996) study (the study area was configured by owner/developer interests to dovetail with the Spear study). The O'Hare et al. study also included the area originally called West Loch Bluffs that was surveyed by CSH in 1990 (Hammatt and Shideler 1990). A non-contiguous portion of the O'Hare et al. (2006) study area was located *mauka* of the H-1 Freeway. The O'Hare et al. (2006) project area surrounds and encompasses more than half of the current project area.

Nineteen trenches were excavated in four areas of historic habitation and/or agriculture, identified by background historic work. The four areas were: 1) nineteenth century (or earlier) habitation and agricultural lots in the nineteenth century Honouliuli Taro Lands and in Honouliuli Village; 2) structures or burials associated with the nineteenth century Kapalani Catholic Church near Old Fort Weaver Road; 3) structures or historic domestic artifacts associated with the early twentieth century Drivers and Stable Village of the Ewa Sugar Plantation; and 4) structures or historic domestic artifacts or pit/privy features associated with the early twentieth century Pipeline Village of the Ewa Sugar Plantation. No cultural deposits, no privy pits, no burials, and no artifacts or any type were found or recovered from the 19 trenches. It seems that sugarcane cultivation, irrigation, flood control, railroad construction, later road construction, the demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of these former traditional Hawaiian habitation and agricultural lands and the later sugarcane plantation workers camps, churches, and schools.

Four sites located within the project area had previously been identified by Hammatt and Shideler (1990): SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Four additional features associated with SIHP # -4344 were documented during the O'Hare et al. (2006) survey. These additional features include Features D and E, two linear walls located along the east bank of Honouliuli Stream; Feature F, a stone-faced berm constructed perpendicular to the orientation of the stream; and Feature G, a concrete ditch and concrete masonry catchment basin on the west bank of Honouliuli Gulch.

3.3.14 Rasmussen and Tomonari-Tuggle 2006

In 2004, archaeological monitoring was conducted along the Waiau Fuel Pipeline corridor, extending from the Hawaiian Electric Company's Barbers Point Tank Farm to the Waiau Generating Station. The Waiau Fuel Pipeline corridor follows Farrington Highway to Kunia Road, angles *makai* near Kunia Road, then continues east along the OR&L right-of-way near the Pearl Harbor coast. It appears no archaeological monitoring was conducted west of Waipi‘o Peninsula (in the vicinity of the current project area), as the corridor to the west had been determined to not be archaeologically sensitive.

3.3.15 O'Hare and Hammatt 2007; Altizer et al. 2010

In 2007, CSH conducted an LRFI of a 4.28-acre parcel on Old Fort Weaver Road, within the "Honouliuli Taro Lands" (O'Hare and Hammatt 2007). During the field inspection, one surface

structure was identified, a complex of concrete curbs. The curbs date to March 1941 and are likely associated with the Ewa Plantation Company. They may have functioned as an irrigation ditch, a flood control device, or may have been associated with a nearby pumping station. Background research indicated the area was a focus for intensive habitation and agriculture in the pre- and post-Contact periods and that related subsurface features could exist.

In 2009, CSH conducted an AIS for the proposed Hale Kipa project (Altizer et al. 2010), located on a portion of the O'Hare and Hammatt (2007) project area. During the AIS, two cultural resources were documented: SIHP # 50-80-12-7084, a series of historic features including house foundations, a cesspool, and water control features; and SIHP # -7085, a subsurface cultural layer consisting of the remains of a *lo‘i* terrace. The *lo‘i* terrace was radiocarbon dated and yielded a calibrated 2-sigma date range of AD 1270-1400.

3.3.16 Mooney and Cleghorn 2008

In 2008, Pacific Legacy, Inc. conducted an AA for the proposed development of two parcels (approximately 23 acres) located between Fort Weaver Road and Old Fort Weaver Road. Fourteen backhoe assisted trenches were excavated to depths of up to 1.8 mbs. Construction fills were observed extending between 0.91.5 mbs with various alluvial deposits observed beneath. No cultural material was identified, and the study recommended no further archaeological work.

3.3.17 Dagher and Spear 2009

In 2009, SCS conducted an LRFI for the Kapolei Computerized Traffic Control System project. The project consists of the construction of the North-South roadway corridor and the installation of underground fiber optic cables, conduits, cameras, and ancillary equipment within existing right-of-ways in Kapolei and Makakilo. The field inspection was conducted along the 4.5-km North/South Roadway Corridor. No evidence of flumes, ditches, or other historic and cultural materials was observed. The study recommended no further archeological work.

3.3.18 Hammatt 2010

In 2009, CSH conducted an AIS for Construction Phase 1 of the Honolulu High-Capacity Transit Corridor project in Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, and Manana Ahupua‘a (Hammatt 2010). An approximately 1.3-km section of this project area extended along Farrington Highway within the current project area. The Hammatt (2010) project area extended west for another approximately 2 km, 0.5 km *makai* of Farrington Highway and the current project area. Only one cultural resource was identified in the Hammatt project area, SIHP # 50-80-09-7751, *lo‘i* sediments, but it was found in Waikele Ahupua‘a, approximately 2.5 km from the east end of the current project area. The Hammatt study identified five stratigraphic zones. Zones 1 and 2 overlap portions of the current project area. Zone 1 covered the western portion of the study area and generally consisted of a single stratum of naturally deposited alluvial sediment utilized for agriculture. Signs of previous disturbance from agricultural activities including tilling of the soil and installation of water lines, were from the surface to a depth of approximately 100 cmbs. Zone 2 covered the central portion of the study area and generally consisted of varying fill layers associated with urban development (i.e., asphalt paving and utility installation) overlying naturally deposited alluvial sediments. No subsurface cultural resources were observed within either Zone 1 or 2.

3.3.19 Sroat and McDermott 2012

In 2011, CSH conducted an LRFI for the Hawaii Medical Center West project. Hawaii Medical Center West consists of a 24-acre campus located at the southwest side of the intersection of Fort Weaver Road and Farrington Highway. Background research and the field inspection indicate the area to have been extensively modified by historic sugarcane cultivation and modern development. No cultural materials were observed and the potential for subsurface historic properties is considered low.

3.4 Background Summary and Predictive Model

According to background research, the immediate vicinity of the project area consisted of a dry plain that was little used prior to being placed under a century of sugarcane cultivation. The area has been extensively graded and plowed repeatedly over the past century in association with sugar cultivation and the construction of plantation infrastructure. Since the cessation of cane production, the lands in the vicinity of the project corridor have been under diversified agricultural cultivation. Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae.

There are no *kuleana* Land Commission Awards in the vicinity of the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area. The distance from the coast (and generally from fresh water) made the vicinity of the project area a little used area in pre-Contact times. The intensive land disturbance of a century of commercial sugarcane cultivation probably removed most of what little evidence of pre-Contact land use there was. The archaeological sensitivity of this area is generally regarded as low. As the project area crosses Honouliuli Stream and passes within approximately 150-250 m of the northern-most extent of the “Honouliuli Taro Lands,” the sensitivity is believed to increase somewhat, but is still regarded as low. Even though the distance to the former taro lands is not that far, the bottom lands preferred for pre-Contact agriculture and habitation near the mouth of Honouliuli Stream seem, in terms of environmental attributes, would have been a world away.

Any pre-Contact surface features and/or shallow subsurface deposits would likely have been destroyed by the continual commercial utilization of the area for crop land. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. Post-Contact archaeological deposits are not anticipated in any abundance on the basis of the historic record and the results reported in previous archaeological studies, but could include irrigation canals, plantation infrastructure remnants, and sections of railroad tracks. Evidence of early Farrington Highway and its predecessors, “Government Road” or “Wai‘anae Road,” are possible. There are a number of historic bridges and culverts within the project area, two of which have been determined eligible for the NRHP (MKE Associates LLC/Fung Associates, Inc. 2013).

Section 4 Results of Fieldwork

CSH archaeologist Sara M. Blahut, M.A., conducted fieldwork 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete. In general, fieldwork included a pedestrian inspection of the project area, GPS data collection, and photography.

This document focuses specifically on the historic crossings identified within the project area; for field results for the remainder of the project area please refer to the companion document *Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu Island, TMKs: [1] 9-1-016, -017, and -018* (Blahut et al. 2018).

Seven historic crossings (bridges and culverts) were identified during the field inspection. The crossings are presented in Table 4 with GPS point locations depicted on Figure 24. Locations and directions of photographs of the crossings can be seen on Figure 25. The seven crossings consist of the Palehua Stream Bridge (Figure 26 through Figure 28), an unnamed culvert (Figure 29 and Figure 30), two bridges at Hunehune Gulch (Figure 31 through Figure 34), two bridges at Kaloi Gulch (Figure 35 through Figure 39), and the Honouliuli Stream Bridge (Figure 40 through Figure 42). A brief description of each crossing is provided below.

Palehua Stream Bridge

The Palehua Stream Bridge spans the Palehua Stream at the west end of the project area and is an active part of Farrington Highway. The existing structure was built in 1922, is 22 ft in length and 27 ft in width. The Palehua Stream Bridge has previously been assessed as significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following description of Palehua Stream Bridge:

> The Farrington Highway Bridge No. 3 carries Farrington Highway across Palehua Stream. This single-span reinforced cast-in-place concrete bridge is in its original location, is in poor condition, and its materials remain intact. The bridge has solid panel reinforced concrete parapets with caps and small end posts with caps. Thrie beams flank the approaches of the parapets but are not attached to the parapet itself. The concrete deck is supported by reinforced concrete abutments and spread footings. The workmanship of the bridge has not been obscured by additions or repairs. [MKE Associates LLC/Fung Associates, Inc. 2013:4-318]

The State Historic Bridge Inventory Evaluation provides the following significance statement for Palehua Stream Bridge:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1920’s concrete slab bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates LLC/Fung Associates, Inc. 2013:4-319]

Table 4. Historic bridges within the project area

Bridge Name	Location	Age	Comments
Palehua Stream Bridge	Palehua Stream	1922	Active, previously determined eligible for listing on the National Register
Unnamed culvert	U.S. Navy Reservoir and Pump Station	Unknown	Active
Hunehune Gulch Bridge (active)	Hunehune Gulch	1941	Active, previously determined not eligible for listing on the National Register
Hunehune Gulch Bridge (inactive)	Hunehune Gulch	Unknown	Inactive, *mauka* of Farrington Hwy
Kaloi Gulch Bridge (active)	Kaloi Gulch	1941	Active, previously determined not eligible for listing on the National Register
Kaloi Gulch Bridge (inactive)	Kaloi Gulch	1920	Inactive, *makai* of Farrington Hwy
Honouliuli Stream Bridge	Honouliuli Stream	1939	Active, previously determined eligible for listing on the National Register

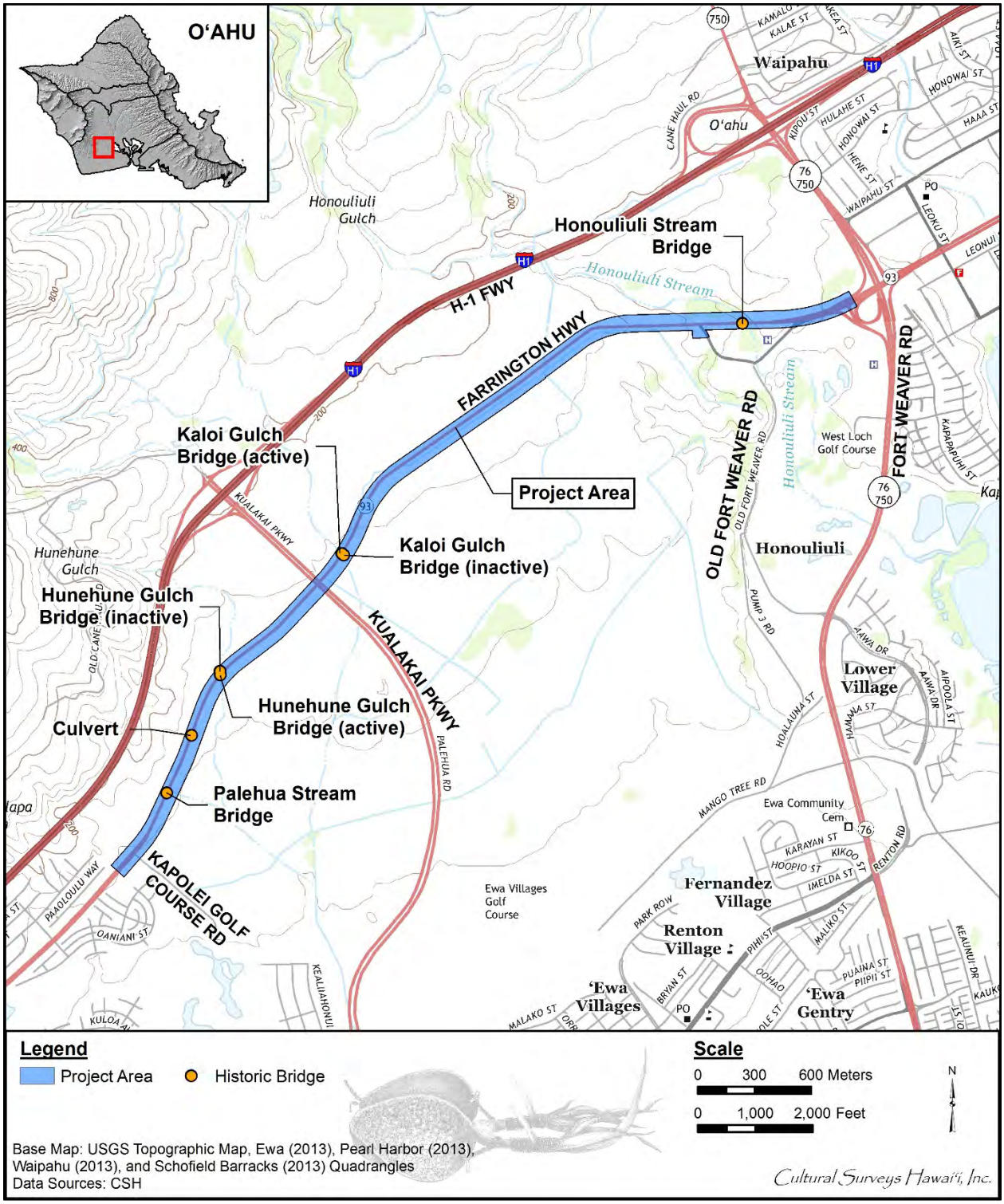


Figure 24. Portion of the 2013 USGS 7.5-minute topographic quadrangle showing GPS point locations of the historic crossings within the project area

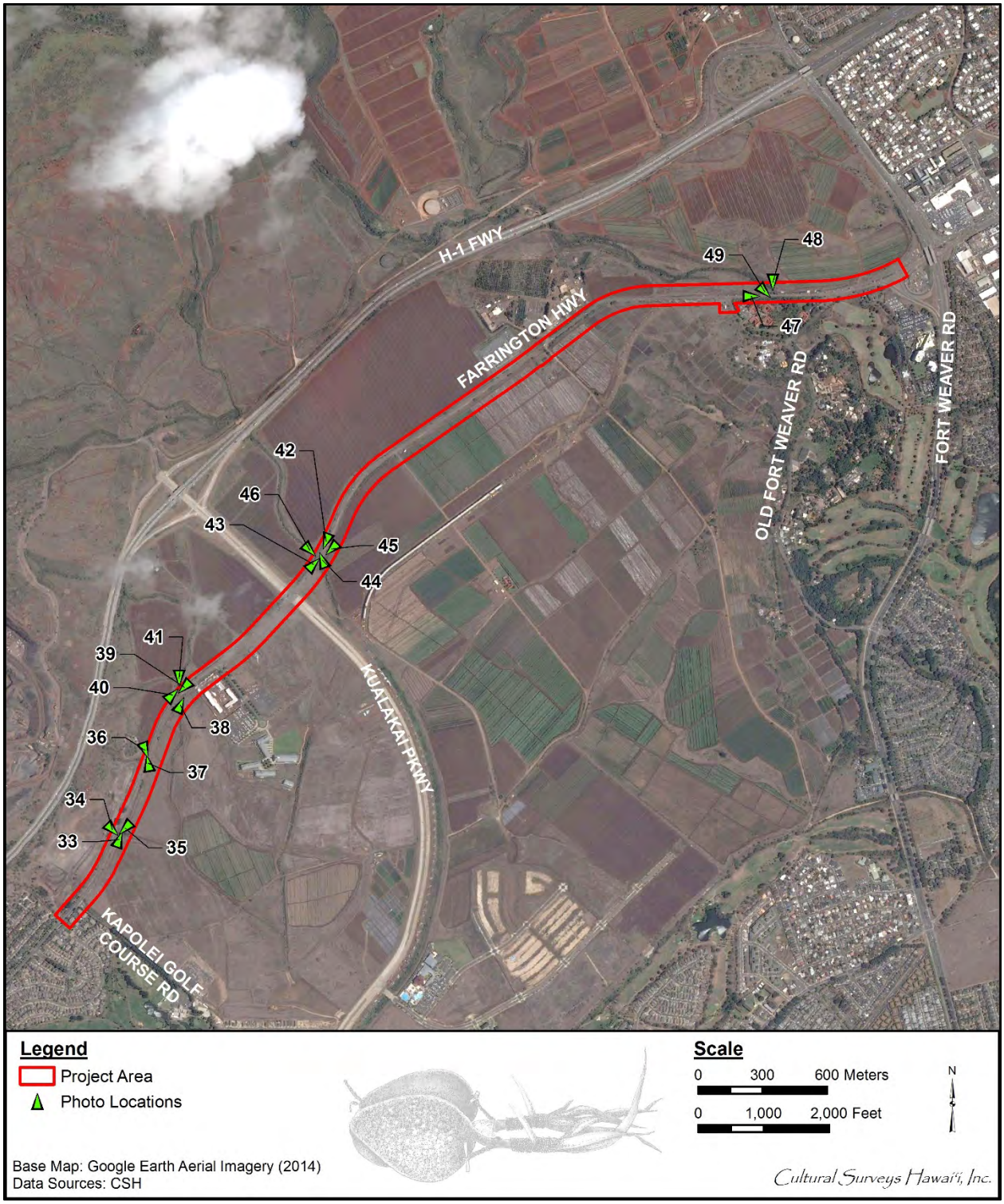


Figure 25. Aerial photograph (Google Earth 2014) showing location and direction of photographs taken during the field inspection, shown in Figure 26 through Figure 42

Figure 26. Palehua Stream Bridge, view to northeast

Figure 27. Palehua Stream Bridge, view to southeast

Figure 28. Palehua Stream Bridge, view to southwest

Figure 29. Culvert at driveway for U.S. Navy Reservoir and Pump Station, view to southeast

Figure 30. Culvert at driveway for U.S. Navy Reservoir and Pump Station, view to northwest

Figure 31. The active bridge at Hunehune Gulch, view to northeast

Figure 32. The active bridge at Hunehune Gulch, view to southwest

Figure 33. Inactive bridge at Hunehune Gulch, *mauka* of Farrington Highway; active bridge is visible to the right, view to the northeast

Figure 34. Hunehune Gulch Bridges, inactive bridge (foreground), and active bridge (background), view to south

Figure 35. Active bridge at Kaloi Gulch, Kualakai Parkway intersection in background, view to southwest

Figure 36. Active Kaloi Gulch Bridge (left), inactive Kaloi Gulch Bridge (right), view to northeast

Figure 37. Active Kaloi Gulch Bridge with abutment intersecting the inactive Kaloi Gulch Bridge in right foreground, view to north

Figure 38. Inactive Kaloi Gulch Bridge (foreground) and active Kaloi Gulch Bridge (background), view to west

Figure 39. Inactive Kaloi Gulch Bridge, *makai* side of Farrington Highway, view to southeast

Figure 40. Honouliuli Stream Bridge, portion of Honolulu Rail Transit track above, view to east

Figure 41. Honouliuli Stream Bridge, view to south

Figure 42. Honouliuli Stream Bridge, view to east

Culvert at U.S. Navy Reservoir and Pump Station

This culvert spans a small drainage in the west end of the project area adjacent to the entrance of the U.S. Navy Reservoir and Pump Station and is an active part of Farrington Highway. The date of construction is unknown but believed to be during the 1920s and ‘30s. The culvert appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map (see Figure 17). The culvert consists of a simple reinforced concrete slab with the addition of modern steel guardrails. This property is not known to have been previously assessed for significance.

Hunehune Gulch Bridge (active)

The Hunehune Gulch Bridge (active) spans Hunehune Gulch in the west end of the project area and is an active part of Farrington Highway. The existing structure was built in 1941 and consists of a single span, reinforced concrete slab-style bridge, with solid concrete parapets. There are modern steel guardrails on either side of the bridge. The Hunehune Gulch Bridge has previously been assessed as non-significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following significance statement for Hunehune Gulch Bridge:

> This bridge has lost integrity due to thrie beams that have been bolted in front of the solid concrete parapet such that the concrete is not visible. The bridge does not have distinctive engineering or architectural features that depart from standard bridge design. [MKE Associates, LLC/Fung Associates, Inc. 2013:4-19]

Hunehune Gulch Bridge (inactive)

The Hunehune Gulch Bridge (inactive) spans Hunehune Gulch in the west end of the project area. The bridge is not an active part of Farrington Highway and lies just *mauka* of the active Hunehune Gulch Bridge. This bridge may still be utilized as part of an agricultural access road but was somewhat overgrown at the time of the field inspection. The date of construction is unknown but believed to be during the 1920s and ‘30s. The bridge appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map (see Figure 17), therefore it is likely this bridge represents an earlier alignment of Farrington Highway. Hunehune Gulch Bridge (inactive) consists of a single span, concrete slab-style bridge which measures 6.4 m in length by 7.8 m in width (Magnusson 1999). Magnusson (1999) previously assessed this property as non-significant.

Kaloi Gulch Bridge (active)

The Kaloi Gulch Bridge (active) spans Kaloi Gulch in the central portion of the project area and is an active part of Farrington Highway. The existing structure was built in 1941 and consists of a single span, reinforced concrete slab-style bridge with solid concrete parapets. Magnusson (1999) recorded the bridge as measuring 6.7 m in length by 8.3 m in width. There are modern steel guardrails on either side of the bridge. The Kaloi Gulch Bridge has previously been assessed as non-significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following significance statement for Kaloi Gulch Bridge:

> This bridge has lost integrity due to thrie beams that have been bolted in front of the solid concrete parapet such that the concrete is not visible. The bridge does not have distinctive engineering or architectural features that depart from standard bridge design. [MKE Associates, LLC/Fung Associates, Inc. 2013:4-19]

Kaloi Gulch Bridge (inactive)

The Kaloi Gulch Bridge (inactive) spans Kaloi Gulch in the central portion of the project area. The bridge is not an active part of Farrington Highway and lies just *makai* of the active Kaloi Gulch Bridge. This bridge does not appear to be in use and was somewhat overgrown at the time of the field inspection. The Kaloi Gulch Bridge (inactive) consists of a single span, reinforced concrete, single arch-style bridge. The western abutments are constructed of cemented basalt cobbles. Magnusson (1999:17) recorded bridge measurements as 10.9 m in length by 4.9 m in width and noted the inscription “HH. CO. C. 3rd U.S. ENGRS. JAN 2(4?) 1920”. The bridge appears to be contemporary with the other bridges in the project area and a bridge/crossing is depicted at this location on a 1930s USGS topographic map (see Figure 17), therefore it is likely this bridge represents an earlier alignment of Farrington Highway. Magnusson (1999) previously assessed this property as non-significant.

Honouliuli Stream Bridge

The Honouliuli Stream Bridge spans the Honouliuli Stream at the east end of the project area and is an active part of Farrington Highway. The existing structure was built in 1939, is 54 ft in length and 32 ft in width. The Honouliuli Stream Bridge has previously been assessed as significant (MKE Associates LLC/Fung Associates, Inc. 2013).

The State Historic Bridge Inventory Evaluation provides the following description of Honouliuli Stream Bridge:

> The Farrington Highway Bridge carries Farrington Highway across the Honouliuli Stream. This single-span reinforced cast-in-place concrete bridge is in its original location, is generally in good condition, and its materials remain intact. The bridge has concrete parapets with cross shaped voids and caps. Wide end posts flank the ends of the parapets. The concrete deck is supported by concrete abutments, two piers, and spread footings. Thrie beams were bolted to the end posts however, the workmanship of the bridge has not been obscured. [MKE Associates LLC/Fung Associates, Inc. 2013:4-321]

The State Historic Bridge Inventory Evaluation provides the following significance statement for Honouliuli Stream Bridge:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1930's concrete tee beam bridge that is typical of its materials, method of construction, craftsmanship, and design. [MKE Associates LLC/Fung Associates, Inc. 2013:4-322]

Section 5 Summary

At the request of G70, CSH has prepared this LRFI to support consultation with SHPD for the Farrington Highway Improvements project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018. The LRFI consisted of background research and a pedestrian field inspection.

5.1 Summary

This document focused specifically on the historic crossings identified within the project area; for results for the remainder of the project area please refer to the companion document *Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu Island, TMKs: [1] 9-1-016, -017, and -018* (Blahut et al. 2018).

Seven historic crossings (bridges and culverts) were identified during the field inspection. These consist of Palehua Stream Bridge, an unnamed culvert, two bridges at Hunehune Gulch, two bridges at Kaloi Gulch, and Honouliuli Stream Bridge. The Palehua Stream Bridge and the Honouliuli Stream Bridge have previously been assessed as eligible for listing on the National Register of Historic Places (MKE Associates LLC/Fung Associates, Inc. 2013). For the completion of the proposed project it is anticipated that all crossings will need to be replaced.

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Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for the Farrington Highway Improvements Project, Honouliuli Ahupuaʻa, ʻEwa District, Oʻahu TMKs: [1] 9-1-016, 017, and 018

Prepared for
Group 70 International, Inc.
and
City and County of Honolulu

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Cultural Surveys Hawaiʻi, Inc.
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(Job Code: HONOULIULI 153)

August 2019

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Management Summary

Reference	Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018 (Blahut et al. 2019)
Date	August 2019
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: HONOULIULI 153
Investigation Permit Number	CSH conducted the fieldwork component of this literature review and field inspection (LRFI) under archaeological fieldwork permit number 18-15, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-282.
Agencies	SHPD, City and County of Honolulu Department of Design and Construction (DDC), Federal Highway Administration (FHWA)
Project Proponent	City and County of Honolulu DDC
Project Funding	FHWA
Land Jurisdiction	City and County of Honolulu (City), State of Hawai‘i (State), United States of America, Grace Pacific Corporation, Ho‘opili (D.R. Horton), Honolulu Electric Company, Campbell Hawai‘i, Saint Francis Healthcare System, University of Hawai‘i West O‘ahu, and Hawaiian Golf Properties, LLC
Project Location	The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of a 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) topographic quadrangle.
Project Description	The City DDC is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.
Project Acreage	The project area comprises approximately 149.7 acres (60.58 hectares) over 3.1 linear miles.
Area of Potential Effect (APE)	The APE is considered the entire 3.1-mile-long project area
Document Purpose	This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the

	project area—to determine the likelihood that cultural resources/historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project's planning and support the project's historic preservation and environmental review compliance. This investigation does not fulfill the requirements of an archaeological inventory survey investigation, per HAR §13-276, nor does it fulfill the requirements of Section 106 of the National Historic Preservation Act. Consequently, this report cannot be used to make formal recommendations for federal agency and SHPD review and acceptance.
Fieldwork Effort	CSH archaeologist, Sara Blahut, M.A., conducted the field inspection 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete.
Results Summary	The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. Background research indicates the project area was relatively little used in the pre-Contact period although Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae. However, the intensive land disturbance of a century of commercial sugarcane cultivation probably removed most of what little evidence of pre-Contact land use there was. The area currently hosts diversified agricultural cultivation. There are no *kuleana* Land Commission Awards within the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area. The current field inspection identified seven historic crossings within the project area, as well as structural remnants likely associated with irrigation infrastructure from the plantation era. These include basalt and mortar retaining walls, concrete shafts, ditches, and other remnants. No surface pre-Contact archaeological remains were identified. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. It is very likely additional post-Contact archaeological deposits (both surface and subsurface) related to the plantation era exist within the project area.

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Section 1 Introduction

1.1 Project Background

At the request of Group 70 International, Inc. (G70), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this literature review and field inspection report (LRFI) to support consultation with the State Historic Preservation Division (SHPD) for the Farrington Highway Improvements project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK plats: [1] 9-1-016, 017, and 018. The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of the 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 through Figure 4), and a 2013 aerial photograph (Figure 5).

The City and County of Honolulu (City), Department of Design and Construction (DDC), is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.

1.2 Document Purpose

This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project area—to determine the likelihood that historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project’s planning and support the project’s historic preservation and environmental review compliance. This investigation does not fulfill the requirements of an archaeological inventory survey investigation, per Hawai‘i Administrative Rules (HAR) §13-276. Consequently, this report cannot be used to make formal recommendations for SHPD review and acceptance.

1.1 Environmental Setting

1.1.1 Natural Environment

The project area extends through the ‘Ewa Plain, *makai* (seaward) of the Wai‘anae Mountains. The ‘Ewa Plain is a Pleistocene (>38,000 years old) reef platform overlain by alluvium. The terrain consists of limestone and alluvial deposits, which overlie flows of the Wai‘anae volcanic series (Macdonald et al. 1983:423). In pre-Contact Hawai‘i, the project area would have been covered by lowland dry shrub and grassland; however, the area has been extensively disturbed and transformed by human activity and is now dominated by a variety of exotic grasses, weeds, and shrubs.

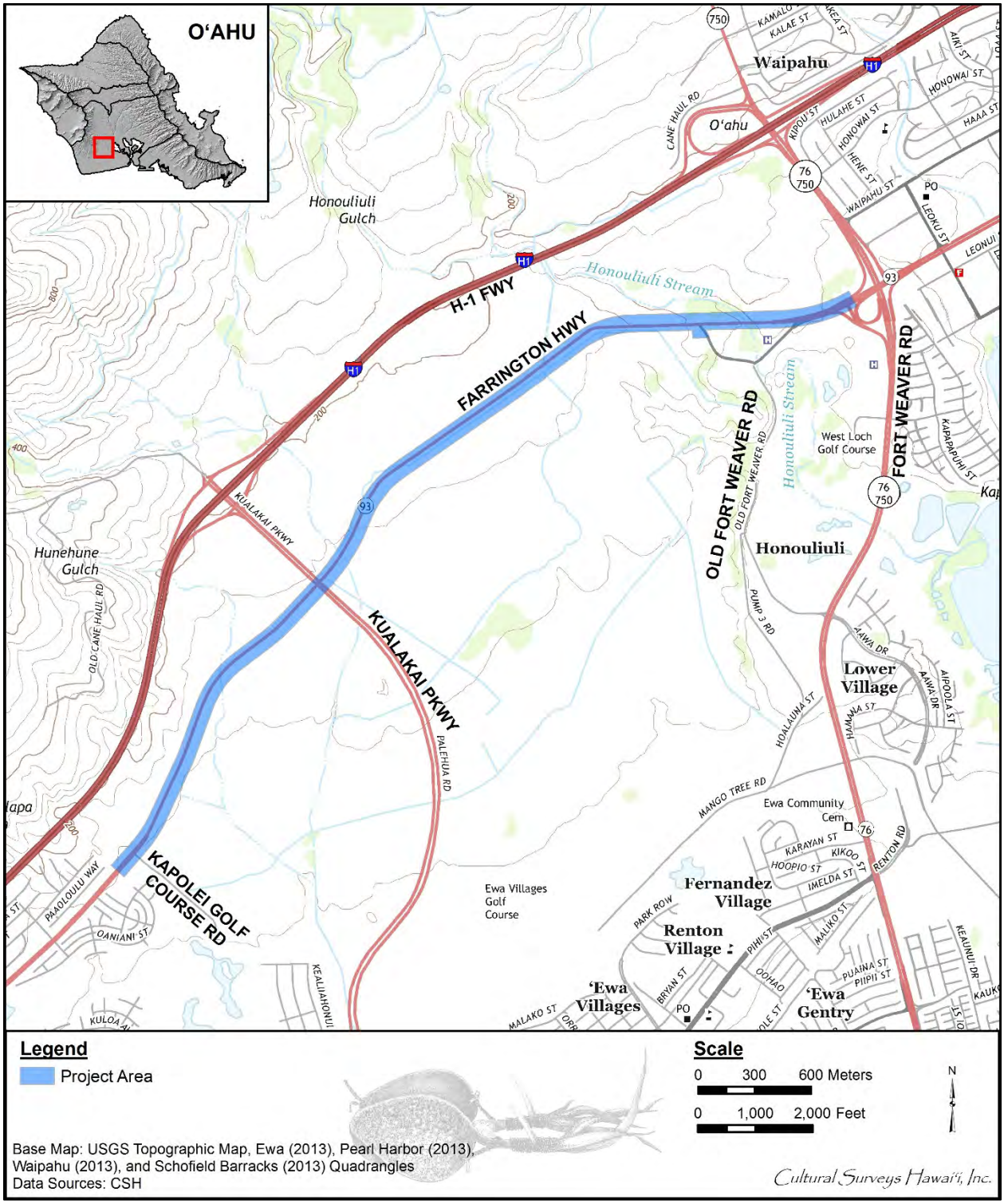

Figure 1. Portion of the 2013 USGS 7.5-minute topographic quadrangle showing the location of the project area

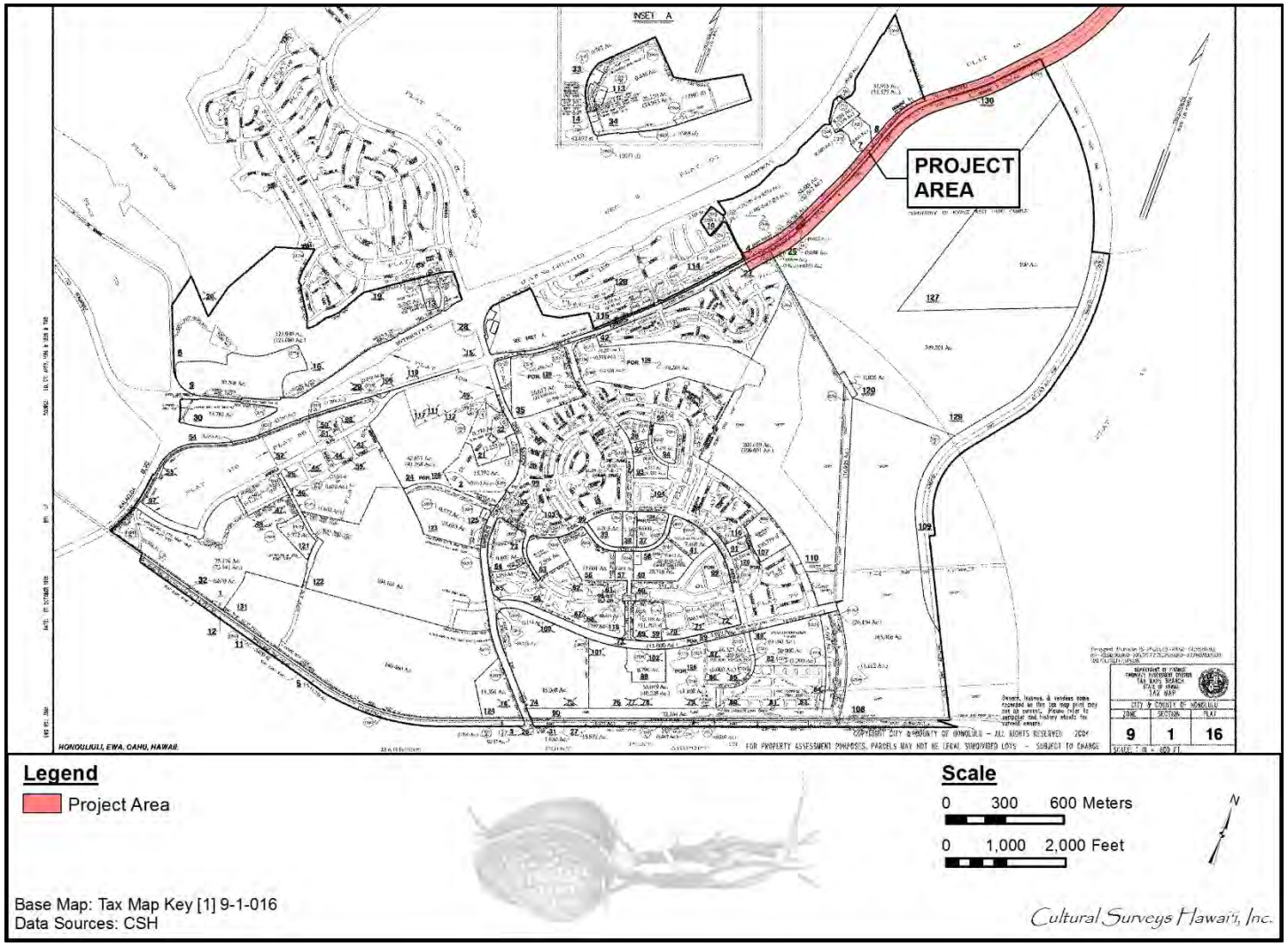

Figure 2. TMK: [1] 9-1-016 showing portion of the project area (Hawai‘i TMK Service 1996)

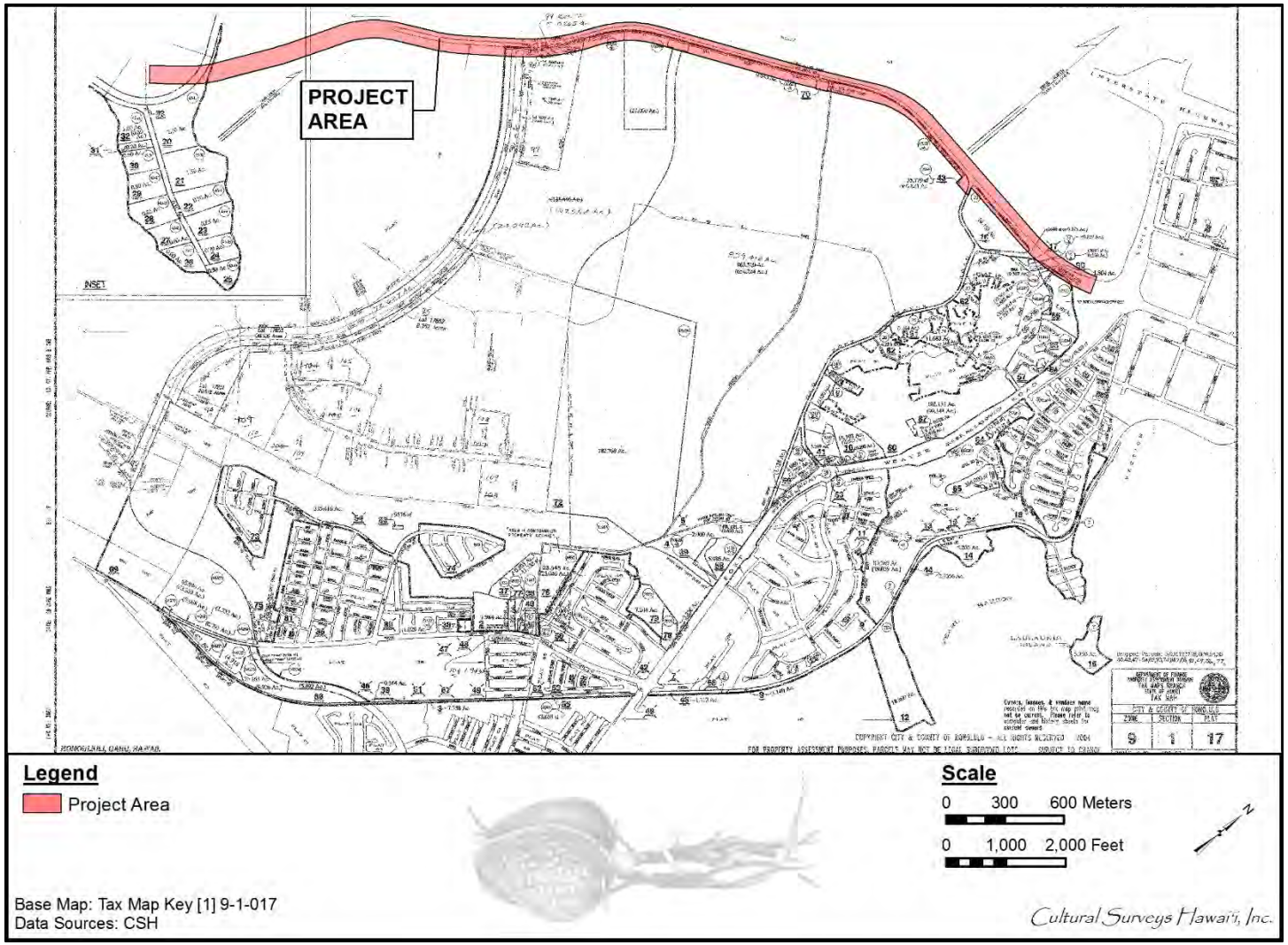

Figure 3. TMK: [1] 9-1-017 showing portion of the project area (Hawai‘i TMK Service 1999)

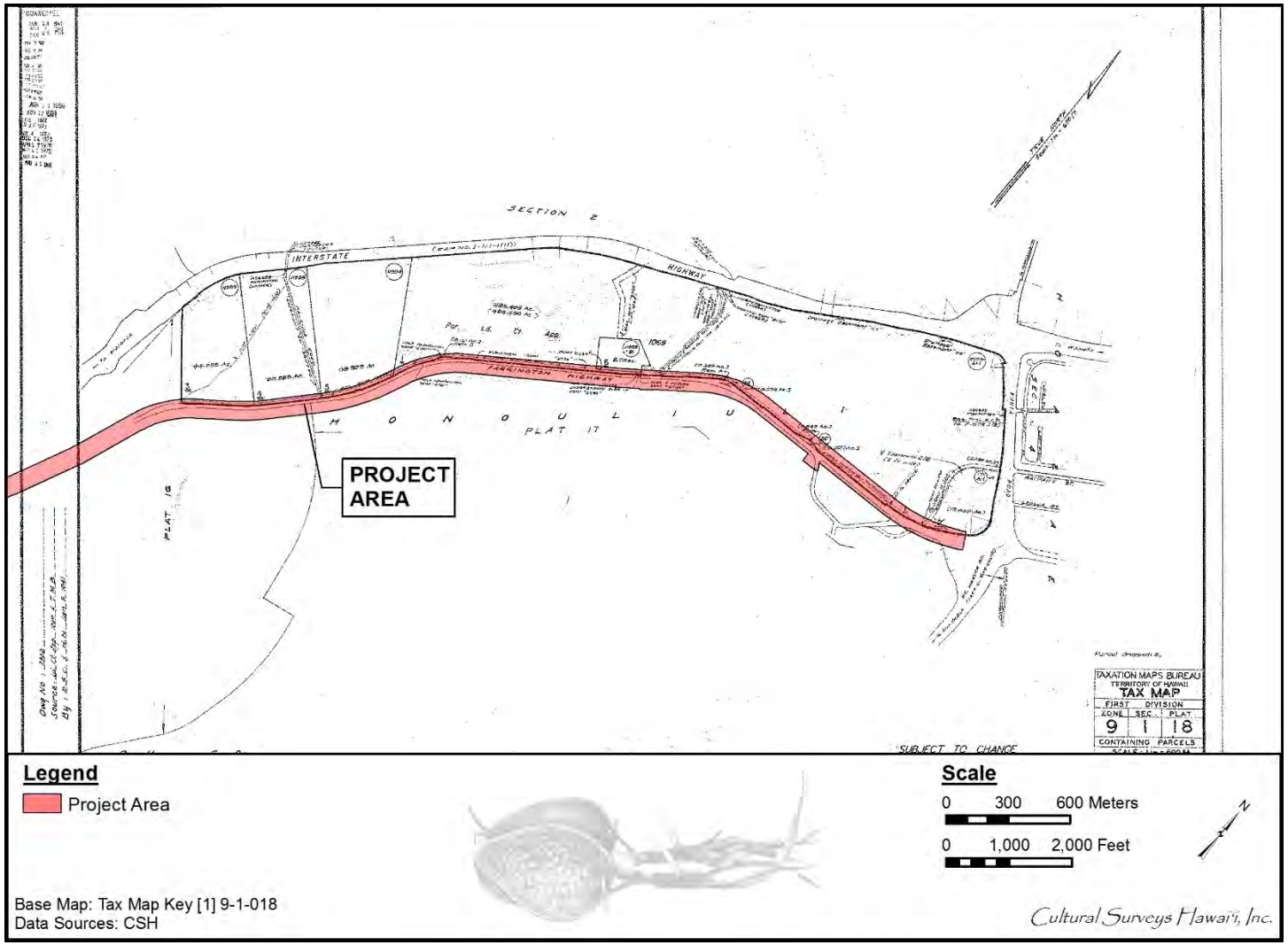

Figure 4. TMK: [1] 9-1-018 showing portion of the project area (Hawai'i TMK Service 1996)

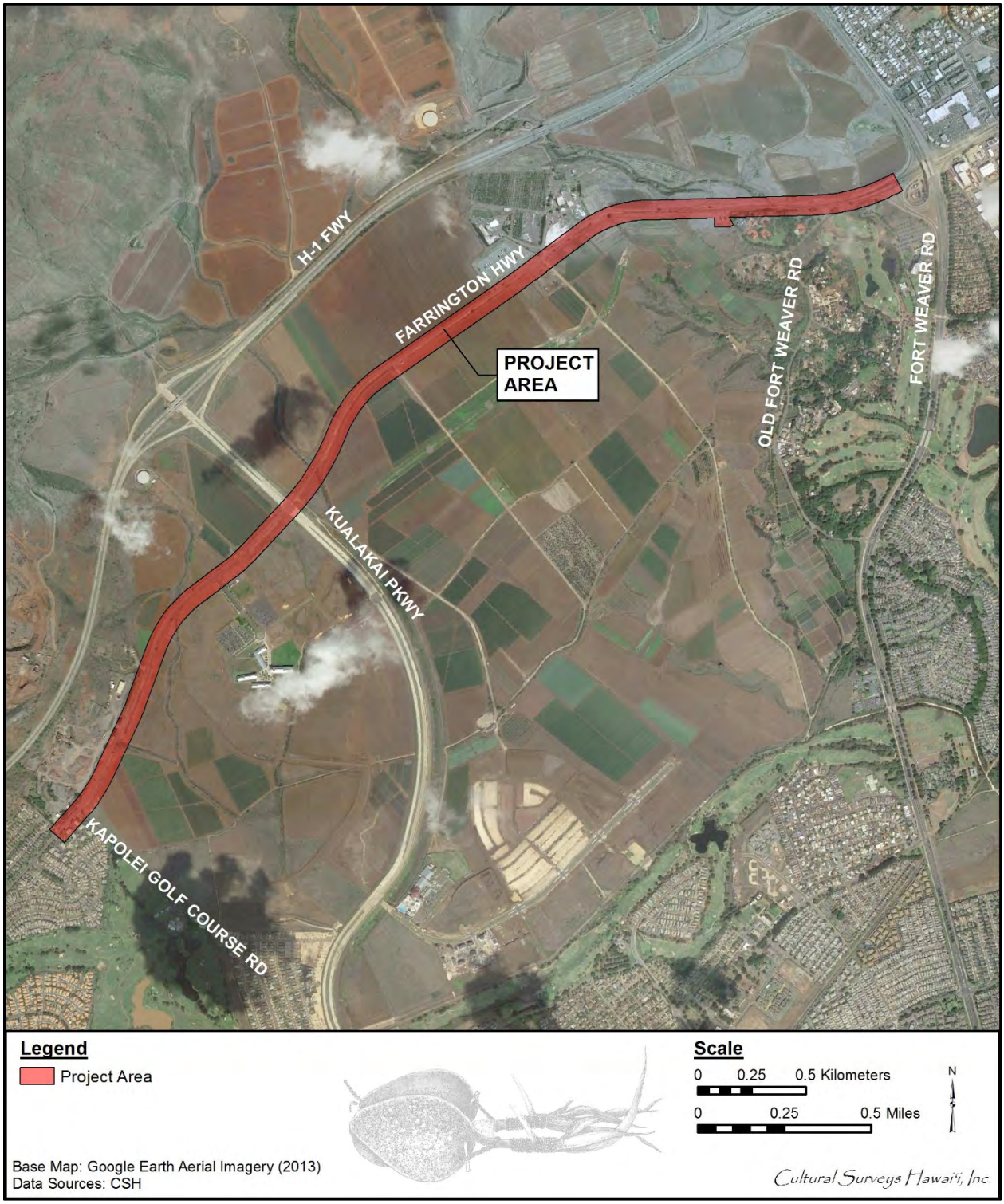

Figure 5. Aerial photograph of the project area (Google Earth Imagery 2014)

In the late nineteenth and early twentieth centuries, the Ewa Plantation Company installed ditches running from the lower slopes of the Wai‘anae Mountains to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17). These activities relocated sediments from the higher, soil-rich slopes of the Wai‘anae Mountains down to the soil-poor Pleistocene limestone plains of the Kalaeloa area. Portions of the agricultural lands in Honouliuli were developed from this arable land expansion program. In traditional Hawaiian times, the areas of exposed coral outcrop were undoubtedly more extensive.

The project area receives an average of 23–24 inches of annual rainfall (Giambelluca et al. 2013). Honouliuli Stream is the only major stream traversed by the project area. Elevations within the project area range from approximately 80 to 160 feet (ft) above mean sea level.

The vicinity of the project area is made up of various soils and sediments (Figure 6). The project area is composed of 12 soil types: Ewa silty clay loam (3 to 6% slopes, EaB), Ewa stony silty clay (6 to 12% slopes, EwC), Mahana silty clay loam (12 to 20% slopes, eroded, McD2), Honouliuli clay (0 to 2% slopes, HxA), Honouliuli clay (2 to 6% slopes, HxB), Kawaihapai clay loam (0 to 2% slopes, KIA), Kunia silty clay (0 to 3% slopes, KyA), Water (W), Waialua stony silty clay (3 to 8% slopes, WIB), Waialua silty clay (0 to 3% slopes, WkA), Waipahu silty clay (0 to 12% slopes, WzA), and Waipahu silty clay (6 to 12% slopes, WzC).

Soils of the Ewa Series are described as follows:

> This series consists of well-drained soils in basins and on alluvial fans on the islands of Maui and Oahu. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from near sea level to 150 feet. The annual rainfall amounts to 10 to 30 inches. Most of it occurs between November and April. The mean annual soil temperature is 73° F. Ewa soils are geographically associated with Honouliuli, Mamala, Molokai, Pulehu, and Waiakoa soils.
>
> These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of fingergrass, kiawe, koa haole, klu, and uhaloa. [Foote et al. 1972:29]

Soils of the Mahana Series are described as follows:

> This series consists of well-drained soils on uplands on the islands of Kauai and Oahu. These soils developed in volcanic ash. They are gently sloping to very steep. Elevations range from 1,000 to 3,000 feet. The annual rainfall amounts to 30 to 45 inches. The mean annual soil temperature is 67° F. Mahana soils are geographically associated with Oli and Puu Opae soils on Kauai and with Kolekole soils on Oahu.
>
> These soils are used for pasture, woodland, wildlife habitat, irrigated sugarcane, and water supply. The natural yegetation consists of puakeawe, aa1ii, ricegrass, molassesgrass, silver oak, yellow foxtail, lantana, joee, Japanese tea, passion flower, and associated plants. [Foote et al. 1972:85]

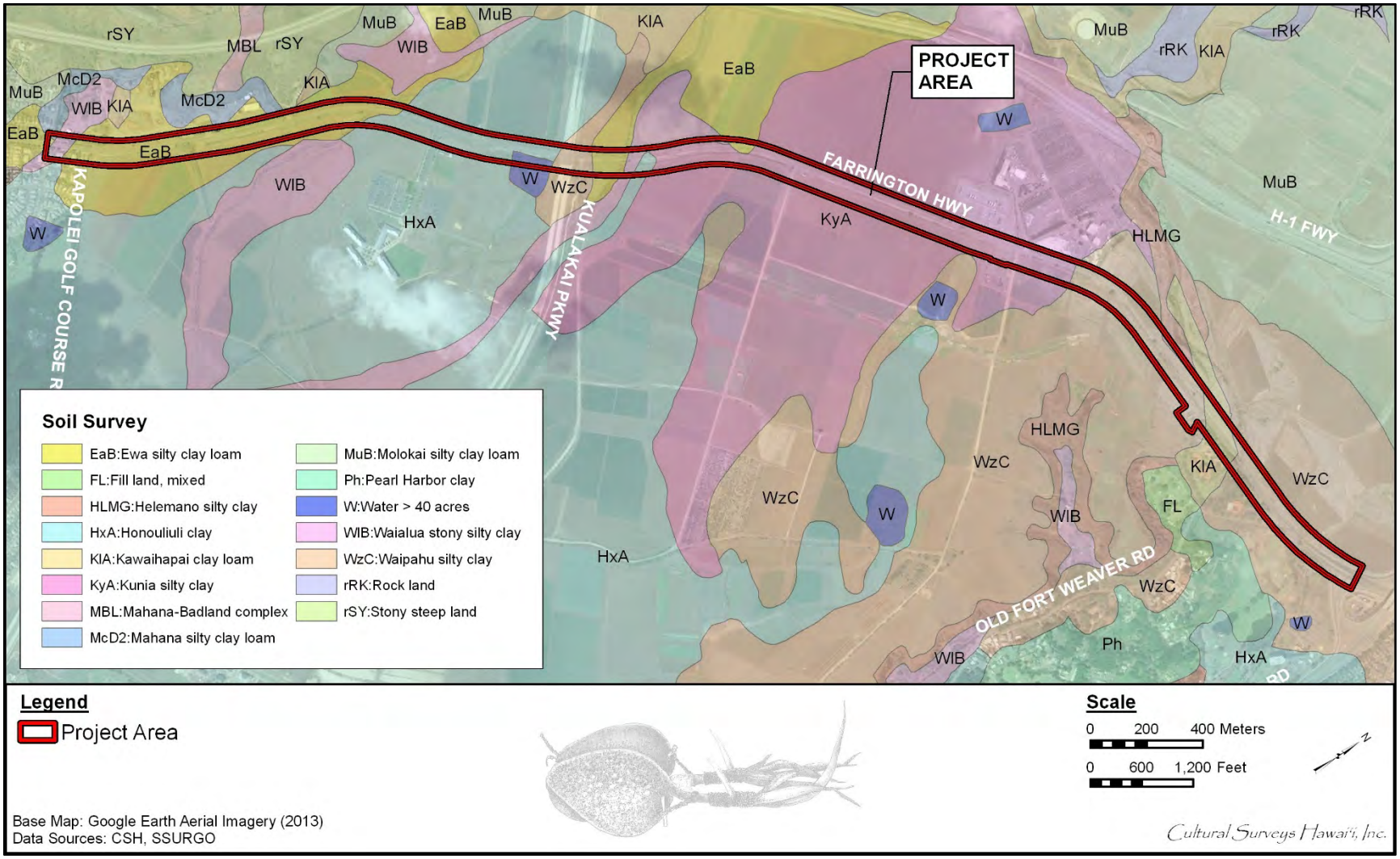

Figure 6. 2013 Aerial image with overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the project area

Soils of Honouliuli Series are described as follows:

> This series consists of well-drained soils on coastal plains on the island of O‘ahu in the ‘Ewa area. These soils developed in alluvium derived from basic igneous material. They are nearly level and gently sloping. Elevations range from 15 to 125 feet. The annual rainfall amounts to 18 to 30 inches and occurs mainly between November and April. The mean annual soil temperature is 74° F. Honouliuli soils are geographically associated with ‘Ewa, Lualualei, Mamala, and Waialua soils.
>
> These soils are used for sugar cane, truck crops, orchards, and pasture. The natural vegetation consists of kiawe, koa haole, fingergrass, bristly foxtail, and bermudagrass. [Foote et al. 1972:43]

Soils of the Kawaihapai Series are described as follows:

> This series consists of well-drained soils in drainage ways and on alluvial fans on the coastal plains on the islands of O‘ahu and Moloka‘i. These soils formed in alluvium derived from basic igneous rock in humid uplands.
>
> They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. The mean annual soil temperature is 73° F. Kawaihapai soils are geographically associated with Haleiwa, Waialua, and Jaucas soils.
>
> These soils are used for sugar cane, truck crops, and pasture. The natural vegetation consists of *kiawe*, *koa haole*, lantana, and bermudagrass. [Foote et al. 1972:6364]

Soils of the Kunia Series are described as follows:

> This series consists of well-drained soils on upland terraces and fans on the island of Oahu. These soils developed in old alluvium. They are nearly level to moderately sloping. Elevations range from 700 to 1,000 feet. The mean annual rainfall amounts to 30 to 40 inches, most of which occurs from November to April. The mean annual soil temperature is 71° F. Kunia soils occur on the foot slopes of the Waianae Range, near Schofield Barracks. They are geographically associated with Kolekole, Lahaina, and Wahiawa soils.
>
> These soils are used for sugarcane, pineapple, home sites, and military reservations. Most areas are cultivated, and the natural vegetation is not significant. [Foote et al. 1972:77]

Soils of the Waialua Series are described as follows:

> This series consists of moderately well drained soils on alluvial fans on the island of Oahu. These soils developed in alluvium weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 100 feet. The annual rainfall amounts to 25 to 50 inches; most of it occurs between November and April. The mean annual soil temperature is 73° F. "Waialua soils are geographically associated with Honouliuli, Kaena, and Kawaihapai soils.
>
> These soils are used for sugarcane, truck crops, or- chards, and pasture. The natural vegetation is swollen fingergrass, koa haole, and uhaloa. [Foote et al. 1972:128]

Soils of the Waipahu Series are described as follows:

> This series consists of well-drained soils on marine terraces on the island of O‘ahu. These soils developed in old alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from nearly sea level to 125 feet. Rainfall amounts to 25 to 35 inches annually; most of it occurs between November and April. The mean annual soil temperature is 75° F. Waipahu soils are geographically associated with Hanalei, Honouliuli, and Waialua soils. [Foote et al. 1972:134]

The project area extends alongside a number of active agricultural fields. Vegetation outside of the cultivated fields consists predominantly of introduced perennial grasses and weeds, along with *kiawe* (*Prosopis pallida*) and *koa haole* (*Leucaena leucocephala*).

1.1.2 Built Environment

The project area contains a 3.1-mile-long portion of Farrington Highway. The immediate vicinity of the project area has been drastically altered by historic and modern land use including, in particular, intensive commercial sugarcane cultivation. In recent years, a portion of the project area has also been altered by the construction of the Kualakai Parkway and related infrastructure improvement projects. Aside from Kualakai Parkway, development within the immediate vicinity of the project area includes the University of Hawai‘i West O‘ahu campus, Aloun Farm, and the Kahi Mohala Behavioral Health center. Generally, the vicinity of the project area consists of rural agricultural lands.

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this study under archaeological fieldwork permit number 18-15, issued by the SHPD pursuant to HAR §13-282. CSH archaeologist Sara M. Blahut, M.A., conducted fieldwork 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete.

In general, fieldwork included a pedestrian inspection of the project area, GPS data collection, and photography.

A pedestrian inspection of the study area was undertaken for the purpose of historic property identification and documentation. The pedestrian survey was completed within the proposed right-of-way (ROW) and APE. A Garmin handheld GPS unit was used (GPSMAP 64s)—which has a horizontal accuracy of approximately 3 and 5 m—to record feature locations and track logs. The archaeologist did not enter any fenced-off areas and no vegetation clearance was attempted.

2.2 Research Methods

Background research included a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2000).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of cultural resources in the project area.

Section 3 Background Research

Honouliuli Ahupua‘a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. Within Honouliuli Ahupua‘a there are 12 miles of coastline with continuous shallow fringing reef, which offers rich marine resources in addition to the 4 miles of waterfront along the west side of the West Loch of Pu‘uloa (commonly known as Pearl Harbor) that offered extensive fisheries (mullet, *awa* [*Chanos chanos;* milkfish], shellfish) as well as frontage suitable for development of fishponds (e.g., Laulaunui). The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua‘a* (traditional land division usually extending from the uplands to the sea) as a whole. A broad limestone plain with innumerable limestone sinkholes offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions to human settlement. The lower portion of Honouliuli Valley in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley, consisting of an extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. As Handy and Handy (1972:469) have pointed out, the forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the *ahupua‘a* contained biologically diverse forest with *kukui* (*Aleurites moluccana;* candlenut), *‘ōhi‘a lehua* (*Metrosideros macropus*), *‘iliahi* (*Santalum* spp.; sandalwood), *hau* (*Hibiscus tiliaceus;* beach hibiscus), tī (*Cordyline terminalis*), banana, etc. These valuable resources contribute to the richness of Honouliuli and the ‘Ewa *moku* (district).

Honouliuli is the largest *ahupua‘a* in the *moku* of ‘Ewa. Honouliuli means “dark water,” “dark bay,” or “blue harbor” and was named for the waters of Pu‘uloa (literally “long hill”) (Jarrett 1930:22), which marks the eastern boundary of the *ahupua‘a*.

3.1 Traditional Background

The traditions of Honouliuli Ahupua‘a have been published by numerous authors including Kamakau (1991a and 1991b), ‘Ī‘ī (1959), and Fornander (1917) and compiled and summarized numerous times by Charvet-Pond and Davis (1992), Hammatt and Folk (1981), Kelly (1991), Maly and Rosendahl (1993), Sterling and Summers (1978), and Tuggle and Tomonari-Tuggle (1997). Some of the themes of these traditions include connections with Kahiki (i.e., Tahiti, thought to be one of the primary sources of major migrations to Hawai‘i) and the special character and relationship of the places known as Pu‘uokapolei and Kūalaka‘i. There are several versions of the chief Kaha‘i leaving from Kalaeloa for Kahiki; on his return to the Hawaiian Islands he brought back the first breadfruit (Kamakau 1991b:110) and planted it at Pu‘uloa, near Pearl Harbor in ‘Ewa (Beckwith 1970:97).

3.1.1 Nā Ala Hele

John Papa ‘Ī‘ī described a network of Leeward O‘ahu *ala hele* (trails), which in historic times encircled and crossed the Wai‘anae Range, allowing passage from Lualualei to Honouliuli by three different trails (‘Ī‘ī 1959:96–98). The following description of the trails is provided by ‘Ī‘ī:

> The trail went down to the stream and up again, then went above the taro patches of Waiau, up to a makai field, to Waimano, to Manana, and to Waiawa; then to the

> stream of Kukehi and up to two other maika [ancient Hawaiian game suggesting bowling] fields, Pueohulunui and Haupuu. At Pueohulunui was the place where a trail branched off to go to Waialua and down to Honouliuli and on to Waianae. As mentioned before, there were three trails to Waianae, one by way of Pu‘u o Kapolei, another by way of Pohakea, and the third by way of Kolekole. [‘Ī‘ī 1959:97]

The cross-*ahupua‘a* (east-west) trail that skirted Pearl Harbor, passed north of Pu‘uokapolei, and continued along the coast to Wai‘anae, is depicted in an 1825 map of the South Coast of O‘ahu by Charles Malden of the British ship, the *Blonde* (Figure 7). The trail generally follows the route of the modern Farrington Highway. Malden’s 1825 map also shows a *mauka-makai* (mountain-sea, north-south) trail with two spurs that extend from the cross-*ahupua‘a* (east-west) trail to settlements at the coast.

3.1.2 Place Names of Honouliuli

A Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v). *Wahi pana* are sacred places that include such cultural properties as *heiau* (Pre-Christian place of worship), *loko i‘a* (fishponds), *ala hele*, *ilina* (graves) and *iwi kūpuna* (ancestral bone remains), land divisions, and natural geographic locations such as streams, peaks, rock formations, ridges, and offshore islands and reefs associated with culturally significant beliefs or events. A *wahi pana* leaves an imprint on the landscape even if its tangible properties no longer exist, as the *mana* (divine power) of previous people and events associated with this space continues to manifest itself. Table 1 displays the McAllister (1933) site (if available), *wahi pana*, significance, and source. Figure 8 depicts the project area with *wahi pana* within Honouliuli Ahupua‘a.

3.1.3 *Mo‘olelo* and *‘Ōlelo No‘eau*

This section compiles *mo‘olelo* (stories) of Honouliuli Ahupua‘a through summaries, and when possible, quotations of the original stories. Archival research included previous compilations of *mo‘olelo* (Beckwith 1970; Fornander 1919; Sterling and Summers 1978; Westervelt 1923) and the writings of Native Hawaiians (Kamakau 1991a and 1991b).

3.1.3.1 Legend of Lepeamoa

Another explanation for the name Honouliuli comes from the “Legend of Lepeamoa,” the *kupua* (demigod or cultural hero, especially a supernatural being possessing several forms) of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Westervelt 1923:164–184). One translation of the name for this district is given as “unequal” (*Saturday Press*, 11 August 1883). Others translate the word as “strayed” and associate it with the legends of the gods Kāne and Kanaloa.

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ewa. To mark boundaries of the land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere, in the Waimanalo section. When they went to find it, they could not locate the spot where it fell. So

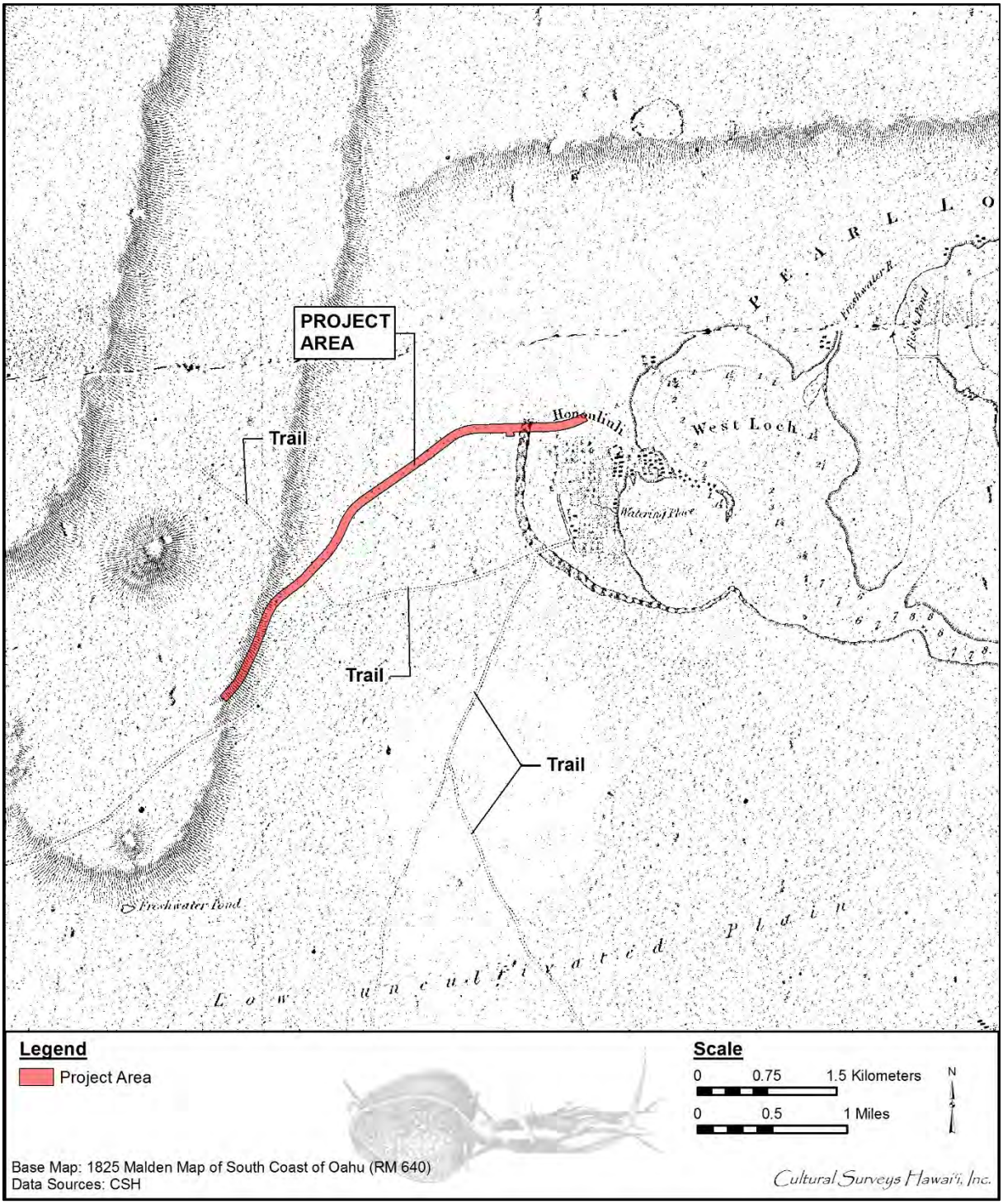

Figure 7. 1825 Malden map of the southern coast of O‘ahu with project area; note the faint lines from West Loch stretching northwest, west, and south depict ancient foot trails

Table 1. Place names with significance including McAllister site number (if available)

Site # (if available)	Place Name	Significance	Source
N/A	Awanui Gulch	Gulch located north of Pu‘u Pālailai	Sterling and Summers 1978
135	Enclosures	A number of enclosures sit inland from the old ranch house on the land of Kukuilua; leveled-off areas; the largest enclosure is 85 ft x 100 ft with low walls and facings; probably *kuleana* (land claim) sites	McAllister 1933
N/A	‘Ēkahanui Gulch	Gulch in Honouliuli; literally “large bird’s-nest fern”	Pukui et al. 1974
133	Heiau	A small enclosure said to be a *heiau* on a slight elevation in the gulch at the foot of Pu‘u Kanehoa; one of McAllister’s informants, Reiney, recalls old Hawaiians respecting the area; enclosure is approx. 25 ft x 30 ft; inside, walls are between 2-3 ft high with width ranging from 2-5 ft depending on the slope of the land; walls evenly faced with fill of smaller stones; site surrounded by lantana and thick grass; a few guava trees grow inside the *heiau*; possibly not a *heiau*, but a small enclosure	McAllister 1933
N/A	Honouliuli Stream	The stream passes through the eastern portion of the project area and Honouliuli Taro Lands eventually drain into West Loch	USGS Orthoimagery aerial photographs 2011
N/A	Honouliuli Taro Lands	See Section 3.2.2.2	N/A
N/A	Kahe, Kahe Point	Beach park (approx. 4.5 acres), ideal for diving; close to Nānākuli Ahupua‘a; also known as Electric Beach as it is adjacent to the Hawaiian Electric Company Power Plant; literally means “flow”	Clark 2002
N/A	Kalaeloa (Barbers Point)	Regional park consisting of approx. 120 acres; formerly Barbers Point Naval Air Station, turned over to the state on 2 July 1999; literally meaning “long point,” probably named for the view of the point from the east (Diamond Head) end of Māmala Bay, from which it appears to be an extremely long point	Clark 2002

Site # (if available)	Place Name	Significance	Source
139	Kalanamaihiki Fishing Shrine (ko‘a)	Located at Kapapapuhi, Honouliuli; two large rough stones near the end of the small tongue of land that juts out opposite Laulaunui Island in West Loch; approx. 2.5 ft in size with six or seven smooth stones averaging 1 ft in size in a small pile adjoining the larger stones; entire site is covered in *‘ākulikuli* (general name for succulent plants)	McAllister 1933
N/A	Kalo‘i Gulch	Gulch in Honouliuli; literally “the taro patch”	Pukui et al. 1974
N/A	Kānehili	An *‘ili* (land section; subdivision of an *ahupua‘a*) extending south of the project area to the shoreline	Sterling and Summers 1978
N/A	Kapapapuhi Point	Translates to “the numerous eels”; a land section southeast of the project area; point located on West Loch	Pukui and Elbert 1986
N/A	Kaupe‘a	Plain; where ghosts wandered to catch night moths and spiders for food; extending from the *wiliwili* (*Erythrina sandwicensis*; Hawaiian leguminous tree) trees of Kaupea to Kānehili	*Ke Au Hou*, 12 July 1911 in Sterling and Summers 1978
N/A	Ko‘olina	Beaches, man-made lagoons, private marina, gated community, and hotels; literally “delightful, lovely”	Clark 2002
N/A	Kualaka‘i	Area near Barbers Point; a spring here is called Hoaka-lei (“lei reflection”) because Hi‘iaka picked *‘ōhi‘a lehua* flowers here to make a lei (garland, wreath) and saw her reflection in the water; literally “Tethys” (a sea creature)	Pukui et al. 1974
N/A	Kupehau	Translates to “hibiscus canoe-rim,” this is an *‘ili* in the *mauka* section of Honouliuli Ahupua‘a	Pukui and Elbert 1986
N/A	Līhu‘e	Former land division near Schofield Barracks; literally “cold chill”	Pukui et al. 1974
N/A	Limaloa Gulch	Gulch located in Nānākuli; Limaloa is the name of a luckless lover in the Kamapua‘a legend; literally “long arm”	Pukui et al. 1974
N/A	Makaīwa Gulch	Gulch near Barbers Point; literally “mother-of-pearl eyes” (as an image)	Pukui et al. 1974
N/A	Mauna Kapu	Mountain in the Wai‘anae Range separating Nānākuli and Honouliuli forest reserves	Pukui et al. 1974

Site # (if available)	Place Name	Significance	Source
N/A	Maunauna	Hill in Honouliuli Ahupua‘a standing approx. 1,769 ft high; literally “mountain sent [on errands]”; the *mo‘olelo* behind this feature is of two servant *mo‘o* (lizard) who lived here and had no keepers to supply their needs	Pukui et al. 1974; Sterling and Summers 1978
N/A	Namo‘opuna	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2011
N/A	One‘ula	Beach park located in Honouliuli Ahupua‘a; literally “red sand”	Pukui et al. 1974
N/A	Pālehua	Land division, hill (elevation 2,566 ft), and road; literally “lehua flower enclosure”	Pukui et al. 1974
N/A	Palikea	Peak above Lualualei (approx. 3,098 ft high) in the Wai‘anae Mountains; literally “white cliff”	Pukui et al. 1974
N/A	Paupauwela	Northernmost *‘ili* within Honouliuli Ahupua‘a; near Wai‘anae Uka	Sterling and Summers 1978
N/A	Pili o Kahe	Land section; literally “clinging to Kahe”	Pukui et al. 1974
136	Platform	Located near Mauna Kapu on the ridge that divides ‘Ewa and Wai‘anae District	McAllister 1933
N/A	Pōhākea Pass	Mountain and pass (approx. 2,200 ft high) in the Wai‘anae Mountains; from this point, Hi‘iaka saw by cloud omens that her *lehua* groves on Hawai‘i Island had been burned by her sister Pele, and that her friend Hōpoe had been turned to stone; this is where Ka-uhi brutally murdered his wife, Ka-hala-o-Puna, because he thought she had been defiled; literally “white stone” (*pōhā* is short for *pōhaku*, which means stone or rock)	Pukui et al. 1974
N/A	Pouilihale	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2011
N/A	Pu‘u Hāpapa	Literally translates to “rock stratum,” this mountain converges at the border of the Honouliuli, Wahiawā, and Wai‘anae Districts	Sterling and Summers 1978

Site # (if available)	Place Name	Significance	Source
N/A	Pu‘u Kānehoa	Peak (approx. 2,728 ft high) in Honouliuli Ahupua‘a; named for native shrubs	Pukui et al. 1974
138	Pu‘u o Kapolei and Heiau	The stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side; formerly a rock shelter was on the *makai* side where Kamapua‘a is said to have lived with his grandmother; hill located in Honouliuli ; Kamapua‘a, the pig-man demigod, established his grandmother as queen here after conquering most of O‘ahu	McAllister 1933; Pukui et al. 1974
N/A	Pu‘u Kapua‘i	Hill (approx. 1,047 ft high); literally “foot print hill”	Pukui et al. 1974
137	Pu‘u Kaua	*Heiau* located on the ridge, overlooking Nānākuli, as well as Honouliuli, at the approx. height of 1,800 ft; most of the *heiau* stones were used for a cattle pen located on the sea side of the site; portion of the *heiau* not been cleared for pineapples has been planted in ironwoods; peak; literally “war hill” or “fort hill”; place where chiefs lived in ancient times; see Section 0 for an expanded account	McAllister 1933; Pukui et al. 1974
134	Pu‘u Ku‘ina Heiau	Aikukai, Honouliuli, located in a gulch at the foot of Mauna Kapu; suggestion of a terrace is about all that remains; no idea of the size of the *heiau* or number of terraces can be obtained	McAllister 1933
N/A	Pu‘u Ku‘ua Heiau	Hill located in Honouliuli Ahupua‘a; Pele’s sister, Kapo, once left her flying vagina (*kohe lele*) there; literally “relinquished hill”	Pukui et al. 1974
N/A	Pu‘u Makakilo	Hill near Honouliuli Ahupua‘a; literally “observing eyes hill”	Pukui et al. 1974
N/A	Pu‘u Manawahua	Peak (approx. 2,401 ft high) located in Nānākuli Ahupua‘a; literally “great grief hill” or “nausea hill”	Pukui et al. 1974
N/A	Pu‘u Pālailai	Hill (approx. 492 ft high) located in ‘Ewa; literally “young lai fish hill”	Pukui et al. 1974
N/A	Waimānalo	Land division, road, gulch near Barbers Point; also the site of Chief Kākuhihewa’s home; literally “potable water”	Pukui et al. 1974

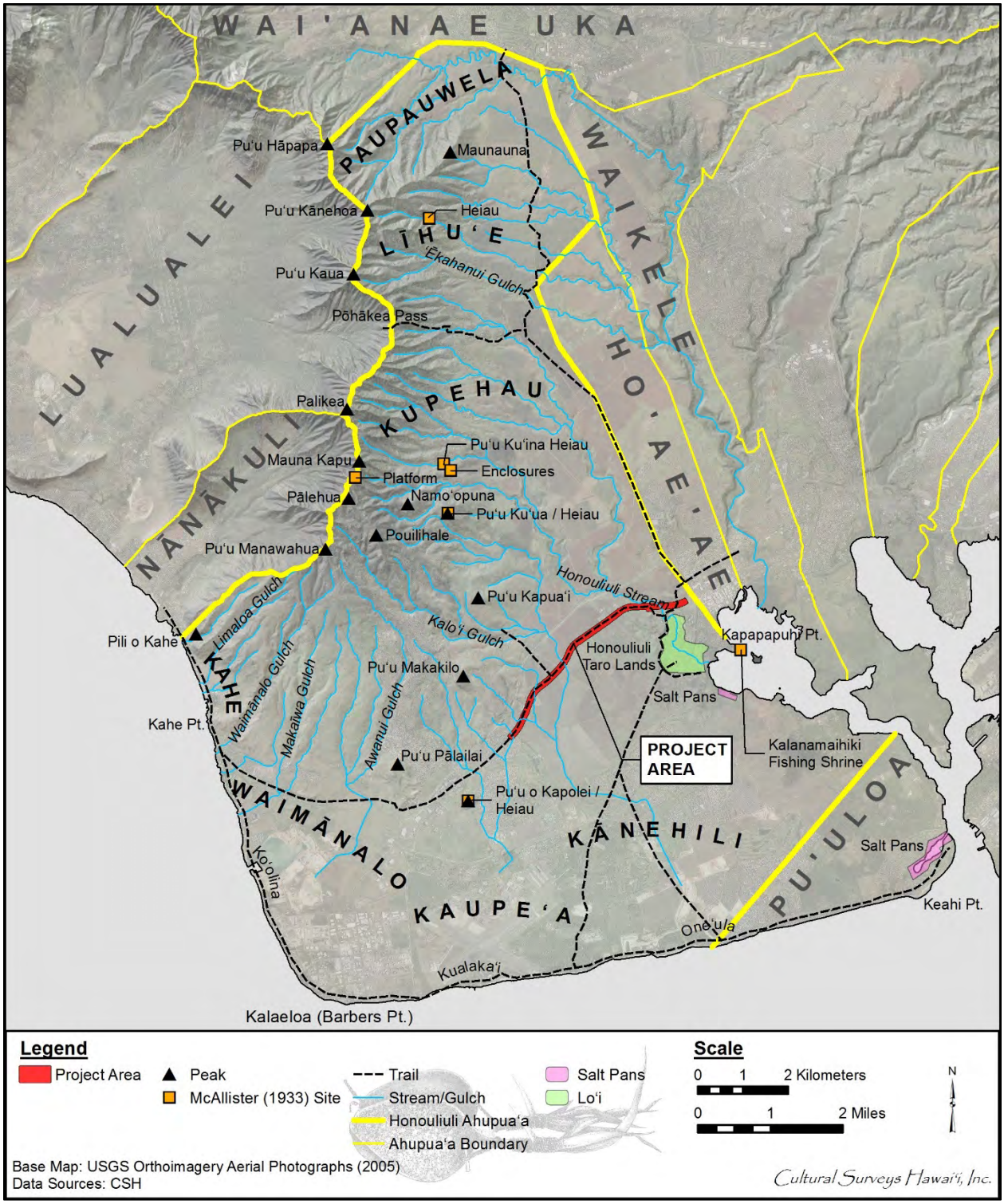

Figure 8. 2011 USGS Orthoimagery aerial photograph depicting project area with *wahi pana*

> Ewa (strayed) became known by the name. The stone that strayed [Told to E.S. by Simeon Nawaa, 22 March 1954, in Sterling and Summers 1978:1]

According to S.K. Nawaa (22 March 1954) in Sterling and Summers, the stone found at Pili o Kahe and that is the diving marker between two hills that run parallel, the hill on the ‘Ewa side was considered male and the hill on the Wai‘anae side marking the boundary between Nānākuli and Honouliuli was interpreted as female. The name “Pili o Kahe (Pili = cling to, Kahe = flow) refers, therefore, to the female or Wai‘anae side hill. And that is where the boundary between the two districts runs” (Sterling and Summers 1978:1). The boundaries of Honouliuli Ahupua‘a extend from Paupauwela in the north, Ho‘ae‘ae to the east, and Pu‘uloa to the south with the coastline on the southern border.

3.1.3.2 Kamapua‘a

Kamapua‘a, the pig god, is associated with Honouliuli:

> Kamapua‘a subsequently conquered most of the island of O‘ahu, and, installing his grandmother [Kamaunuaniho] as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Wai‘anae Mountain Range, and made her establish her court there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all. [Nakuina 1904:50]

Emma Nakuina goes on to note, “A very short time ago [prior to 1904] the foundations of Kamaunuaniho’s house could still be seen at Puuokapolei” (Nakuina 1904:50).

3.1.3.3 Pu‘uokapolei

Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor west to Wai‘anae (Sterling and Summers 1978:34). Pu‘u means “hill” and Kapolei means “beloved Kapo,” a reference to the sister of the Hawaiian volcano goddess, Pele.

Several places on the ‘Ewa coastal plain are associated with *ao kuewa*, the realm of the homeless souls. Samuel Kamakau explains Hawaiian beliefs in the afterlife:

> There were three realms (*ao*) for the spirits of the dead . . . There were, first, the realm of the homeless souls, the *ao kuewa*; second, the realm of the ancestral spirits, the *ao ‘aumakua*; and third, the realm of Milu, *ke ao o Milu* . . .
>
> The *ao kuewa*, the realm of homeless souls, was also called the *ao ‘auwana*, the realm of wandering souls. When a man who had no rightful place in the *‘aumakua* [family or personal gods] realm (*kanaka kuleana ‘ole*) died, his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Halawa, ‘Ewa near Red Hill], there he would find the breadfruit tree of Leiwalo, *ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, *the pō pau ‘olo o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend

> (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, a *leina a ka ‘uhane*.
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could not go far in the places mentioned earlier before they would be found catching spiders by *‘aumakua* souls, and be helped to escape. . . . [Kamakau 1991a:47–49]

The breadfruit tree, Leilono, was said to have been located on the ‘Ewa-Kona border, above Āliamanu. In another section of his account of the dead, Kamakau calls the plain of wandering souls the “plain at Pu‘uokapolei.”

> There are many who have died and have returned to say that they had no claim to an ‘aumakua [realm] (*kuleana‘ole*). These are the souls, it is said, who only wander upon the plain of Kama‘oma‘o on Maui or on the plain at Pu‘uokapolei on Oahu. Spiders and moths are their food. [Kamakau 1991b:29]

This association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu, who was killed by his father, Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

Go carefully lest you fall dead in the sun,	*E newa ai o hea make i ka lā,*
The god that dwells on Kapolei hill.	*Akua noho la i Pu‘uokapolei.*
The sun is wailing on account of the	*E hanehane mai ana ka lā i nā*
women of Kamao,	*wahine o Kamao*,
A hiding god, blossoming ohai of the banks,	*Akua pe‘e, pua ‘ohai o ke kaha*,
Contented among the stones-	*I walea wale i ke a-*
Among the breadfruit planted by Kahai.	*I ka ulu kanu a Kahai*.
Thou hast spoken of by the oo-	*Haina ‘oe e ka oo-*
By the bird of Kanehili.	*E ka manu o Kānehili.*

[Fornander 1919:6(2):297]

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association with wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919:6[2]:304).

Pukui (1983:180) offers this *‘ōlelo no‘eau*, or Hawaiian saying, which places the wandering souls in a *wiliwili* grove at Kaupe‘a.

The wiliwili grove of Kaupe‘a	*Ka wiliwili of Kaupe‘a*.

In ‘Ewa, O‘ahu. Said to be where homeless ghosts wander among the trees.

Beckwith (1970:154) has stressed that “the worst fate that could befall a soul was to be abandoned by its ‘aumakua and left to stray, a wandering spirit (kuewa) in some barren and

desolate place.” These wandering spirits were often malicious, so the places where they wandered were avoided.

In a chant by Hi‘iaka, the sister of the Hawaiian volcano goddess, Pele, several place names in ‘Ewa are mentioned as Hi‘iaka travels from Pu‘uokapolei toward the ‘Ewa coast. In the chant, Hi‘iaka is moving downhill from Kaupe‘a, probably the plains adjacent to Pu‘uokapolei, toward the coast, to the plains of Kānehili. The chant also refers to Pe‘e-kaua, which may be a variation of Kau-pe‘e or Kaupe‘a. Hi‘iaka sang this bitter chant addressed to Lohi‘au and Wahine‘ōma‘o, and it uses the association of the Plains of Kaupe‘a as a place for the wandering of lost souls. The name Kānehili also refers to wandering, as the word *hili* means “to go astray” (Emerson 1915:162).

Ku‘u aikana i ke awa lau o Pu‘uloa,

Mai ke kula o Pe‘e-kaua, ke noho oe,

E noho kaua e kui, e lei i ka pua o ke kauno‘a,

I ka pua o ke akuli-kuli, o ka wili-wili;

O ka iho‘na o Kau-pe‘e i K-hili,

Ua hili au; akahi no ka hili o ka la pomaika‘i;

E Lohiau ipo, e Wahine-oma‘o,

Hoe ‘a mai ka wa‘a i a‘e aku au.

We meet at Ewa’s leaf-shaped lagoon, friends;

Let us sit, if you will on this lea

And bedeck us with wreaths of Kauno‘a,

Of akuli-kuli and wili-wili,

My soul went astray in this solitude;

It lost the track for once, in spite of luck,

As I came down the road to Kau-pe‘a.

No nightmare dream was that which tricked my soul.

This way, dear friends; turn the canoe this way;

Paddle hither and let me embark.

[Emerson 1915:167–168]

Samuel Kamakau says that ancient Hawaiians also used Pu‘uokapolei as an astronomical marker to designate the seasons:

> . . . the O‘ahu people who reckoned the time (*O‘ahu po‘e helu*) called the season Kau [summer] for the setting of the sun from Pu‘uokapolei, a hill in Honouliuli, ‘Ewa, to the opening of Mahinaona (*i ke kawaha o Mahinaona*). When the sun moved south from Pu‘uokapolei—and during the season of the sun in the south—for the coming of coolness and for the sprouting of new buds on growing things—the season was called Ho‘oilo [winter, rainy, season]. [Kamakau 1976:14]

A *heiau* was once on Pu‘uokapolei, but it had been destroyed by the time of McAllister's (1933:108) survey of the island conducted in 1930. The hill was used as a point of solar reference or as a place for such observations (Fornander 1919:6[2]:297). Pu‘uokapolei may have been regarded as the gate of the setting sun, just as the eastern gate of Kumukahi in Puna is regarded as the gate of the rising sun; both places are associated with the Hawaiian goddess Kapo (Emerson 1915:41). This somewhat contradicts some Hawaiian cosmologies, in which Kū was the god of the rising sun, and Hina, the mother of Kamapua‘a, was associated with the setting of the sun. Fornander (1919:6[2]:292) states that Pu‘uokapolei may have been a jumping off point associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill.

A ceremony commemorating the changing of the seasons is still observed each year in the beginning of May at Waikīkī and Honouliuli. This ceremony was documented in a previous cultural impact assessment conducted by CSH (Genz et al. 2011). Sam ‘Ohukani‘ōhi‘a Gon III, Na Wa‘a Lalani Kahuna O Pu‘u Kohola, and the late Kumu Hula John Keola Lake's *hula hālau* (hula instruction) perform *‘oli* and *hula*, explaining that the *kilo hōkū* (astronomers) of O‘ahu observed how, from the perspective of Waikīkī, the sun sets in a southerly direction over the ocean during the winter solstice and in a northerly direction behind the ‘Ewa ridgeline during the summer solstice. During the springtime, the position of the setting sun marches steadily northward each day, and at the beginning of May, the sun sets behind Pu‘uokapolei, perfectly centered within its depression from the vantage point of Kūpalaha Heiau just west of the Waikīkī Aquarium. A coinciding ceremony at a *heiau* on Pu‘uokapolei similarly views the setting of the sun behind Pu‘ula‘ila‘i farther west, and a line of sight extending eastward from Pu‘ula‘ila‘i, Pu‘uokapolei, and the former site of Kūpalaha Heiau ends at the closely associated Papa‘ena‘ena Heiau. Mr. Gon suggests Papa‘ena‘ena Heiau may have been part of the ceremonies of this astronomical event.

3.1.3.4 The Traveling Mullet of Honouliuli

The story of (Ka) Ihuopala‘ai is also associated with the tradition of the *‘anae-holo* or traveling mullet (Thrum 1906:270–272):

> The home of the anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopalaai. They make periodical journeys around to the opposite side of the island, starting from Puuloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai, and so on, around to the Koolau side, ending at Laie, and then returning by the same course to their starting point. [Thrum 1907:271]

In Thrum's account, Ihuopala‘ai is a male who possesses a *kū‘ula*, or fish god, which supplied the large mullet known as *‘anae*. His sister lived in Lā‘ie and there came a time when there were no fish. She sent her husband to visit Ihuopala‘ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā‘ie.

This story is associated with a poetical saying documented by Mary Kawena Pukui (1983:145) about Honouliuli:

Ka i‘a hali a ka makani	The fish fetched by the wind.

Pukui explains, "The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong" (Pukui 1983:145).

3.2 **Historical Background**

3.2.1 ‘Ewa as a Political Center

There are many documented references to chiefs residing in ‘Ewa and to its being a political center in the past. These include oral accounts of chiefs and chiefesses recorded by noted Hawaiian historian Samuel Kamakau that date back to at least the twelfth century. He tells us that

> The chiefs of Līhu‘e, Wahiawā, and Halemano on O‘ahu were called lō ali‘i. Because the chiefs at these places lived there continually and guarded their kapu [taboo, prohibition], they were called lō ali‘i [from whom a ‘guaranteed’ chief might be obtained, loa‘a]. They were like gods, unseen, resembling men. [Kamakau 1991b:40]

By the early 1300s, ‘Ewa along with Kona and Ko‘olaupoko were the dominant political districts ruled by the sons of a chief named Māweke. It was during this time that the ‘Aha Ali‘i (council of chiefs) was also established (Cordy 2002:21). ‘Ewa at this time included the traditional districts of ‘Ewa, Wai‘anae, and Waialua (Fornander 1996:48). Around AD 1400, ‘Ewa was ruled by the *ali‘i* (chief, ruler) La‘akona of the senior Māweke-Kumuhonua genealogy and was recognized as the overall ruler of O‘ahu. Chiefs in this genealogy reigned until about AD 1520-1540, with their major royal center in Līhu‘e (Cordy 2002:24). Haka, the last chief of the Māweke-Kumuhonua line to hold this position, was deposed and slain by his men at the fortress of Waewae near Līhu‘e (Fornander 1996:88; Kamakau 1991a:54).

Then, with Haka being deposed as Ali‘i Nui (high chief), the ‘Aha Ali‘i chose Mā‘ilikūkahi, an Ali‘i Kapu (ruler of best bloodline) of the junior Māweke-Mō‘īkeha line. Mā‘ilikūkahi was born at Kūkaniloko and was to be the new Ali‘i Nui of O‘ahu. After Mā‘ilikūkahi’s dedication at the *heiau* of Kapukapuākea (Site 225; McAllister 1933:140) in central Waialua, there was a shift in political centers from ‘Ewa to Kona *moku* (district), specifically Waikīkī. However, Mā‘ilikūkahi did keep a presence in Līhu‘e. During this time, he instituted an explicit land division and administration structure. O‘ahu was divided into six *moku*—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olauloa, and Ko‘olaupoko—that were further divided into 86 *ahupua‘a* and smaller territorial units (Kirch 2010:84-90). In reference to the productivity of the land and the population during Mā‘ilikūkahi’s reign, Kamakau writes,

> In the time of Mā‘ili-kūkahi, the land was full of people. From the brow, lae, of Kulihemo to the brow of Maunauna in ‘Ewa, from the brow of Maunauna to the brow of Pu‘ukea [Pu‘u Ku‘ua] the land was full of chiefs and people. From Kānewai to Halemano in Wai‘alua, from Halemano to Paupali, from Paupali to Hālawa in ‘Ewa the land was filled with chiefs and people. [Kamakau 1991b:55]

The picture presented here is that the whole *moku* of ‘Ewa was one of prosperity and productivity in the land and its people.

According to Cordy (2002:31), the period following Mā‘ilikūkahi, specifically AD 1600-1700, was the peak of power for the O‘ahu Kingdom during the “times of these famed O‘ahu rulers: Kala‘imanuia (1600-1620), Kākuihihewa (1640-1660), Kūali‘i (1720-1740), and Peleioholani (1740-1779).” Power shifted between the chiefs of different districts until Kākuhihewa reunited the O‘ahu kingdom under one rule. He went on to become one of the famed rulers of O‘ahu and

also held a residence in Kailua, Ko‘olaupoko (Cordy 2002:31–33). Generations later, his descendent Kūali‘i achieved control of all of O‘ahu by defeating the O‘ahu district chiefs and expanding his control on the windward side of Kaua‘i. Peleiōholani was called to be the regent for his nephew following the death of Kapiho‘okalani, the heir of Kūali‘i. Peleiōhōlani later assumed control of O‘ahu and later conquered parts of Moloka‘i. “By 1778, the O‘ahu Kingdom stretched across O‘ahu, to parts of Kaua‘i” (Cordy 2002:31).

‘Ewa continued to be a political center until the eighteenth century when Kahahana, the nephew of Peleiōhōlani who was raised in the court of the Maui chief Kahekili, was appointed to be chief of O‘ahu. Kahahana was defeated by Kahekili and the Maui army shortly after the *kahuna* (priest, sorcerer) Ka‘opulupulu and his son were slain at Pu‘uloa and Wai‘anae respectively, which according to Cordy occurred about 1783 (Cordy 2002:36; Thrum 1907:203–214). Kahahana’s father, ‘Elani, along with other O‘ahu chiefs, plotted to kill Kahekili and his chiefs who were residing at Kailua, O‘ahu, as well as his chiefs residing in ‘Ewa and Waialua. The plot was discovered by Kahekili and a messenger was sent to warn Hū‘eu, another O‘ahu chief, who was at Waialua. For some reason, the messenger never reached Hū‘eu and he and his retinue were killed. Kahekili avenged the death of Hū‘eu by pillaging and destroying the districts of Kona and ‘Ewa. It is said that the streams of Makaho and Niuhelewai in Kona, as well as Hō‘ae‘ae in ‘Ewa were choked with the bodies of the slain (Fornander 1996:290).

‘Ewa and Waikīkī remained political centers and favorite playgrounds for the chiefs of Kona, and ‘Ewa until Kou (old name for Honolulu, used until about 1800) was established as a center for trade of foreign goods (Pukui et al. 1974:117). With the battle of Nu‘uanu in 1895 and the subsequent unification of the Hawaiian Islands by Kamehameha I, Hawai‘i began its national history. As attention shifted to Kou, which had a deep enough harbor for ships to pull in and anchor, this place became the center of activity and royalty moved away from the outer districts toward the center of commerce. Archibald Campbell writes about O‘ahu in 1809, “In consequence of this, and of the facility with which fresh provisions can be procured, almost every vessel that navigates the North Pacific puts in here to refit. This is probably the principal reason why the king has chosen it as his place of residence” (Campbell 1967:109–110).

Despite this shift in political importance, ‘Ewa is depicted as an abundant and populated land where chiefs of distinguished lineages were born and resided. The land was fertile and well fed by mountain streams that helped sustain the agricultural lifestyle needed to support the chiefs, their households, and their people. An examination of the place names reveals that water was a very important factor in this district. Six of the 12 *ahupua‘a* names begin with *wai*, the Hawaiian word for water (Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu). The fact that there were so many fishponds in the ‘Ewa District and in the Pu‘uloa area, more than any other district on O‘ahu, indicates agricultural and aquacultural intensification was a direct link to the political history and also to the increasing needs of the population.

3.2.2 Settlement Patterns of Honouliuli

Archaeological and traditional sources show a general pattern of three main areas of settlement within Honouliuli Ahupua‘a—the coastal zone, the Honouliuli taro lands, and the inland settlement at Pu‘u Ku‘ua.

3.2.2.1 The Coastal Zone (Kalaeloa, Barbers Point)

Archaeological research at Barbers Point has focused on the areas in and around the Deep Draft Harbor (Barrera 1975; Davis and Griffin 1978; Hammatt and Folk 1981). Series of small clustered shelters, enclosures, and platforms show limited but recurrent use at the shoreline zone for marine-oriented exploitation. This settlement covers much of the shoreline, with more concentrated features around small marshes and wet sinks. Immediately behind the shoreline, under a linear dune deposit, is a buried cultural layer believed to contain some of the earliest habitation evidence in the area.

The attraction of the area to early Hawaiians may have been the plentiful and easily exploited bird population. Particular evidence for the taking of petrel occurs at State Inventory Historic Places (SIHP) # 50-80-12-2763 (Hammatt and Folk 1981). Initial heavy exploitation of nesting seabirds and other species, in conjunction with habitat destruction, may have contributed to some avian extinctions.

There is some indication of limited agriculture in mulched sinkholes and limited soil areas. Considering the lack of rainfall, this activity would have been limited, but probably involved tree crops and roots (sweet potatoes). The archaeological content of the sites indicates a major focus on marine resources.

Davis and Griffin (1978) distinguish functional classes of sites based on surface area size and argue that the Barbers Point settlement consists of functionally integrated, multi-household residence groups. Density contours of midden (by weight) and artifacts (by numbers) plotted for residence sites by Hammatt and Folk (1981) generally indicate narrowly defined spatial foci of discard, possibly indicating continuous use, or at least with no refurbishing or additions to the structures over time. The focus is small habitation sites, typically lacking the full range of features found in large permanent residence complexes such as high platforms, complex enclosures, and conspicuous ceremonial sites.

3.2.2.2 The Honouliuli Taro Lands

Centered around the west side of Pu‘uloa at Honouliuli Stream and its broad outlet into the West Loch are the rich irrigated lands of the *‘ili* of Honouliuli, which give the *ahupua‘a* its name. The major archaeological reference to this area is Dicks et al. (1987), who documented remnants of a once widespread wetland system consisting of *lo‘i* (irrigated terrace) and fishponds, as well as dryland cultivation of the adjacent slopes (Figure 9).

According to Carol Silva’s “Historic Research Relative to the Land of Honouliuli” (in Dicks et al. 1987), the Honouliuli area bordering West Loch was clearly a major population center, a logical response to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomlands suitable for wetland taro cultivation. The earliest detailed map by Malden (from 1825; see Figure 7) shows all the roads of southwest O‘ahu coalescing and descending the *pali* (cliff) as they funnel into the area of Honouliuli Village. Dicks et al. (1987:78–79) conclude on the basis of 19 carbon isotope dates and three volcanic glass dates that “agricultural use of the area spans over 1,000 years.” Undoubtedly, Honouliuli was a locus of habitation for thousands of Hawaiians. ‘Ewa was also famous for a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marshy locations (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

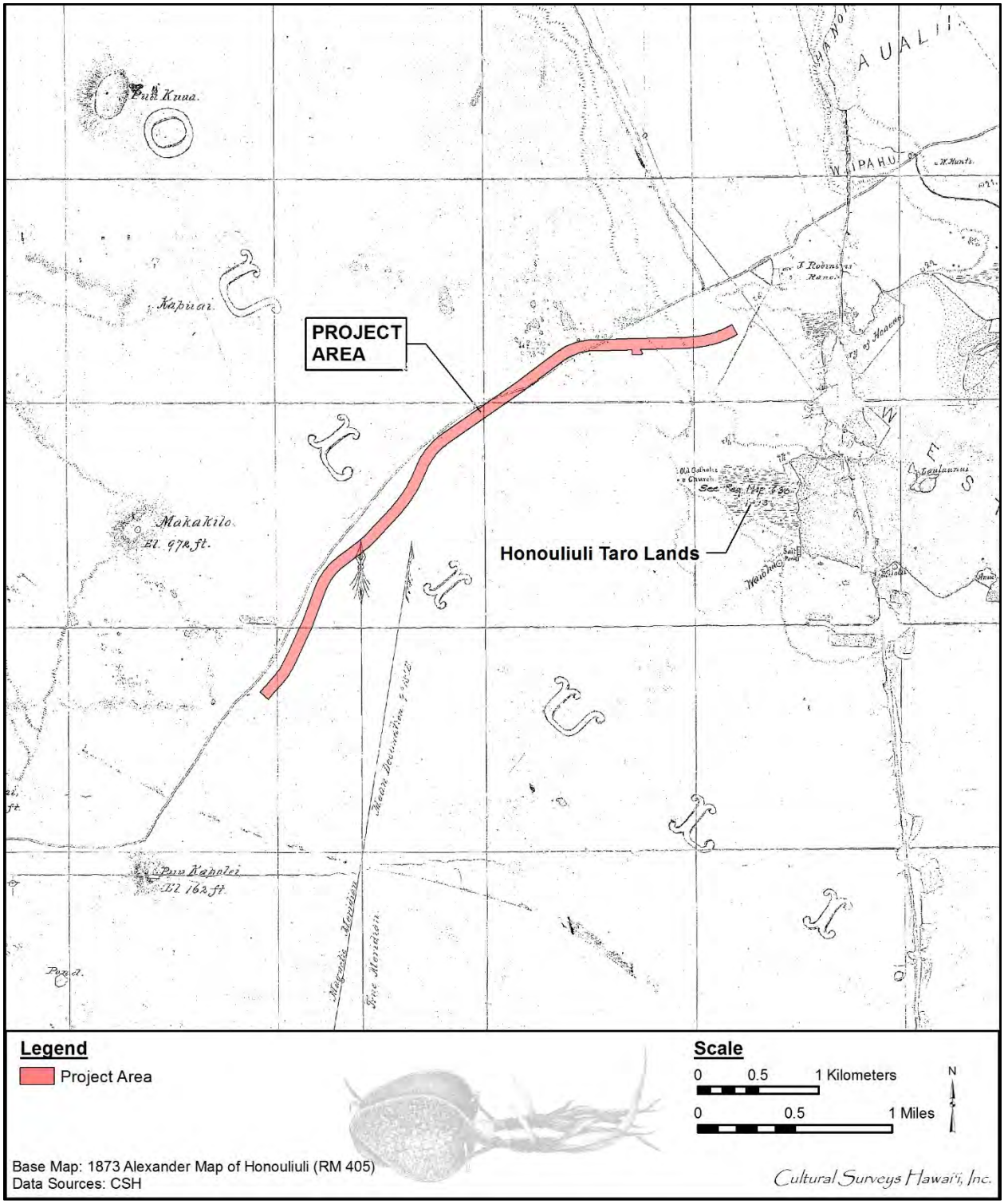

Figure 9. 1873 Alexander map of Honouliuli depicting project area; note the Honouliuli Taro Lands lie to the southeast of the project area

Ua ‘ai i ke kāī-koi o ‘Ewa.

He has eaten the Kāī-koi taro of ‘Ewa.

Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it.

Said of a youth of a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

According to Handy and Handy (1972), the irrigated lowlands were suitable for wetland taro cultivation, as well as the lower forest area of the mountain slopes for the procurement of forest resources. The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges with steep sides, but a very gradual increase of altitude. The lower part of the valley sides were excellent for cultivating yams and bananas. Farther inland grew the *‘awa* (*Piper methysticum*; kava) for which the area was famous (Handy and Handy 1972:429).

In addition, breadfruit, coconuts, *wauke* (*Broussonetia papyrifera*; paper mulberry), bananas, *olonā* (*Touchardia latifoldia*), and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (*Pipturus* spp.).

3.2.2.3 Pu‘u Ku‘ua: Inland Settlement

Documentation of inland settlement in Honouliuli Ahupua‘a is more problematic in that there are relatively few documented archaeological sources. However, it is probable the area around Pu‘u Ku‘ua, on the east side of the Wai‘anae Ridge, 7 miles inland of the coast, was a place of some importance for Hawaiians.

In 1899, the Hawaiian newspaper *Ka Loea Kalaiaina* relates a story of Pu‘u Ku‘ua as “a place where chiefs lived in ancient times” and a “battle field,” “thickly populated.” The article summarizes that “this place was entirely deserted and left uninhabited and it seems that this happened before the coming of righteousness to Hawai‘i Nei. Not an inhabitant is left” and that “the descendants of the people of this place were so mixed that they were all of one class. Here the gods became tired and returned to Kahiki” (Sterling and Summers 1978:33).

McAllister recorded three sites in this area, two *heiau* (Site 134, Pu‘u Kuina, and Site 137, Pu‘u Ku‘ua; both destroyed) and a series of enclosures in Kukuilua which he calls “kuleana sites” (McAllister 1933:107). On the opposite side of the Wai‘anae range, Cordy states “Kākuhihewa was said to have built (or rebuilt) Nīoi‘ula, a po‘okanaka [sacrificial] heiau (1,300 sq. m.) in Hālona in upper Lualualei, along the trail to Pōhākea Pass leading into ‘Ewa, circa A.D. 1640-1660” (Cordy 2002:36). There is no direct archaeological evidence available to the authors’ knowledge that intensive Hawaiian settlement occurred here, but it is considered as a place of high probability, based on the above indications. John Papa ‘Ī‘ī (1959) described a journey that Liholiho took which led him and an entourage through inland Honouliuli and over Pōhākea Pass. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources.

3.2.3 Observations of Honouliuli from Early Explorers

The first mission station in ‘Ewa was established in 1834 at Kalua‘aha near Pearl Harbor. Charles Wilkes, of the U.S. Exploring Expedition, visited the missionary enclave at Honouliuli town in 1840:

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them . . . The natives have made some advance in the arts of civilized life; there is a sugar-mill which, in the season, makes two hundred pounds of sugar a day . . . In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop’s church. [Wilkes 1970:80–81]

Early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Honouliuli Ahupua‘a indicate prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

The earliest detailed maps of the area show no substantial habitation closer to the project area than the western edge of West Loch, in the vicinity of Kapapapuhi Point (Hō‘ae‘ae Point on modern maps). The 1825 Malden map documents substantial settlement at the “Honouliuli Taro Lands” west of Kapapapuhi Point, and it seems clear that in early historic times, this was the population center for Honouliuli Ahupua‘a (Dicks et al. 1987). The amenities of that area, such as fishponds, taro *lo‘i*, shellfish collecting, and salt drying would have focused population there in pre-Contact times. Perhaps because of the significance of this *‘ili*, Honouliuli was also applied to the entire *ahupua‘a*.

Among the first historic accounts of Honoululi was one written by Captain Vancouver when he sailed by Kalaeloa (Barbers Point) in 1792 and recorded his impression of the small coastal village of Kūalaka‘i and the arid Honouliuli coast.

> The point is low flat land, with a reef round it . . . Not far from the S.W. point is a small grove of shabby cocoa-nut trees, and along these shores are a few struggling fishermen’s huts. [Vancouver 1798:1:167]

> . . . from the commencement of the high land to the westward of Opooroah [Pu‘uloa], was composed of one very barren rocky waste, nearly destitute of verdure, cultivation or inhabitants, with little variation all the way to the west point of the island . . . [Vancouver 1798:2:217]

> This tract of land was of some extent but did not seem to be populous, nor to possess any great degree of fertility; although we were told that at a little distance from the sea, the soil is rich, and all necessaries of life are abundantly produced. [Vancouver 1798:III:363]

Archibald Campbell, an English seaman who was given some land in Waimano Ahupua‘a by King Kamehameha in 1809, described his land around Pearl Harbor:

> In the month of November the king was pleased to grant me about sixty acres (ac) of land, situated upon the Wymummee [traditional Hawaiian name for Pearl River], or Pearl-water, an inlet of the sea about twelve mi to the west of Hanaroora [Honolulu] . . . We passed by footpaths, winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for the taro beds. Where there was not water, the land was under crops of yams and sweet potatoes. [Campbell 1967:103–104]
>
> Pearl and mother-of-pearl shells are found here in considerable quantity. Since the king has learned of their value, he has kept the fishing to himself, and employs divers for the purpose. [Campbell 1967:114–115]

3.2.4 Mid-Nineteenth Century and the Māhele

In the mid-nineteenth century, during the time of Kamehameha III, a series of legal and legislative changes were brought about in the name of "land reform" (Chinen 1958; Chinen 1971). Following the enactment of the Organic Acts of 1845 and 1846, the concept of private land ownership was introduced and all land in the Hawaiian Kingdom was divided into three main types: government (or Crown) land; *ali‘i* lands; and commoner lands, which *maka‘āinana* (commoner) could in principle obtain in fee simple, following passage of the Kuleana Act in 1850. This act allowed *maka‘āinana* to own land parcels at which they were currently and actively cultivating and/or residing. Of the hundreds of thousands of acres set aside as potential *kuleana* (land claims by *maka‘āinana*) parcels only about 10,000 claimants ultimately obtained some 30,000 acres, while 252 chiefs, for example, divided up about a million acres, leaving most Hawaiians disenfranchised.

In 1848, the crown and the *ali‘i* received their land titles. The common people began to receive their *kuleana* parcels in the beginning of 1850. During the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III. The 72 *kuleana* awards given to commoners were almost all made adjacent to Honouliuli Gulch, most within the "Honouliuli Taro Lands," which contained fishponds and irrigated taro fields (Tuggle and Tomonari-Tuggle 1997:34). No *kuleana* claims were made for land within the current study area. However, there were several claims in the vicinity of the project area, specifically near Honouliuli Stream.

In 1855, the Land Commission awarded all of unclaimed lands in Honouliuli, (43,250 acres), to Miriam Ke‘ahikuni Kekau‘ōnohi (Royal Patent 6971, Land Commission Award [LCA] 11216), granddaughter of Kamehameha I and the heir of Kalanimōkū. Kalanimōkū had been given the land by Kamehameha after the conquest of O‘ahu (Kame‘eleihiwa 1992; Waihona ‘Aina 2000). Kekau‘ōnohi was one of Liholiho's (Kamehameha II's) wives. After his death, she lived with her half-brother, Luanu‘u Kahalai‘a, who was governor of Kaua‘i (Kelly 1985:21). Subsequently, Kekau‘ōnohi ran away with Queen Ka‘ahumanu's stepson, Keli‘iahonui, and then became the wife of Chief Levi Ha‘alelea. Upon her death on 2 June 1851, all her property was passed on to her husband and his heirs. In 1863, the owners of the *kuleana* lands deeded their lands back to Ha‘alelea to pay off debts owed to him (Frierson 1972:12). In 1864, Ha‘alelea died, and his second wife, Anadelia Amoe, transferred ownership of the land to her sister's husband, John Coney.

Table 2 displays Land Commission Awards awarded in the vicinity of the project area. Details include LCA number, claimant, *‘ili*, and a brief description of the parcels (if available). Figure 10 depicts the project area and LCAs found in the vicinity.

Table 2. Land Commission Awards in the vicinity of the project area

LCA Number	Claimant	*‘Ili*	Notes
831	Kaekuna	Poohilo	*‘Āpana* (parcel) 2: House lot *‘Āpana* 3: Not available *‘Āpana* 4: Not available
834	Oni	Poohilo, Kailikahi	*‘Āpana* 2: Loko Kumuulio
847	Hinaa	Poohilo	‘Āpana 1: *Mo‘o‘āina* (land parcel) *‘Āpana* 2: *Kahua hale* (house foundation or site) called Aihonu
848	Kapule	Poohilo	*‘Āpana* 4: *Loko* (fishpond) *‘Āpana* 5: *Kula ‘āina* (plain) of banana
911	Kauhailepa	Poohilo	*‘Āpana* 1: Four *lo‘i* (irrigated terrace) and a small strip of *kula* *‘Āpana* 2: One *lo‘i*
1570	Kekua	Poohilo	*‘Āpana* 1: One *lo‘i* and *kula* called Aihonu *‘Āpana* 2: One *lo‘i* called Haaleluunui

3.2.5 Shifting Landscape

Much of the *mauka* lands in western Honouliuli including ridges and deep gulches were unsuitable for commercial sugar cultivation and remained pastureland for grazing livestock. By 1920, however, many of the lands of Honouliuli were used for commercial sugarcane cultivation (Frierson 1972:18). By 1919, reservoirs had been established throughout the region. In the late 1920s, the main residential communities were at the northeast edge of the ‘Ewa Plain. The largest community was still at Honouliuli Village. ‘Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese school. Additional settlement was in Waipahu, centered on the Waipahu Sugar Mill, operated by the Oahu Sugar Company. Historic maps of the Makakilo area indicate a lack of any other significant development in the area into the 1940s.

3.2.5.1 Early Ranching on the ‘Ewa Plain

John Coney rented land to James Dowsett and John Meek in 1871, who used it for cattle grazing. In 1877 this land in Honouliuli, except for the *‘ili* of Pu‘uloa, was sold to James Campbell for $95,000. Campbell then drove away 32,237 head of cattle belonging to Dowsett, Meek, and James Robinson, and constructed a fence around the outer boundary of his property (Bordner and Silva 1983: C-12). He let the land rest for one year and then began to restock the ranch, so that he had 5,500 head after a few years (Dillingham 1885 in Frierson 1972:14).

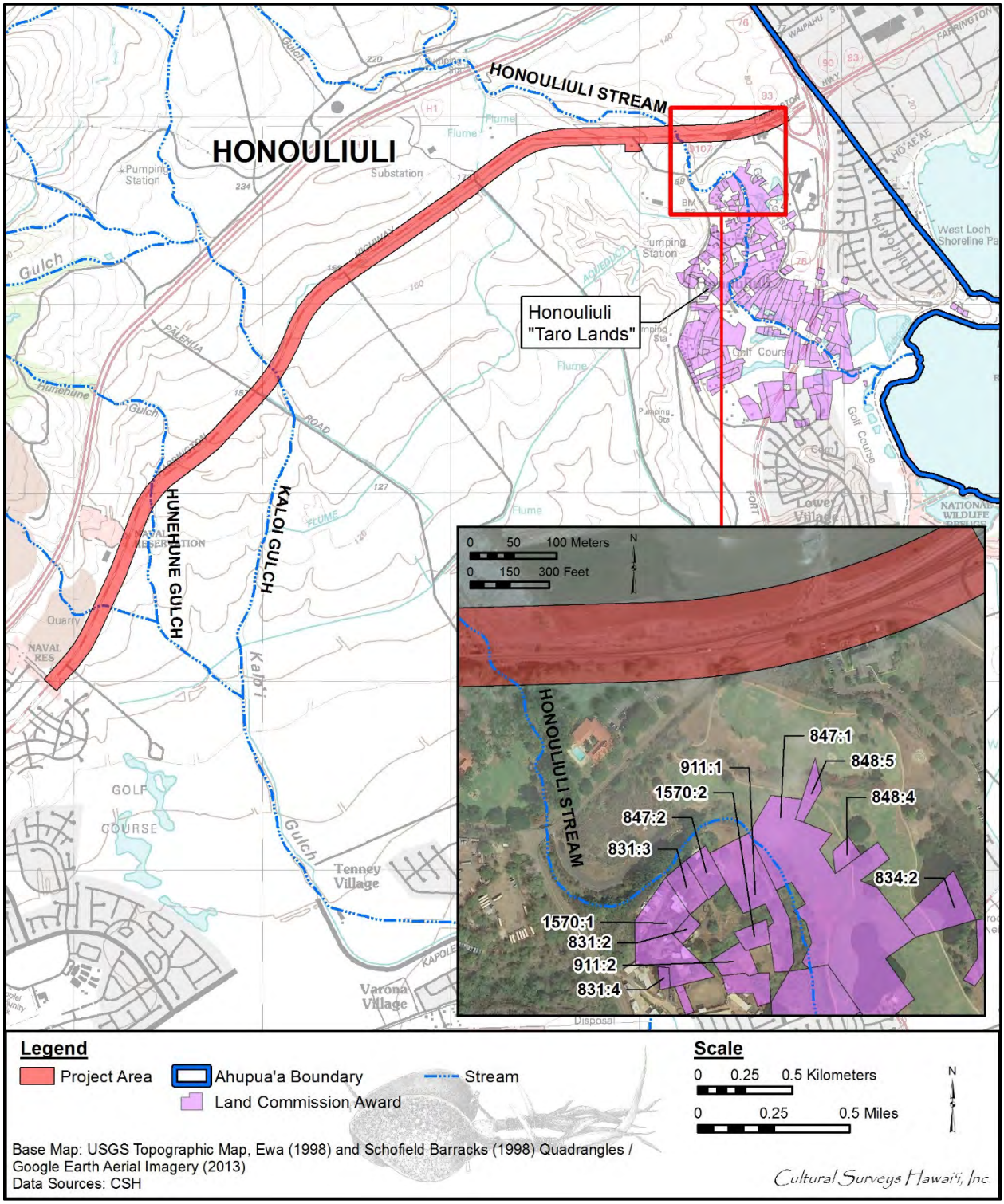

Figure 10. Portion of 1998 Ewa and Schofield Barracks USGS Topographic Quadrangles, depicting project area with Land Commission Awards in the vicinity

In 1880-1881, the Honouliuli ranch was described as follows:

> . . . acreage, 43,250, all in pasture, but possessing fertile soils suitable for agriculture; affords grazing for such valuable stock. The length of this estate is no less than 18 mi. It extends to within less than a mi of the sea coast, to the westward of the Pearl River inlet . . . There are valuable fisheries attached to this estate . . . [Bowser 1880:489]
>
> From Mr. Campbell's veranda, looking eastward, you have one of the most splendid sights imaginable. Below the house there are two lochs, or lagoons, covered with water fowl, and celebrated for their plentiful supply of fish, chiefly mullet . . . Besides Mr. Campbell's residence, which is pleasantly situated and surrounded with ornamental and shade trees, there are at Honouliuli two churches and a school house, with a little village of native huts. [Bowser 1880:495]

In 1881, a medical student, touring the island to provide smallpox vaccinations to the population, viewed Campbell's property, called the Honouliuli Ranch:

> I took a ride over the Honouliuli Ranch which is quite romantic. The soil is a deep, reddish loam, up to the highest peaks, and the country is well-grassed. Springs of water abound. The ilima, which grows in endless quantities on the plains of this ranch, is considered excellent for feeding cattle; beside it grows the indigo plant, whose young shoots are also good fodder, of which the cattle are fond. Beneath these grows the manieizie grass, and Spanish clover and native grasses grow in the open; so there is abundant pasturage of various kinds here. As I rode, to the left were towering mountains and gaping gorges; ahead, undulating plains, and to the right, creeks and indentations from the sea. A wide valley of fertile land extends between the Nuuanu Range and the Waianae Mountains and thence to the coast of Waialua. There are many wild goats in this valley, which are left more or less undisturbed because they kill the growth of mimosa bushes, which would otherwise overrun the country and destroy the pasturage for cattle. [Briggs 1926:62–63]

Most of Campbell's lands in Honouliuli were used exclusively for cattle ranching. At that time, one planter remarked "the country was so dry and full of bottomless cracks and fissures that water would all be lost and irrigation impracticable" (Ewa Plantation Company 1923:6–7). In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water. The well, drilled to a depth of 240 ft near Campbell's home in ‘Ewa, resulted in "a sheet of pure water flowing like a dome of glass from all sides of the well casing" (*The Legacy of James Campbell* in Pagliaro 1987:3). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource.

3.2.5.2 Other Enterprises on Campbell Lands

As noted above, part of Mr. Campbell's lands were also used to grow rice. These rice fields were planted in former taro fields or in undeveloped swamps (Figure 11). The rice fields in 1882 were described by Frank Damon, during a tour of the area:

> Towards evening we reached Honouliuli, where the whole valley is leased to rice planters . . . This was one of the largest rice plantations we visited. Sometimes two

Figure 11. Photo of rice fields in Honouliuli Ahupua‘a (Hawai‘i State Archives n.d.)

> or three men only, have a few fields which they cultivate for themselves, and we often too came upon houses where there were eight or ten men working their own land. But the larger plantations are owned by merchants in Honolulu, who have a manager acting for them . . . [Damon 1882:37]

In 1890, Dillingham leased all land below 200 ft to William Castle, who used most of it for sugarcane, but also leased some for rice cultivation, pasture, wood lots, bee-keeping, garden crops, and quarries. Some land above 650 ft was also leased for the cultivation of canaigre, an herbal source of tannin used in leather production (Frierson 1972:15–16).

An additional agricultural trial was conducted in the Honouliuli area for the cultivation of sisal, a plant used to make fibers for rope and other material. Some sisal was planted before 1898 and production continued until the 1920s (Frierson 1972:16). This was grown mainly on the coastal plain of Honouliuli in Kānehili, just *mauka* of Kualaka‘i Beach (now Nimitz Beach).

Into the early twentieth century, some Hawaiian families continued to live in Honouliuli and preserved the traditional lifestyle, including at the fishing village of Kūalaka‘i. One resident, Mrs. Eli Williamson, recalled,

> In the Honouliuli area the train stopped among the *kiawe* (algaraboa) trees and *malina* (sisal) thickets. We disembarked with the assorted food bundles and water containers. Some of the Kualaka‘i *‘ohana* (family) met us to help carry the *‘ukana* (bundles) along a sandstone pathway through the *kiawe* and *malina*. The distance to the frame house near the shore seemed long. When we departed our *‘ukana* contained fresh lobsters, *limu* (seaweed), fish and *i‘a malo‘o* (dried fish) . . . [Williamson in Kelly 1985:160]

3.2.5.3 Pineapple Cultivation

In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation (Figure 12). There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893. Later attempts were made in Waiawa and Honouliuli. James Dole founded the Hawaiian Pineapple Company in 1901. The previous year, Dole had purchased 61 acres of land in Wahiawa for growing pineapple. Prior to 1913, most of the upland plateau areas in Waiawa were planted in pineapple (Goodman and Nees 1991:59) and small plots along gullies, those not appropriate for sugarcane cultivation, in several ‘Ewa *ahupua‘a* were planted in pineapple. Many of these small plots were cultivated by independent farmers, who sold the crops at markets or to larger companies. In 1901, the Hawaiian Pineapple Company obtained 61 acres in Waiawa through public auction. Initially, most pineapple was shipped to California for packing. In an attempt to speed up processing, save money and produce a fresher product, a cannery was constructed in Waiawa. This cannery was constructed by the Pearl City Fruit Company but became a part of the Hawaiian Pineapple Company operations after the Pearl City Fruit Company went bankrupt. The cannery was in operation from 1905 to 1935.

3.2.5.4 The Oahu Railway and Land Company (OR&L)

In 1886, Campbell and B.F. Dillingham put together the “Colonization Project,” which was an attempt to sell Honouliuli land to homesteaders (Thrum 1886:64). This homestead project failed, largely due to the lack of water and the distance from ‘Ewa to Honolulu. The water problem was

Figure 12. Photo of first pineapple plantation in Kunia ca. 1900 (University of Hawai‘i at Mānoa Digital Collection)

solved by the drilling of artesian wells, and Dillingham decided the area could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was to be solved by the construction of a railroad, which B. Franklin Dillingham soon began to finance under the company name of the Oahu Railway and Land Company (OR&L).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the OR&L in 1890. To attract business to his new railroad, Dillingham subleased all land below a 200 ft elevation to William Castle who in turn sublet the area to the Ewa Plantation Company for sugarcane cultivation (Frierson 1972:15). Throughout this time, and continuing into modern times, cattle ranching continued in the area, and Honouliuli Ranch—established by Dillingham—was the "fattening" area for other ranches (Frierson 1972:15).

During the last decade of the nineteenth century, the railroad traveled from Honolulu to Pearl City in 1890, eventually making its way to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:III, 100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields.

Dillingham's *mauka* lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892 the Ranch Department of the OR&L Company tapped plantation flumes and searched for alternative sources of water. Ida von Holt leaves this account of her husband Harry's (Superintendent of the OR&L Ranch Department) search for water in the foothills of the Wai‘anae Range:

> One of those places is on the old trail to Pālehua, and had evidently been a place of which the Hawaiians had known, for its name is Kalo‘i (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. [Von Holt 1985:136]

The spring was located along the upper slopes of the southern face of Kalo‘i Gulch. A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo‘i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring. [Von Holt 1985:138]

Following the discovery, two old Hawaiians began to ask Von Holt about the spring.

> Finally he [Harry von Holt] got them to explain that the spring, called ‘Waihuna' (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840 . . . A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. [Von Holt 1985:138–140]

Operations at the OR&L began to slow down in the 1920s, when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families

for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around, as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted that one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The Navy base at Pearl Harbor had its own rail lines that connected to the OR&L rail lines.

In August 1945 the war ended and so did the OR&L's operation as a military transport line:

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

There was no choice but to abandon the OR&L main line, and in 1946 Water F. Dillingham, son of B.F. Dillingham, wrote,

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and the shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Walter Dillingham in Chiddix and Simpson 2004:257]

After the war, most of the 150 miles of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track for their own use, to transport bombs, ammunition, and torpedoes from the ammunition magazines at Lualualei, West Loch in Pearl Harbor, and Waikele on OR&L's Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968.

In 1970, the Hawaiian Railway Society was formed to save and restore the remaining OR&L railway tracks and stock. The federal government donated the tracks and right-of-way to the State of Hawai‘i in 1974, and the Society was able to place the Navy's Lualualei-Pearl Harbor track on the National Register of Historic Places on 1 December 1975. The Highway Railway Society has currently restored about 6.5 miles of this track, on which they run weekly tourist train rides from Ewa Station to Nānākuli, pulled by restored OR&L locomotives (Chiddix and Simpson 2004:273).

3.2.5.5 Ewa Plantation Company

The Ewa Plantation Company (Figure 13) was incorporated in 1890 for sugarcane cultivation. Ewa Plantation's first crop, 2,849 tons of sugar, was harvested in 1892. Ewa Plantation was the first all-artesian plantation, and it gave an impressive demonstration of the role artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:III, 69). As a means

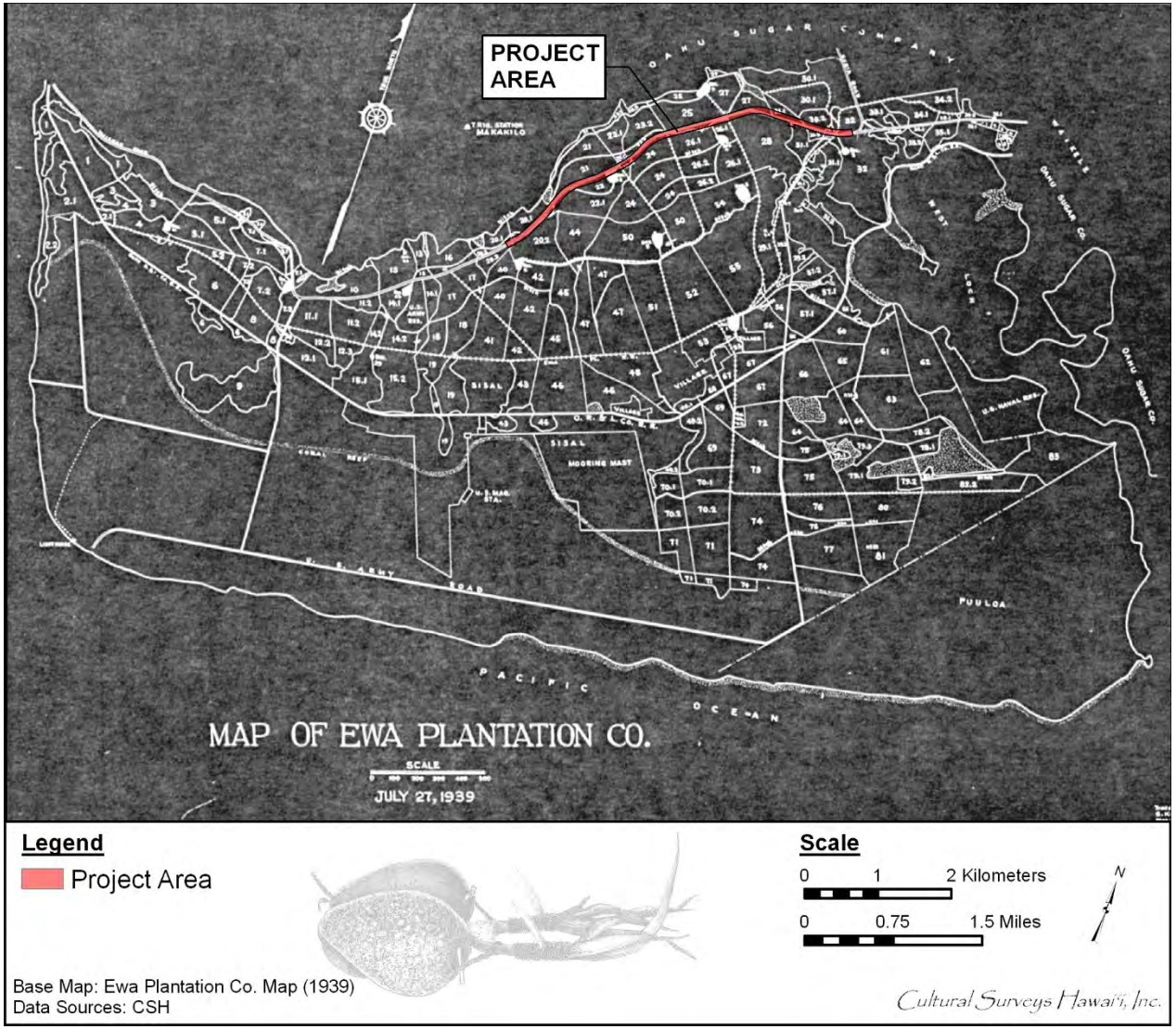

Figure 13. 1939 Ewa Planation Company map with project area location

to generate soil deposition on the coral plain and increase arable land in the lowlands, the Ewa Plantation Company installed ditches running from the lower slopes of the mountain range to the lowlands. When the rainy season began, they plowed ground perpendicular to the slope so that soil would be carried down the drainage ditches into the lower coral plain. After a few years, about 373 acres of coral wasteland were reclaimed in this manner (Immisch 1964). By the 1920s, Ewa Plantation was generating large profits and was the "richest sugar plantation in the world" (*Paradise of the Pacific,* December 1902:19–22 in Kelly 1985:171).

Just north of Ewa Plantation was the equally sprawling Oahu Sugar Company, which "covered some 20 square mi . . . ranging in elevation from 10 feet at the Waipio Peninsula . . . to 700 feet at the Waiahole Ditch" (Condé and Best 1973:313). The Oahu Sugar Company lands were described as being "of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project" (Condé and Best 1973:313). The Oahu Sugar Company took control of the Ewa Plantation lands in 1970 and continued operations until 1995, when they decided to shut down sugarcane production in the combined plantation area (Dorrance and Morgan 2000:45, 50).

3.2.5.6 Plantation Worker Housing: ‘Ewa Villages

In 1890, construction began on housing for over 500 Ewa Plantation workers (Hammatt et al. 1990:13). Eight main plantation camps, collectively known as ‘Ewa Villages, were constructed in the vicinity of Ewa Plantation sugar mill. These villages included (from northeast to southwest) Lower Village, Middle Village (also called Korean Village), Fernandez Village, Renton Village, Tenney Village, Mill Village, Varona Village, and "C" Village. The mill and plantation camps are located at junctions of major plantation transportation corridors, including the Ewa Plantation railway, the OR&L railway, and plantation roads (Figure 14).

In 1928, probably the year with the greatest number of workers, the census bureau counted 4,967 people living on and associated with the Ewa Plantation (Hammatt et al. 1990:13). These workers were Japanese, Chinese, Okinawan, Korean, Portuguese, Spanish, Hawaiian, Filipino, and European, who usually lived in segregated camps or housing areas (Figure 15). The plantation houses were described by George F. Renton, the plantation manager from 1899 to 1920:

> Each of these dwellings is enclosed by a fence and supplied with water. It is pleasant to note the eagerness with which these homes have been taken up, and how much the premises have been improved. This is especially noticeable among the Japanese . . . At present writing there are 451 dwellings on this estate. These are actual houses exclusive of restaurants, bath houses, cook houses, work shops, schools or churches. [Pagliaro 1987:17]

With the onset of World War II in the 1940s, the U.S. military drew from the plantation workforce to support the war effort. To cope with the loss of plantation laborers, Ewa Plantation came to rely on mechanical harvesting. This led to the overall decline in the large, multi-racial plantation workforce that had characterized the early history of the plantation (Hammatt et al. 1990:13). The Ewa Plantation Mill closed in the mid-1970s, following the sale of Ewa Plantation to Oahu Sugar Company. Sugarcane cultivation continued in ‘Ewa until the mid-1990s.

3.2.5.7 World War II and the Military in ‘Ewa

By 1941, Pacific Naval Air Bases expenditures for new construction at Pearl Harbor were in the hundreds of millions of dollars. The Japanese attack on Pearl Harbor on 7 December 1941

Figure 14. Photo of the Ewa Plantation train ca. 1950s (Hawaii Aviation 1950)

Figure 15. Photo of Ewa Plantation ca. 1925 at the Filipino Laborers Village (University of Hawai‘i at Mānoa Digital Collection)

damaged or destroyed much of the new construction. Reconstruction was instituted to double Pearl Harbor’s war capacity. Military planners approved a new ammunition depot in the mountainside of Waipahu, a large new hospital in ‘Aiea, and thousands of additional changes to the Navy yard to accommodate the new aircraft carrier task forces (Woodbury 1946:342–343). During World War II, the military used the sugarcane rail system to “haul large quantities of ammunition” (Condé and Best 1973:315).

Before the war, the main Pearl Harbor Naval yard was a sufficient staging and storage area for the Pacific fleet, but after the Japanese attack and the beginning of World War II, additional areas were needed for supply depots and warehouses. The government procured additional land after the beginning of World War II to expand the functionality of the military bases. The Navy took all of the coastline area in eastern ‘Ewa District from the coast inland of the OR&L railroad tracks (Ching 1996:24). Waipi‘o Point, Waiawa Gulch, Pearl City (Mānana) Peninsula, Iroquois Point in Hālawa, and small areas in Honouliuli and Hō‘ae‘ae were taken over as supply depots and storage areas. The OR&L railroad had built a spur from the coast to Wahiawa in 1905, to haul cane and pineapples down to the coast and later to haul men and supplies from Pearl Harbor to Schofield Barracks in Wahiawa through Waikakalaua Gulch in Waikele. During the war, the military built a “secret railroad” from the railroad terminus at Waikakalaua Gulch to join the OR&L railroad coming around Ka‘ena Point at Hale‘iwa, thus providing a short cut from Pearl Harbor to Army facilities at Kahuku on the north shore of O‘ahu (Kneiss 1957:11–12). By 1944, the Navy had claimed close to 2,400 acres of land in the Pearl Harbor and Pearl City areas within Mānana, Waiawa, and Hālawa for use as military staging areas in the war effort (Allen 1999:234).

To this day, much of the Pearl City peninsula remains in the custody of the U.S. Navy; however, in the late 1990s, much of the rest of the previous Pearl City regions were released to the state for public use (Allen 1999:239).

3.2.5.8 Residential and Commercial Development in Honouliuli

A series of historic topographic maps shows the gradual residential and commercial development of Honouliuli. On the 1919 U.S. Army War Department fire control map (Figure 16), residential areas were limited to a cluster at Honouliuli near the old taro lands, adjacent to West Loch, and the Ewa Plantation Villages *makai* of Honouliuli. On the 1930s USGS map (Figure 17), both Honouliuli and the Ewa Plantation villages were expanding with new and improved roads. On the 1943 U.S. Army War Department map (Figure 18), Ewa Villages had expanded with additional “ethnic camps,” while Honouliuli had become a smaller residential area, rather than a separate “village.” On the 1953 USGS map (Figure 19), residential subdivisions were spreading to the shore of Pearl Harbor. However, the lands surrounding the current project area remained almost exclusively under commercial sugarcane cultivation until the end of the twentieth century (Figure 20).

Few irrigation ditches are indicated on maps from the 1930s and 1940s, although several reservoirs are shown near the project area (see Figure 17 and Figure 18). However, by 1953 a system of interconnected ditches and flumes are present along or near Farrington Highway and connecting to reservoirs (see Figure 19). These ditches, flumes, and reservoirs appeared extant through 1977 (see Figure 20). The end of the plantation era likely saw these structures filled in or removed to accommodate subsequent development of the area.

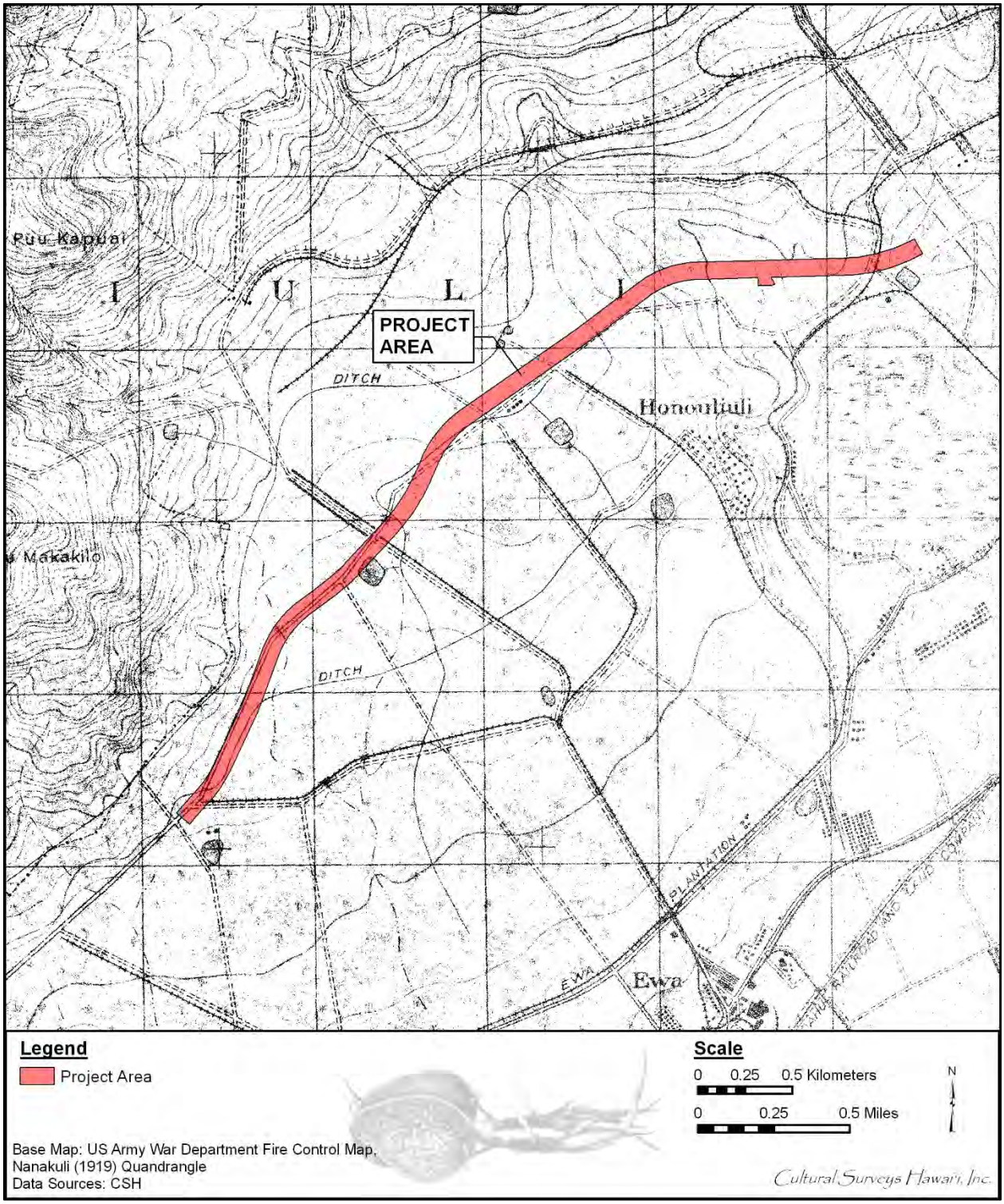

Figure 16. 1919 U.S. War Department fire control map, Nanakuli quadrangle showing project area

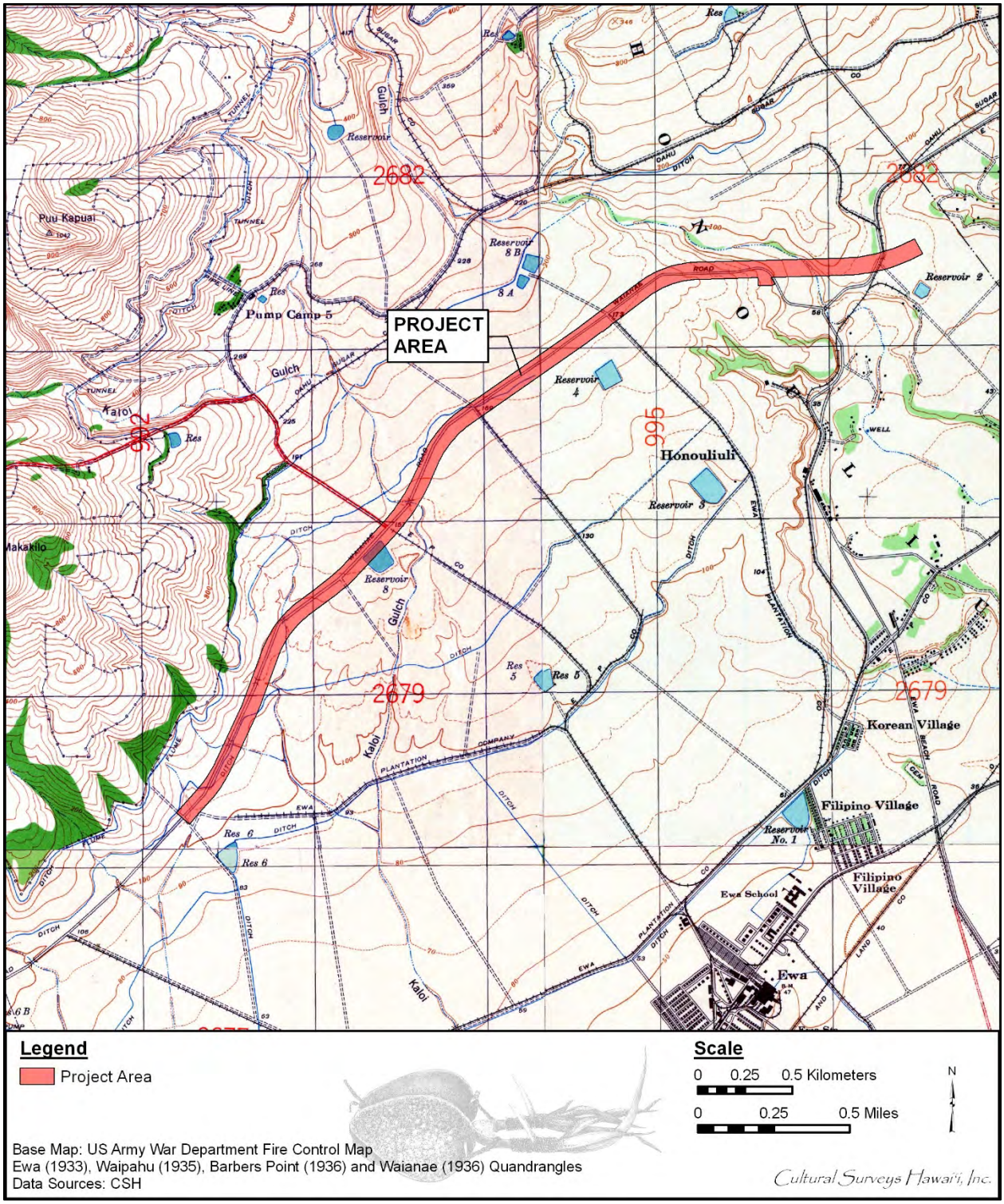

Figure 17. 1930s U.S. War Department fire control map showing project area, note plantation reservoir located in central project area

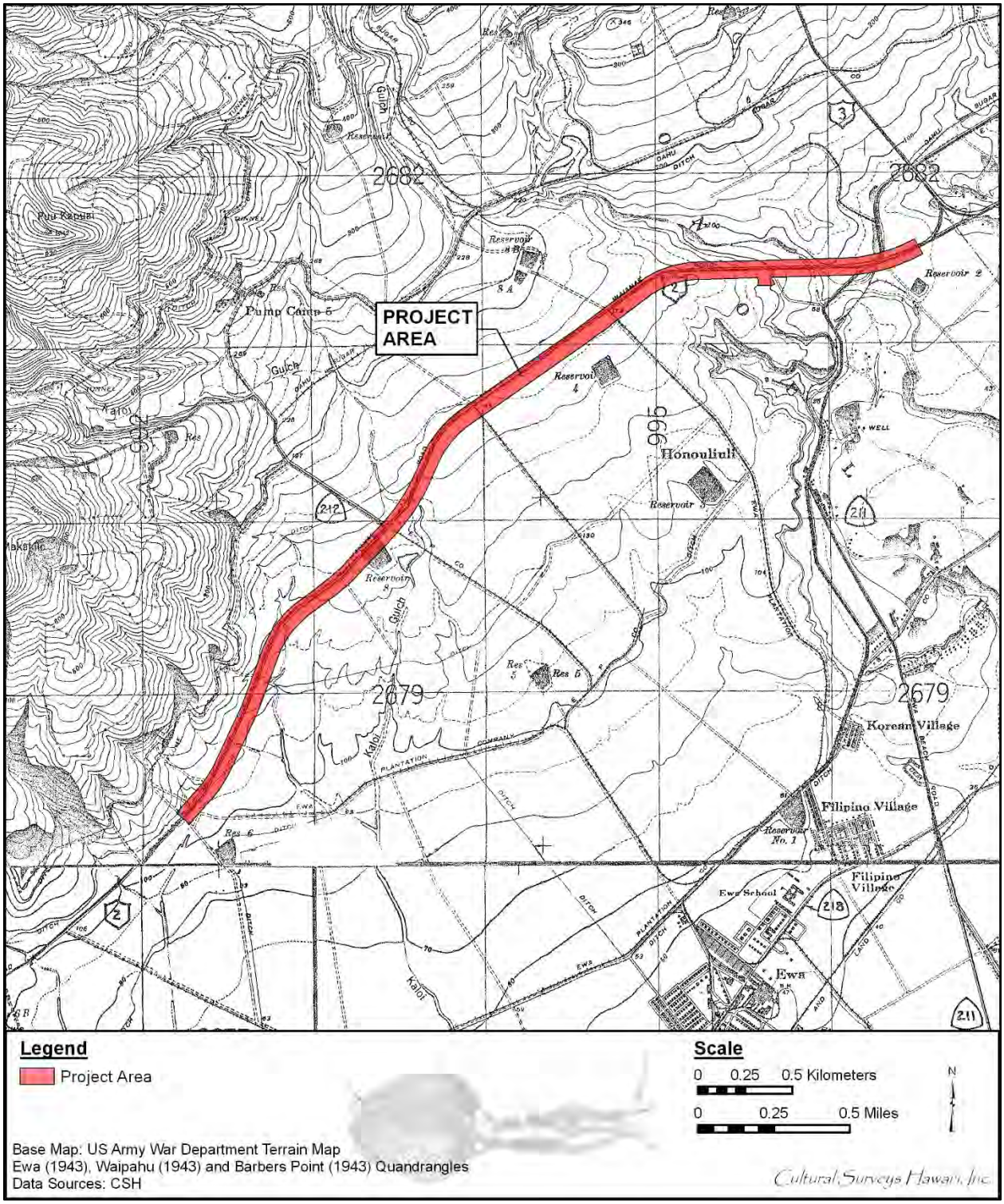

Figure 18. 1943 U.S. War Department terrain map showing project area

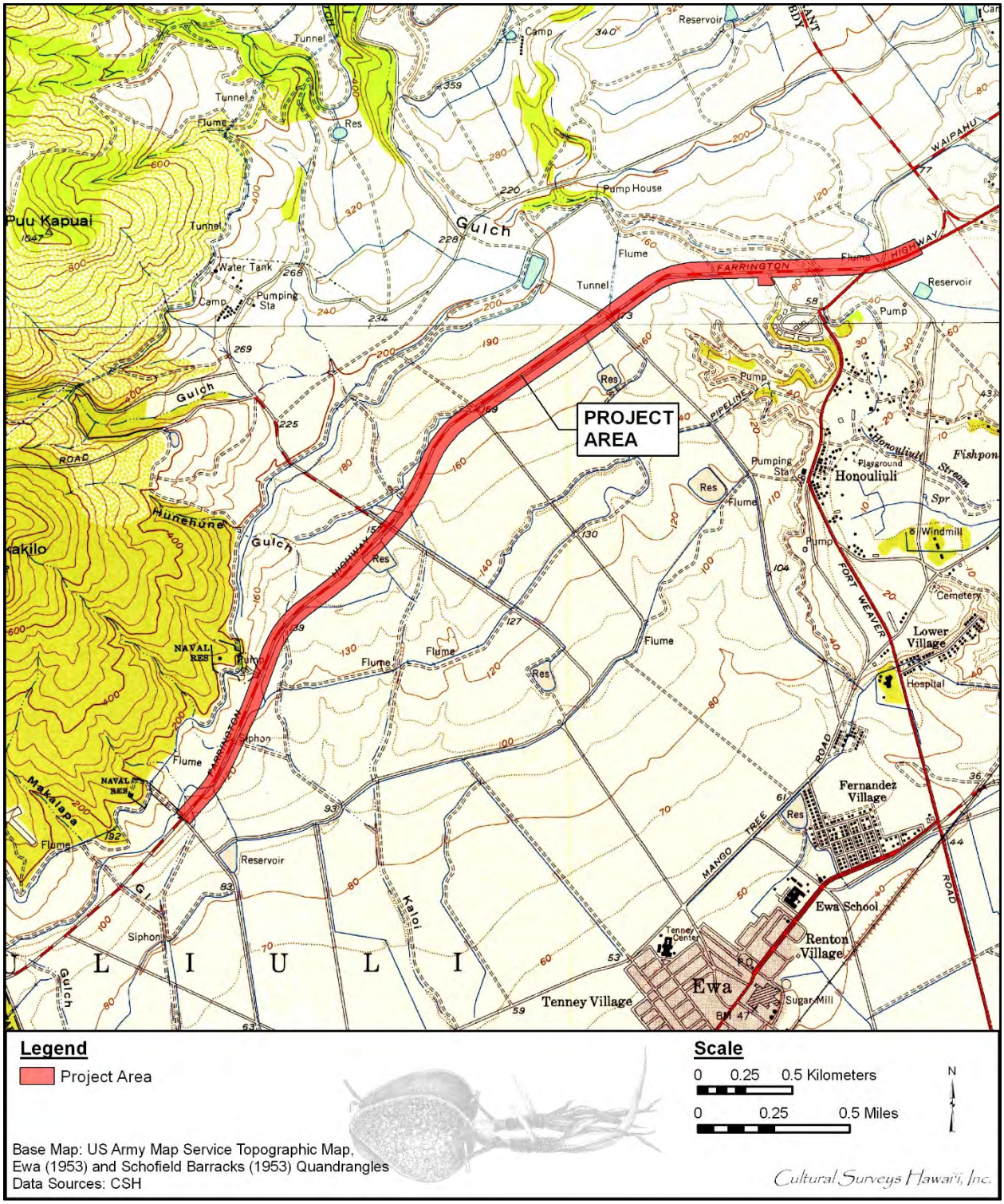

Figure 19. 1953 Ewa and Schofield Barracks USGS topographic quadrangles, showing project area, note presence of irrigation infrastructure associated with sugarcane agriculture throughout the region

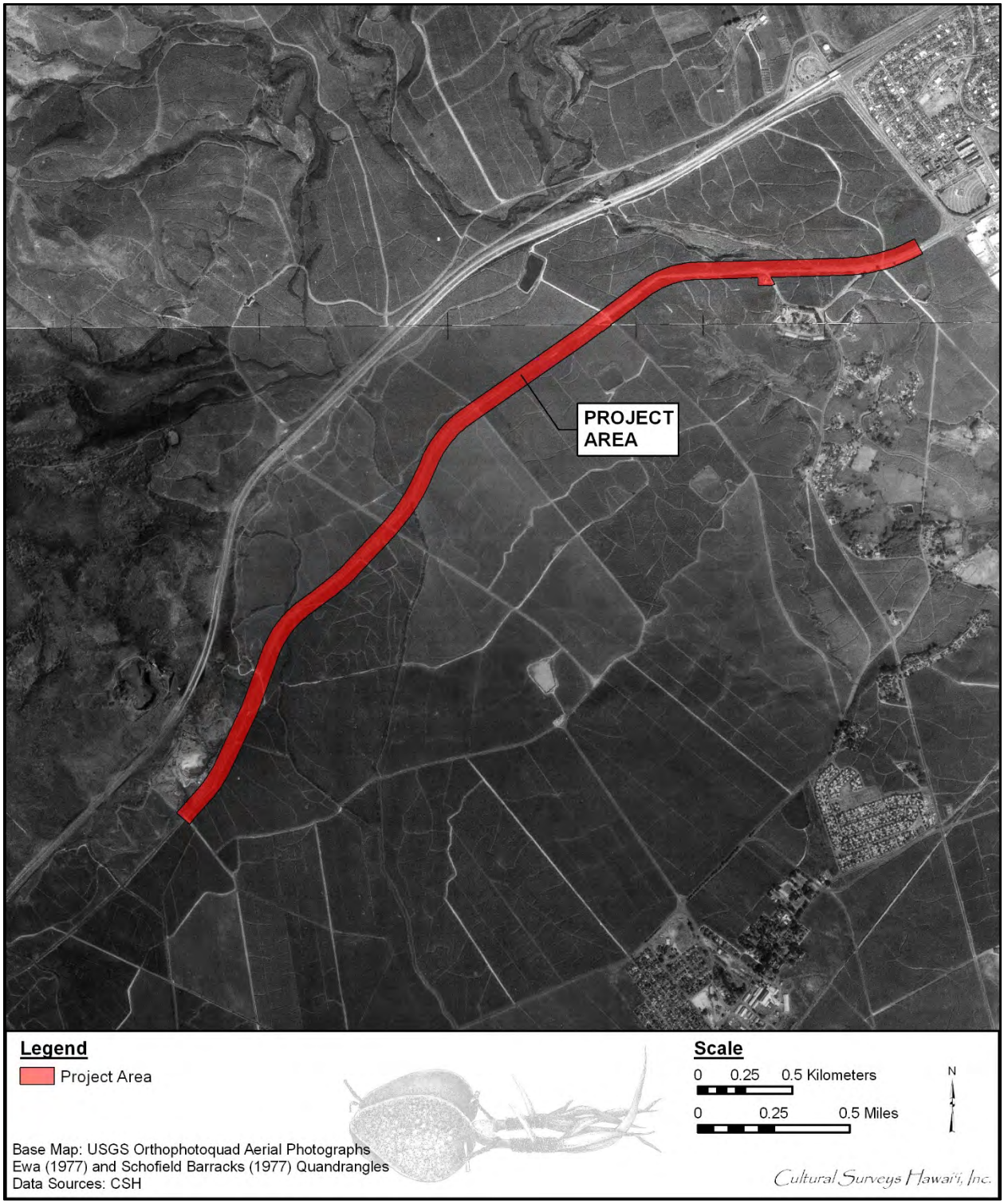

Figure 20. 1977 USGS Orthoimagery aerial photograph showing project area still under cane cultivation

3.2.6 History of Farrington Highway

Farrington Highway was originally constructed in the 1930s. Its predecessor was variously termed the “Government Road” or “Wai‘anae Road” and provided less than ideal travel and transport conditions. These precursor roads generally followed the path of a pre-Contact trail that crossed several *ahupua‘a* and connected Honolulu to Wai‘anae. An 1873 map by W.D. Alexander (Registered Map 405; see Figure 9) depicts the road and labels it as “Road.” A copy of Alexander’s 1873 map (Registered Map 618) has a handwritten label for the road, “Govt Road.” It is not known at what date this label was added. In 1902, the road is referred to as the Government Road (Condé and Best 1973). The 1930s USGS map (see Figure 17), as well as the 1943 U.S. Army War Department map (see Figure 18), label the road as Waianae Road. The 1953 USGS map (see Figure 19) has the road labeled as Farrington Highway.

A section of Farrington Highway’s predecessor in the Wai‘anae District was described as a “mud hole in the winter and billowed dust in the summer” (McGrath et al. 1973:51). The Wai‘anae Road was not paved. Because of the transport limitations over the Wai‘anae Road, most transport and travel between Wai‘anae and Honolulu, prior to the construction of Farrington Highway, was made using the OR&L Railroad or steamer ship (McGrath et al. 1973).

The construction of Farrington Highway was a component of the overall Territorial Highway System. It was only after 1925 that Territorial officials made use of available federal funding assistance for road and bridge construction. This led to abundant bridge and road construction after 1925 in Hawai‘i. Further federal assistance became available in the 1930s as part of the Works Progress Administration and National Reclamation Association programs; this funding lead to additional standardization and improvement of the Territorial Highway System (Thompson 1983:III–15). These improvements were significant events that greatly facilitated intra-island travel, transportation, and communication. Farrington Highway was eventually named after Wallace Rider Farrington (1871–1933), a former Honolulu newspaper man, mayor of Honolulu, and Territorial Governor of Hawaii (1921–1929), who was influential in expanding Hawai‘i’s roadways.

3.3 Previous Archaeological Research

Numerous previous archaeological studies have been conducted in the vicinity of the project area. These studies are depicted in Figure 21 and Figure 22 and summarized in Table 3. A summary of each archaeological study follows.

3.3.1 McAllister 1933; Thrum 1906, 1907

The earliest attempt to record archaeological remains in Honouliuli Ahupua‘a was made by Thomas Thrum (1906). He reported the existence of a *heiau* located on Pu‘uokapolei, west of the present project area. In a second monograph on *heiau*, Thrum (1907) called this *heiau* Palole‘i (Kapolei).

During a survey of the island in 1930, J. Gilbert McAllister recorded the specific locations of important sites and the general locations of less important sites (at least at Honouliuli). He recorded 14 specific sites in Honouliuli, Sites 133–146 (McAllister 1933:107–108), none of which are located in the immediate vicinity of the project area. Site 138, Puu Kapolei Heiau, is located approximately 2 km to the west of the project area.

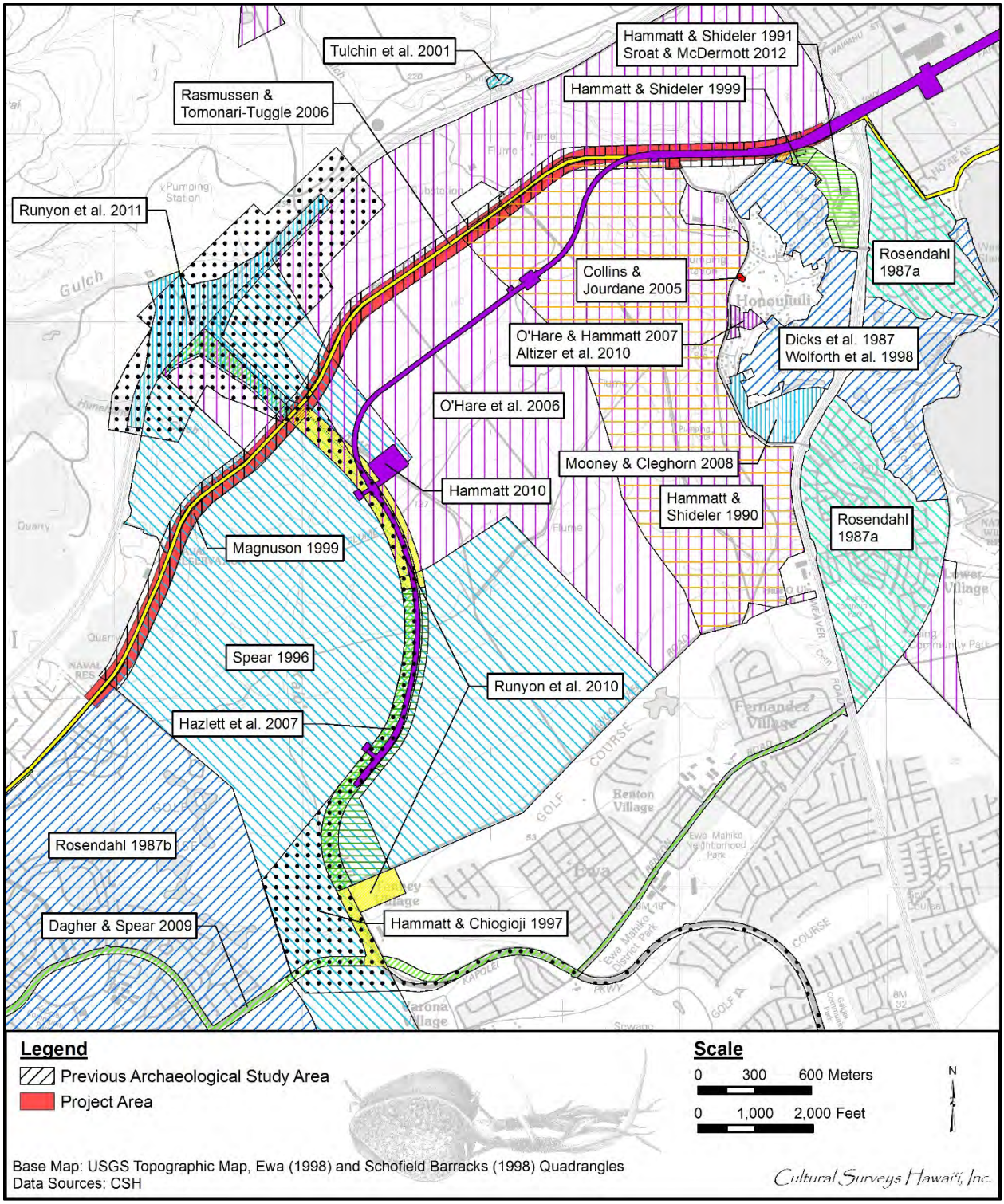

Figure 21. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previous archaeological research in the vicinity of the project area

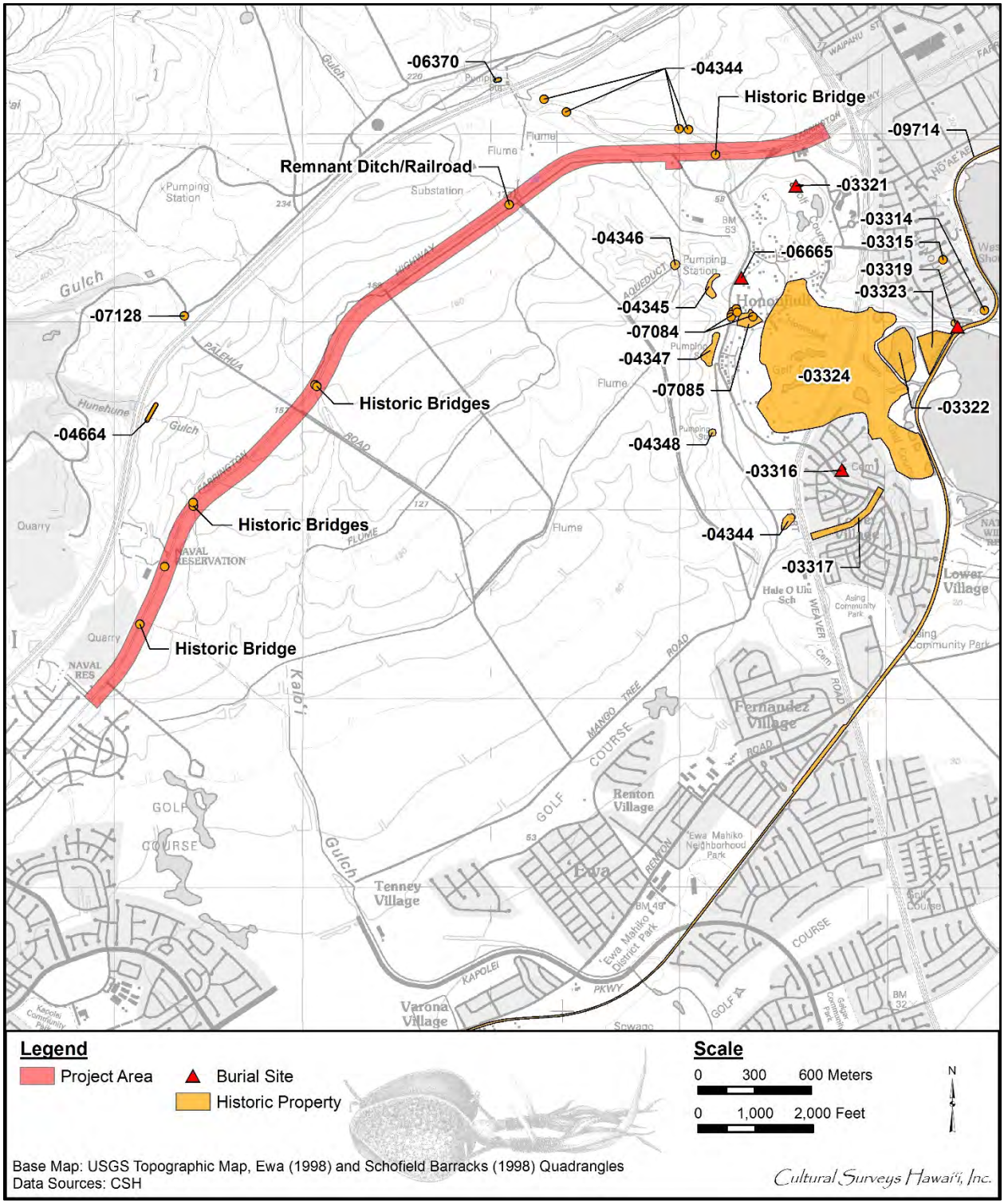

Figure 22. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previously identified archaeological sites in the vicinity of the project area

Table 3. Previous archaeological studies in the vicinity of the project area

Reference	Nature of Study	Project/Location	Results
Thrum 1906, 1907	*Heiau* Studies	Island-wide	Reported the existence of Pu‘uokapolei in 1906; in 1917, called the *heiau* Palole‘i (Kapolei)
McAllister 1933	Archaeological survey	Island-wide	Recorded 14 sites in Honouliuli, including Puu Kapolei Heiau (Site 138)
Dicks et al. 1987	Archaeological reconnaissance survey	West Loch Estates – Golf Course and Parks	Identified seven sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3233 (a historic fishpond), and -3324 (a pre- through post-Contact buried pondfield system)
Rosendahl 1987a	Archaeological reconnaissance survey	West Loch Estates – Residential Increments I and II	Documented four sites: T-1, a midden deposit; T-2, a historic surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern surface artifact scatter related to the Lower Village plantation settlement
Rosendahl 1987b	Archaeological reconnaissance survey	Kapolei Village Master Plan project	No archaeological sites identified; noted entire project area had been extensively modified by sugarcane cultivation
Hammatt and Shideler 1990	Archaeological inventory survey	West Loch Bluffs project	Recorded four surface features: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (northern pumping station), -4347 (central pumping station), and -4348 (southern pumping station)

Reference	Nature of Study	Project/Location	Results
Hammatt and Shideler 1991	Archaeological inventory survey	Saint Francis Medical Center West	Project area had been extensively disturbed and contained no surface archaeological sites
Spear 1996	Archaeological reconnaissance survey and assessment	East Kapolei Development project	No archaeological sites identified; reported Kalo‘i and Hunehune Gulches modified for sugarcane irrigation
Hammatt and Chiogioji 1997	Archaeological reconnaissance survey	North-South Rd	Documented that entire area had been extensively graded in association with sugarcane cultivation and construction of plantation infrastructure
Wolforth et al. 1998	Archaeological data recovery	West Loch Estates Residential Increment I, Golf Course and Shoreline Park project	Consisted of excavations of SIHP #s 50-80-12-3319, -3320, -3321, -3322, and -3324; radiocarbon dates for -3321 indicate pond-fields used from tenth to seventeenth centuries
Hammatt and Shideler 1999	Archaeological inventory survey (recorded as an archaeological assessment)	Saint Francis Medical Center West	No cultural resources identified
Magnuson 1999	Archaeological reconnaissance survey	Farrington Hwy between Fort Weaver and Kapolei Golf Course roads	Documented eight historic sites: six bridges, a section of railroad track, and an irrigation ditch; all sites considered not significant and not designated SIHP numbers
Tulchin et al. 2001	Archaeological inventory survey	‘Ewa Shaft Renovation project	Identified one surface site, SIHP #50-80-08-6370, a historic stone wall alignment
Collins and Jourdane 2005	Burial report	Old Fort Weaver Rd	Partial remains of a possibly Native Hawaiian, adult female found eroding out of ground surface after heavy rains; burial believed to be historic in age

Reference	Nature of Study	Project/Location	Results
O’Hare et al. 2006	Archaeological inventory survey	Ho‘opili project	Documented four additional features associated with SIHP # 50-80-12-4344, plantation infrastructure; concluded sugarcane cultivation, irrigation, flood control, railroad construction, road construction, demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of archaeological cultural resources
Rasmussen and Tomonari-Tuggle 2006	Archaeological monitoring	Waiau Fuel Pipeline	Project area along Farrington Hwy not monitored as area determined to not be archaeologically sensitive
Hazlett et al. 2007	Archaeological monitoring	North-South Rd	No cultural materials encountered, with exception of a portion of plantation-era road and associated ditch removed during road construction
O’Hare and Hammatt 2007	Archaeological literature review and field inspection	Old Fort Weaver Rd	Observed one site, a complex of concrete curbs likely associated with Ewa Plantation Co.
Mooney and Cleghorn 2008	Archaeological assessment	Proposed development of two parcels between Fort Weaver Rd and Old Fort Weaver Rd	No cultural materials identified, no further work recommended
Dagher and Spear 2009	Literature review and field inspection	Kapolei Computerized Traffic Control System project	No cultural material identified, no further work recommended
Altizer et al. 2010	Archaeological inventory survey	Hale Kipa project, Old Fort Weaver Rd	Documented two sites: SIHP #s 50-80-12-7084 (historic features including house foundations, a cesspool, and water control features) and -7085 (a subsurface pre-Contact *lo‘i* terrace)
Hammatt 2010	Archaeological inventory survey	Construction Phase I for Honolulu High-Capacity Transit Corridor Project	Identified one site in Waikele Ahupua‘a: SIHP # 50-80-09-7751, *lo‘i* sediments

Reference	Nature of Study	Project/Location	Results
Runyon et al. 2010	Archaeological monitoring	North-South Rd	No cultural materials identified
Runyon et al. 2011	Archaeological monitoring	North-South Rd	Documented two historic-era sites: SIHP #s 50-80-14-4664 (a water diversion structure) and -7128 (burnt trash fill layer used in construction of Pālehua Rd)
Sroat and McDermott 2012	Archaeological literature review and field inspection	Hawaii Medical Center West project	No historic properties identified, area has been extensively modified in historic and modern times

3.3.2 Dicks et al. 1987; Wolforth et al. 1998

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted an archaeological reconnaissance survey (ARS) for the West Loch Estates Golf Course and Parks (Dicks et al 1987). The study addressed an approximately 220-acre project area bisected by Fort Weaver Road, extending from the coast of the West Loch of Pearl Harbor to Farrington Highway. The project area included only a very narrow frontage along the current project area along Farrington Highway near the intersection of old Fort Weaver Road.

The study identified seven new sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3323 (a historic fishpond), and -3324 (a pre- through post-Contact buried pond-field system).

A follow-up archaeological data recovery study (Wolforth et al. 1998) was conducted in 1988 and 1989 and included excavations of SIHP #s -3319, -3320, -3321, and backhoe trenching at SIHP #s -3322 and -3324. Radiocarbon dates from SIHP # -3321 indicated the pond-fields were in use from the tenth to seventeenth centuries. SIHP # -3321 was documented approximately 160 m south of the current project area. It was described as a subsurface cultural layer that included a human burial, artifacts, midden, subsurface features, and structural remains. This site relates to a complex of LCAs that lies in the Honouliuli Stream bottomlands, approximately 80 vertical ft below Farrington Highway and the project area. Thus, although the cultural resource is only approximately 160 m south of the project area, it is ecologically distant.

3.3.3 Rosendahl 1987a

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted a combined surface and subsurface survey of approximately 260 acres in two discontinuous parcels east of Fort Weaver Road for the West Loch Estates Residential Increments I and II project (Rosendahl 1987a). The northern of the two parcels extended *mauka* to the intersection of Fort Weaver Road and Farrington Highway, adjacent to the current project area. This study documented four sites: T-1, a midden deposit (possibly non-cultural); T-2, a historic (pre-1900) surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern (both pre- and post-1900) surface artifact scatter related to the Lower Village plantation settlement.

3.3.4 Rosendahl 1987b

In 1987, PHRI conducted an archaeological reconnaissance survey (ARS) for the 850-acre Kapolei Village Master Plan project, located immediately to the southwest of the current project area (Rosendahl 1987b). It was documented that the entire project area had been extensively modified by sugarcane cultivation in historic/modern times, and no archaeological sites were identified.

3.3.5 Hammatt and Shideler 1990

In 1990, CSH conducted an ARS of a 546-acre parcel south of Farrington Highway, then called West Loch Bluffs (Hammatt and Shideler 1990). The northern boundary of the project area extended along Farrington Highway and the current project area. During the survey, four surface features were recorded: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Preservation of the railroad berm and the pumping stations was recommended.

3.3.6 Hammatt and Shideler 1991

In 1991, CSH conducted an archaeological assessment (AA; no finds archaeological inventory survey) for a proposed expansion of Saint Francis Medical Center West on an approximately 24-acre parcel *makai* of Farrington Highway and west of Fort Weaver Road, fronting the current project area (Hammatt and Shideler 1991). A pedestrian survey and background research revealed the entire study area, located on a bluff northeast of the flood plain of Honouliuli Stream, had been extensively disturbed, contained no surface structures or other remains, and was unlikely to contain any subsurface historic properties. The entire project area had been under sugarcane cultivation for several decades.

3.3.7 Spear 1996

In 1996, Scientific Consultant Services, Inc. (SCS) conducted an archaeological reconnaissance and assessment for the East Kapolei Development project, *makai* of the H-1 Freeway, in the vicinity of the North-South Road corridor (previously known as Pālehua Road, now called Kualakai Parkway) and including portions of Kalo‘i and Hunehune gulches. The project area was located along and surrounding the western half of the current project area. The limited field inspection documented in the Spear (1996) letter report did not identify any cultural resources, but noted that Kalo‘i and Hunehune gulches appeared to have been modified for sugarcane irrigation. The study cited a 1994 SHPD letter (Doc No. 9408TD01) that “clearly indicates that most of the present [Spear 1996] project area has been declared to have ‘no effect’ on historic sites due to the many years of commercial sugarcane production on these lands” (Spear 1996:1). The study concluded, on the basis of the SHPD letter and the field inspection, “that future development on these land parcels will have ‘no effect’ on historic sites, and that no further cultural resource work is required” (Spear 1996:1).

3.3.8 Hammatt and Chiogioji 1997; Hazlett et al. 2007; Runyon et al. 2010; Runyon et al. 2011

In 1997, CSH conducted an ARS of a 4.5 km-long corridor that would become the North-South Road project (Hammatt and Chiogioji 1997). An earlier version of the project area extended an additional 4.4 km from the project’s southern end at the OR&L right-of-way (SIHP # 50-80-12-

9714). It is believed that the project area was revised in order to avoid two previously identified areas of archaeological and historical concern: 1) the ‘Ewa Villages Historic District (SIHP # -9786), which was nominated for National Historic Landmark status; and 2) the OR&L right-of-way (SIHP # -9714), which was placed on the NRHP. The North-South Road corridor runs perpendicular through the current project area.

Background research and a pedestrian survey of the study area revealed that the entire area had been extensively graded by the Ewa Plantation Company in association with sugarcane cultivation and the construction of plantation infrastructure. Some remnant plantation structures—flumes, ditches, and roads—were observed in the project area, but were not considered of historic value and not classified as sites.

Archaeological monitoring for a southern portion (Phase 1A) of the North-South Road project was conducted by CSH intermittently from 2005 through 2007 (Hazlett et al. 2007). This phase of the project involved construction of a 1.4-km section of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring, with the exception of a portion of a plantation-era road and associated ditch that were removed during road construction.

Archaeological monitoring for the central portion and southern end (Phase 1B) of the North-South Road project was conducted by CSH intermittently from 2007 through 2010 (Runyon et al. 2010). This phase of the project involved the construction of two sections of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring.

CSH conducted archaeological monitoring for the northern portion (Phase 1C) of the North-South Road project intermittently from 2007 through 2009 (Runyon et al. 2011). This phase of the North-South Road project consisted of the construction of a new highway interchange and roadway, including two on-ramps and two off-ramps connecting the H-1 Freeway to the North-South Road. During monitoring, two historic-era cultural resources were documented: SIHP #s 50-80-14-4664 and -7128. SIHP # -4664 was a concrete plantation-era water diversion structure containing two sluice gates. A portion of this site located a significant distance to the west of the Runyon et al. (2011) project area was first identified by Nakamura et al. (1993). SIHP # -7128 was a burnt trash fill layer used in the construction of Pālehua Road (a precursor to the North-South Road). This site was newly identified during the Runyon et al. 2011 project. No further work was recommended for these sites.

3.3.9 Hammatt and Shideler 1999

In 1999, CSH conducted an AA for the proposed expansion of Saint Francis Medical Center West, located *makai* of Farrington Highway and west of Fort Weaver Road (Hammatt and Shideler 1999). This study lies adjacent to the current project area along Farrington Highway for approximately 300 ft. The study included a limited field inspection of the study area. No cultural resources were identified. Due to the presence of a subsurface cultural layer (SIHP # 50-80-13-3321) east of the study area, an archaeological inventory survey with a focus on subsurface testing was recommended for the southern portion of the study area prior to any development involving ground disturbance.

3.3.10 Magnuson 1999

In 1999, International Archaeological Research Institute, Inc. (IARII) conducted an ARS along Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road for the Farrington Highway Expansion project (i.e., the current project). The survey revealed eight historic sites, but none of them were considered significant and they were not designated with SIHP numbers. The sites included six bridges (one spanning Honouliuli Stream, two spanning Kalo‘i Gulch, two spanning Hunehune Gulch, and one bridge spanning a separate section of Kalo‘i Gulch), a section of railroad track, and an irrigation ditch. Two of the bridges, the one over Honouliuli Stream and one over Kalo‘i Gulch, were inventoried by Bethany Thompson (1983) for nomination to the NRHP; both bridges were evaluated as not significant and were not recommended for preservation. The other four bridges were not inventoried by Thompson (1983) as they did not meet her criteria of possible significance. Magnuson recommended that the remaining sites— the railroad track and the irrigation ditch—lacked integrity and, therefore, were not significant and did not meet standards for inclusion on the Hawai‘i or National Registers of Historic Places.

3.3.11 Tulchin et al. 2001

In 2001, CSH conducted an archaeological inventory survey (AIS) in support of the proposed ‘Ewa Shaft Renovation project, located in Honouliuli Gulch, adjacent to and *mauka* of the H-1 Freeway (Tulchin et al. 2001). One surface site was identified, SIHP # 50-80-08-6370, a historic stone wall alignment. The wall was believed to have been constructed in association with cattle ranching or a water pumping station. The study noted that all lands outside Honouliuli Gulch had been extensively and repeatedly graded over the past century by the Ewa Plantation Company in association with sugar cultivation and the construction of plantation infrastructure.

3.3.12 Collins and Jourdane 2005

In 2004, the SHPD conducted the disinterment of a burial found eroding out of the ground surface at 91-2168 Old Fort Weaver Road (Collins and Jourdane 2005). The remains had apparently been exposed by heavy rains. The remains were in a flexed/semi-flexed burial position and appeared to be those of a partial adult female. The report concluded the burial was possibly of Native Hawaiian ethnicity and was of historic age.

3.3.13 O’Hare et al. 2006

In 2005 and 2006, CSH conducted an AIS of some 1,630 acres for the East Kapolei project, subsequently known as the Ho‘opili project (O’Hare et al. 2006). The project area was bounded on the east by Fort Weaver Road, on the *makai* side by Mango Tree Road, on the north or *mauka* side by the H-1 Freeway, and on the west side by the Spear (1996) study (the study area was configured by owner/developer interests to dovetail with the Spear study). The O’Hare et al. study also included the area originally called West Loch Bluffs that was surveyed by CSH in 1990 (Hammatt and Shideler 1990). A non-contiguous portion of the O’Hare et al. (2006) study area was located *mauka* of the H-1 Freeway. The O’Hare et al. (2006) project area surrounds and encompasses more than half of the current project area.

Nineteen trenches were excavated in four areas of historic habitation and/or agriculture, identified by background historic work. The four areas were: 1) nineteenth century (or earlier) habitation and agricultural lots in the nineteenth century Honouliuli Taro Lands and in Honouliuli Village; 2) structures or burials associated with the nineteenth century Kapalani Catholic Church

near Old Fort Weaver Road; 3) structures or historic domestic artifacts associated with the early twentieth century Drivers and Stable Village of the Ewa Sugar Plantation; and 4) structures or historic domestic artifacts or pit/privy features associated with the early twentieth century Pipeline Village of the Ewa Sugar Plantation. No cultural deposits, no privy pits, no burials, and no artifacts or any type were found or recovered from the 19 trenches. It seems that sugarcane cultivation, irrigation, flood control, railroad construction, later road construction, the demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of these former traditional Hawaiian habitation and agricultural lands and the later sugarcane plantation workers camps, churches, and schools.

Four sites located within the project area had previously been identified by Hammatt and Shideler (1990): SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Four additional features associated with SIHP # -4344 were documented during the O’Hare et al. (2006) survey. These additional features include Features D and E, two linear walls located along the east bank of Honouliuli Stream; Feature F, a stone-faced berm constructed perpendicular to the orientation of the stream; and Feature G, a concrete ditch and concrete masonry catchment basin on the west bank of Honouliuli Gulch.

3.3.14 Rasmussen and Tomonari-Tuggle 2006

In 2004, archaeological monitoring was conducted along the Waiau Fuel Pipeline corridor, extending from the Hawaiian Electric Company’s Barbers Point Tank Farm to the Waiau Generating Station. The Waiau Fuel Pipeline corridor follows Farrington Highway to Kunia Road, angles *makai* near Kunia Road, then continues east along the OR&L right-of-way near the Pearl Harbor coast. It appears no archaeological monitoring was conducted west of Waipi‘o Peninsula (in the vicinity of the current project area), as the corridor to the west had been determined to not be archaeologically sensitive.

3.3.15 O’Hare and Hammatt 2007; Altizer et al. 2010

In 2007, CSH conducted an LRFI of a 4.28-acre parcel on Old Fort Weaver Road, within the “Honouliuli Taro Lands” (O’Hare and Hammatt 2007). During the field inspection, one surface structure was identified, a complex of concrete curbs. The curbs date to March 1941 and are likely associated with the Ewa Plantation Company. They may have functioned as an irrigation ditch, a flood control device, or may have been associated with a nearby pumping station. Background research indicated the area was a focus for intensive habitation and agriculture in the pre- and post-Contact periods and that related subsurface features could exist.

In 2009, CSH conducted an AIS for the proposed Hale Kipa project (Altizer et al. 2010), located on a portion of the O’Hare and Hammatt (2007) project area. During the AIS, two cultural resources were documented: SIHP # 50-80-12-7084, a series of historic features including house foundations, a cesspool, and water control features; and SIHP # -7085, a subsurface cultural layer consisting of the remains of a *lo‘i* terrace. The *lo‘i* terrace was radiocarbon dated and yielded a calibrated 2-sigma date range of AD 1270-1400.

3.3.16 Mooney and Cleghorn 2008

In 2008, Pacific Legacy, Inc. conducted an AA for the proposed development of two parcels (approximately 23 acres) located between Fort Weaver Road and Old Fort Weaver Road. Fourteen

backhoe assisted trenches were excavated to depths of up to 1.8 mbs. Construction fills were observed extending between 0.91.5 mbs with various alluvial deposits observed beneath. No cultural material was identified, and the study recommended no further archaeological work.

3.3.17 Dagher and Spear 2009

In 2009, SCS conducted an LRFI for the Kapolei Computerized Traffic Control System project. The project consists of the construction of the North-South roadway corridor and the installation of underground fiber optic cables, conduits, cameras, and ancillary equipment within existing right-of-ways in Kapolei and Makakilo. The field inspection was conducted along the 4.5-km North/South Roadway Corridor. No evidence of flumes, ditches, or other historic and cultural materials was observed. The study recommended no further archeological work.

3.3.18 Hammatt 2010

In 2009, CSH conducted an AIS for Construction Phase 1 of the Honolulu High-Capacity Transit Corridor project in Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, and Manana Ahupua‘a (Hammatt 2010). An approximately 1.3-km section of this project area extended along Farrington Highway within the current project area. The Hammatt (2010) project area extended west for another approximately 2 km, 0.5 km *makai* of Farrington Highway and the current project area. Only one cultural resource was identified in the Hammatt project area, SIHP # 50-80-09-7751, *lo‘i* sediments, but it was found in Waikele Ahupua‘a, approximately 2.5 km from the east end of the current project area. The Hammatt study identified five stratigraphic zones. Zones 1 and 2 overlap portions of the current project area. Zone 1 covered the western portion of the study area and generally consisted of a single stratum of naturally deposited alluvial sediment utilized for agriculture. Signs of previous disturbance from agricultural activities including tilling of the soil and installation of water lines, were from the surface to a depth of approximately 100 cmbs. Zone 2 covered the central portion of the study area and generally consisted of varying fill layers associated with urban development (i.e., asphalt paving and utility installation) overlying naturally deposited alluvial sediments. No subsurface cultural resources were observed within either Zone 1 or 2.

3.3.19 Sroat and McDermott 2012

In 2011, CSH conducted an LRFI for the Hawaii Medical Center West project. Hawaii Medical Center West consists of a 24-acre campus located at the southwest side of the intersection of Fort Weaver Road and Farrington Highway. Background research and the field inspection indicate the area to have been extensively modified by historic sugarcane cultivation and modern development. No cultural materials were observed and the potential for subsurface historic properties is considered low.

3.4 **Background Summary and Predictive Model**

According to background research, the immediate vicinity of the project area consisted of a dry plain that was little used prior to being placed under a century of sugarcane cultivation. The area has been extensively graded and plowed repeatedly over the past century in association with sugar cultivation and the construction of plantation infrastructure. Since the cessation of cane production, the lands in the vicinity of the project corridor have been under diversified agricultural cultivation.

Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae.

There are no *kuleana* Land Commission Awards in the vicinity of the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area. The distance from the coast (and generally from fresh water) made the vicinity of the project area a little used area in pre-Contact times. The intensive land disturbance of a century of commercial sugarcane cultivation probably removed most of what little evidence of pre-Contact land use there was. The archaeological sensitivity of this area is generally regarded as low. As the project area crosses Honouliuli Stream and passes within approximately 150-250 m of the northernmost extent of the "Honouliuli Taro Lands," the sensitivity is believed to increase somewhat, but is still regarded as low. Even though the distance to the former taro lands is not that far, the bottom lands that were preferred for pre-Contact agriculture and habitation near the mouth of Honouliuli Stream seem, in terms of environmental attributes, to have been a world away.

Any pre-Contact surface features and/or shallow subsurface deposits would likely have been destroyed by the continual commercial utilization of the area for crop land. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. Post-Contact archaeological deposits are not anticipated in any abundance on the basis of the historic record and the results reported in previous archaeological studies, but could include irrigation canals, plantation infrastructure remnants, sections of railroad tracks, and of course the bridges that are found along Farrington Highway.

Section 4 Results of Fieldwork

CSH archaeologist Sara M. Blahut, M.A., conducted fieldwork 20 September 2018 under the direction of Project Manager Douglas Borthwick, B.A., and the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete. In general, fieldwork included a pedestrian inspection of the project area, GPS data collection, and photography.

The pedestrian inspection was completed per the methods described in Section 2. A GPS tracklog is shown in Figure 23. Observed surface features of potential historic properties are presented in Table 4 with GPS point locations depicted on Figure 24. Locations and directions of photographs showing the general project area and any identified potential historic properties can be seen in Figure 25. These photographs are presented in Figure 26 through Figure 48.

The length of the project area consists of the existing two-lane section of Farrington Highway (between Kapolei Golf Course Road and Fort Weaver Road) and associated infrastructure. Elevated berms run alongside both the *mauka* and *makai* sides of the highway for much of the project area. The edges of the highway are heavily vegetated with an overgrowth of grasses and shrub plants. The *mauka* side of Farrington Highway is characterized by the State Energy Corridor which includes both overhead electrical and underground gas utilities. The majority of the project area runs through agricultural land. In many places, agricultural access roads run parallel to the highway, with farmlands extending out on either side. From west to east notable developments include Grace Pacific Quarry, U.S. Navy Reservoir and Pump Station, Hawaii Tokai International College, University of Hawai‘i West O‘ahu, the intersection with Kualakai Parkway, HECO Ewa Nui Switching Station, Aloun Farms, Board of Water Supply Pump Stations, a section of the Honolulu Rail Transit, Kahi Mohala Health Center, Queen’s Medical Center, and the intersection with Fort Weaver Road.

Fifteen surface features of potential historic properties were observed during the pedestrian inspection. These include bridges, culverts, basalt and mortar retaining walls, and concrete shafts, ditches, and other remnants (see Table 4 and Figure 24).

Seven historic crossings (bridges and culverts) were identified during the field inspection. These consist of Palehua Stream Bridge (see Figure 27), an unnamed culvert (see Figure 29), two bridges at Hunehune Gulch (see Figure 30), two bridges at Kaloi Gulch (see Figure 36), and the Honouliuli Stream Bridge (see Figure 46). These properties are more thoroughly discussed in the companion document *Archaeological Literature Review and Field Inspection to Support Consultation with SHPD for Bridges in the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu Island, TMKs: [1] 9-1-016, -017, and -018* (Blahut et al. 2018).

In additon to the bridges, eight structural remnants were also observed during the field inspection. These consist of three concrete shafts (two open and one filled), a basalt and mortar wall with concrete drainage, a basalt and mortar retaining wall, two concrete ditches (one active and one filled/inactive), and an indeterminte concrete remnant. These remnants are most likely associated with agricultural irrigation infrastructure from the sugar cane plantation era. GPS point locations have been mapped on a 1953 USGS topographic map which also depicts much of the irrigation system at the time (see Figure 24). The basalt and mortar walls and concrete drainage

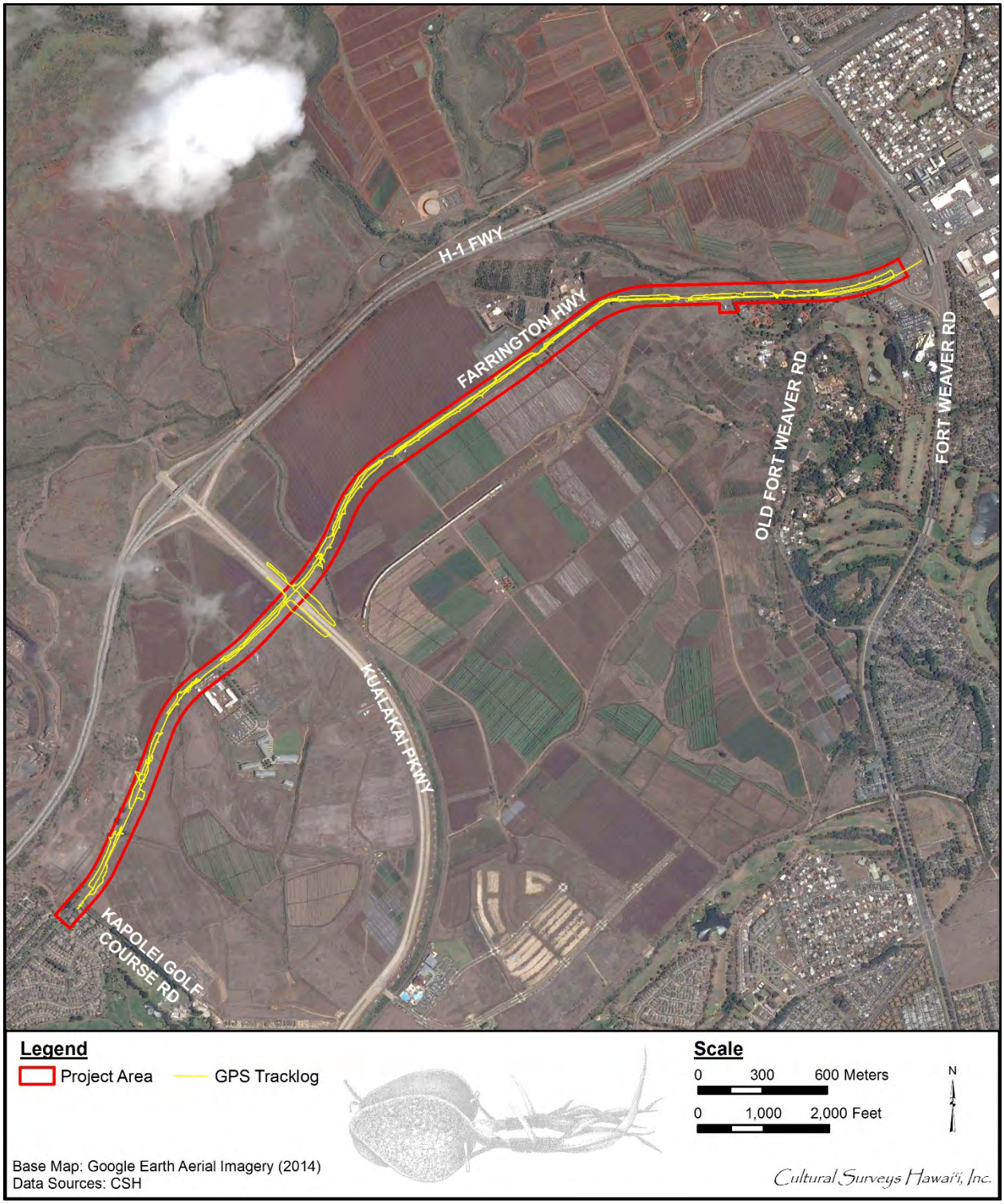

Figure 23. Aerial photograph of the project area with GPS tracklog of the pedestrian inspection fieldwork (Google Earth 2014)

Table 4. Potential historic properties observed during field inspection

GPS Point	Feature	Function	Comments
1	Palehua Stream Bridge	Crossing	Active bridge within Farrington Hwy, previously determined eligible for listing on the National Register
2	Concrete shaft	Irrigation	*Mauka* of Farrington Hwy
3	Culvert	Crossing	Active culvert within Farrington Hwy at U.S Navy Reservoir and Pump Station
4	Hunehune Gulch Bridge (active)	Crossing	Active bridge within Farrington Hwy, previously determined not eligible for listing on the National Register
5	Hunehune Gulch Bridge (inactive)	Crossing	Inactive bridge *mauka* of Farrington Hwy
6	Basalt and mortar wall	Retaining wall	Associated with inactive Kaloi Gulch Bridge, *mauka* of Farrington Hwy
7	Kaloi Gulch Bridge (active)	Crossing	Active bridge within Farrington Hwy, previously determined not eligible for listing on the National Register
8	Kaloi Gulch Bridge (inactive)	Crossing	Inactive bridge *makai* of Farrington Hwy
9	Basalt and mortar wall and concrete drainage	Irrigation/drainage	Associated with the Kaloi Gulch Bridges
10	Concrete remnant/filled concrete shaft	Irrigation	*Makai* of Farrington Hwy
11	Concrete remnant	Irrigation	Unknown type, close proximity to other irrigation remnants at Aloun Farms, *makai* of Farrington Hwy
12	Concrete ditch (active)	Irrigation/drainage	Active irrigation ditch at Aloun Farms, *mauka* of Farrington Hwy
13	Concrete ditch (filled)	Irrigation	Filled in irrigation ditch at Aloun Farms, appears similar in structure to active ditch, *makai* of Farrington Hwy
14	Honouliuli Stream Bridge	Crossing	Active bridge within Farrington Hwy, previously determined eligible for listing on the National Register
15	Concrete shaft	Irrigation	*Mauka* of Farrington Hwy

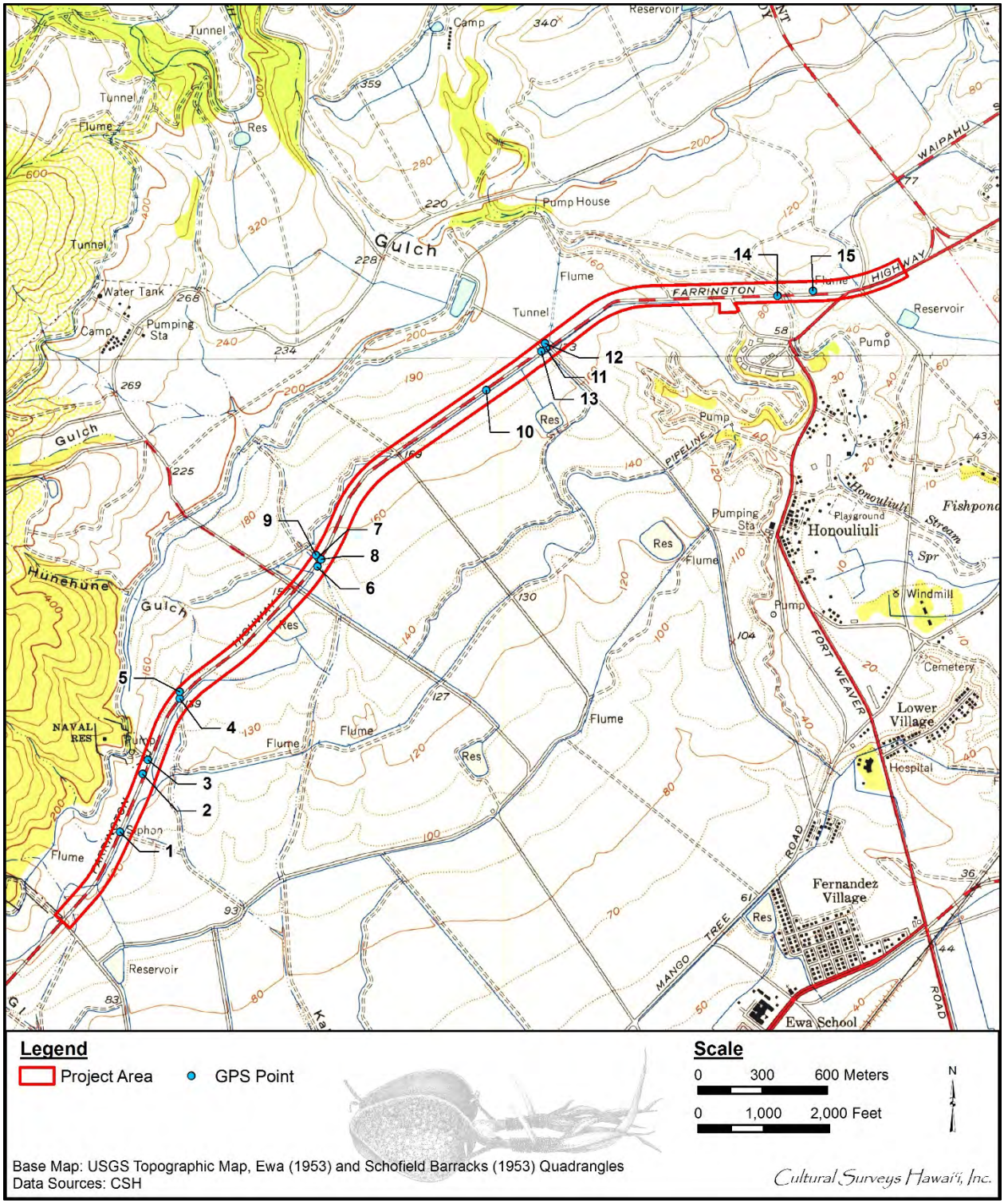

Figure 24. 1953 USGS topographic map with GPS point locations of observed potential historic properties, note alignment of these features with depicted irrigation infrastructure

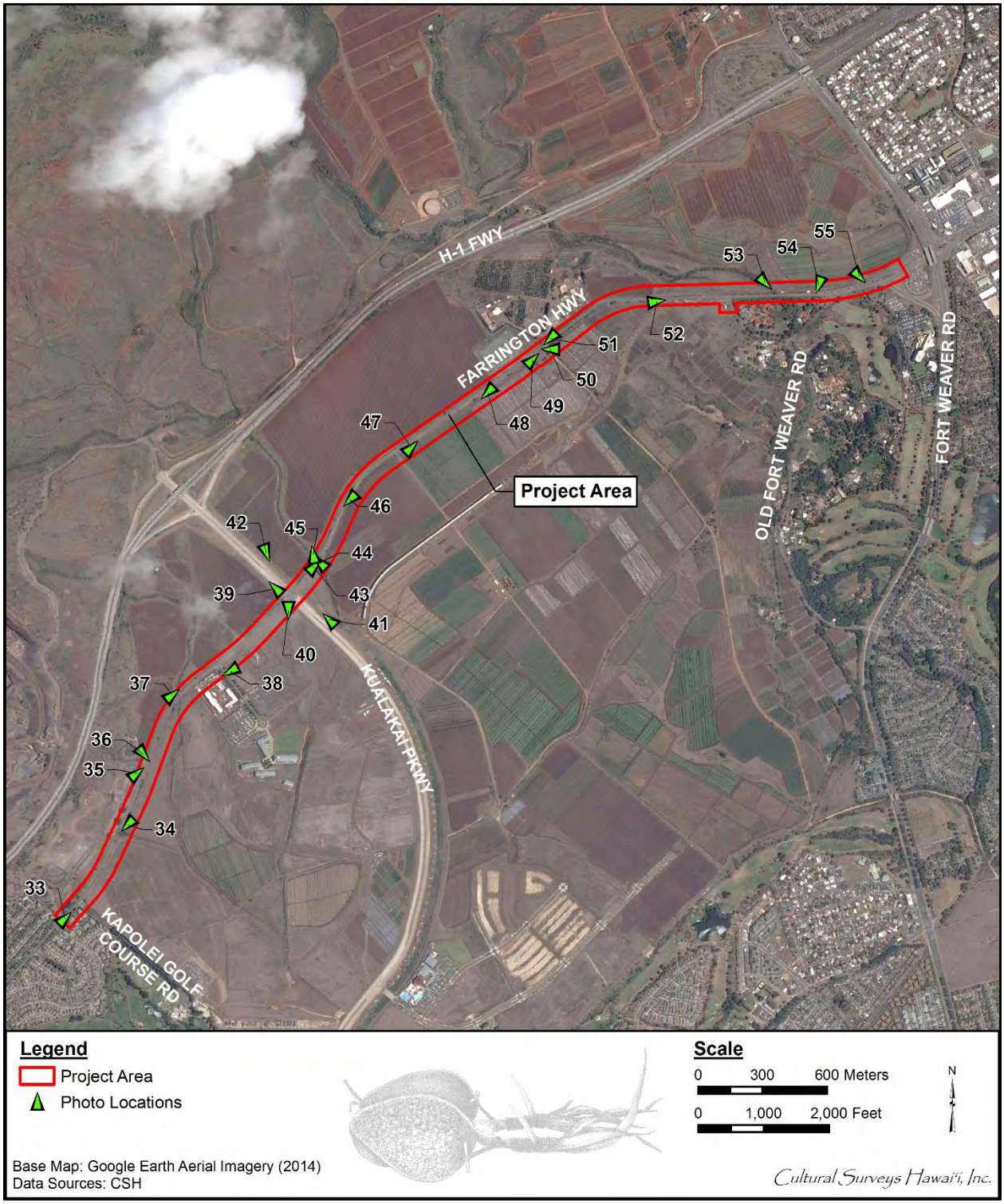

Figure 25. Aerial photograph (Google Earth 2014) showing location and direction of photographs taken during the field inspection, shown in Figure 26 through Figure 48

Figure 26. Kapolei Golf Course Road and Farrington Highway intersection, view to northeast

Figure 27. Palehua Stream Bridge, view to southwest

Figure 28. Concrete shaft, *mauka* of Farrington Highway, west end of project area, view to northeast, University of Hawai‘i West O‘ahu in background

Figure 29. Culvert at driveway for U.S. Navy Reservoir and Pump Station, view to southeast

Figure 30. Inactive bridge at Hunehune Gulch (center) and active Hunehune Gulch Bridge (right), view to northeast

Figure 31. At University of Hawai‘i West O‘ahu, view to southwest

Figure 32. Kualakai Parkway intersection, view to northwest

Figure 33. Kualakai Parkway intersection, view to south, UH West O‘ahu in background

Figure 34. Kualakai Parkway intersection, view to northwest

Figure 35. Kualakai Parkway intersection, view to south, UH West O‘ahu in right background

Figure 36. Active Kaloi Gulch Bridge (left), inactive Kaloi Gulch Bridge (right), view to northeast

Figure 37. Basalt and mortar wall at Kaloi Gulch, *makai* of Farrington Highway, view to northwest

Figure 38. Basalt and mortar wall and concrete drainage (at left, overgrown) at Kaloi Gulch, *mauka* of Farrington Highway, view to north

Figure 39. Taken from top of raised berm, from left to right note farmland, ag access road, raised berm, overgrown roadside, active roadway, energy corridor, view to southwest

Figure 40. Central project area, view to northeast, rail route visible in right background

Figure 41. Concrete remnant (likely filled concrete shaft), view to southwest, just southwest of HECO Ewa Nui Station

Figure 42. Concrete remnants at HECO Ewa Nui Station/Aloun Farms, *makai* side of Farrington Highway, likely filled irrigation ditch, view to northeast

Figure 43. Concrete remnant at Aloun Farms entrance, *makai* side of Farrington Highway, view to west

Figure 44. Concrete ditch and culvert at Aloun Farms entrance, *mauka* side of Farrington Highway, view to southwest

Figure 45. Honolulu Rail Transit intersecting and then running parallel to Farrington Highway/project area, view to east

Figure 46. Honouliuli Stream Bridge, view to south

Figure 47. Concrete shaft at east end of project area, *mauka* side of Farrington Highway, view to south

Figure 48. East end of project area, interchange with Fort Weaver Road, view to southeast

were clearly associated with the Kaloi Gulch Bridges. Another group of features including the concrete ditches and indeterminate remnant were observed at the entrance to present day Aloun Farms. The three concrete shaft remnants were spread throughout the project area but are similar in design and construction.

Due to the limititations of the pedestrian inspection and the generally overgrown state of the project area, it is likely that additional remnants (both surface and subsurface) are present within the project area.

Section 5 Summary

At the request of G70, CSH has prepared this LRFI to support consultation with SHPD for the Farrington Highway Improvements project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK Plats: [1] 9-1-016, 017, and 018. The LRFI consisted of background research and a pedestrian field inspection.

5.1 Summary

The results of the field inspection were consistent with what was expected based on background research and previous archaeological studies conducted in the vicinity. Background research indicates the project area was relatively little used in pre-Contact times although Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae. However, the intensive land disturbance of a century of commercial sugarcane cultivation probably removed most of what little evidence of pre-Contact land use there was. The area currently hosts diversified agricultural cultivation. There are no *kuleana* Land Commission Awards within the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area.

The current field inspection identified seven historic crossings within the project area, as well as structural remnants likely associated with irrigation infrastructure from the plantation era. These include basalt and mortar retaining walls, concrete shafts, ditches, and other remnants. No surface pre-Contact archaeological remains were observed. Archaeological deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. It is very likely additional post-Contact archaeological deposits (both surface and subsurface) related to the plantation era exist within the project area.

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Appendix G

Cultural Impact Assessment

Draft

Cultural Impact Assessment for the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu TMKs: [1] 9-1-016, 017, and 018

Prepared for
Group 70 International, Inc.

Prepared by
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Mary-Lindsey Correa, M.A.,
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Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: HONOULIULI 154)

March 2019

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Management Summary

Reference	Cultural Impact Assessment (CIA) for the Farrington Highway Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018 (Ishihara et al. 2019)
Date	March 2019
Project Number (s)	Cultural Surveys Hawai‘i Inc. (CSH) Job Code: HONOULIULI 154
Project Location	The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of a 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) topographic quadrangle.
Land Jurisdiction	City and County of Honolulu (City), State of Hawai‘i (State), United States of America, Grace Pacific Corporation, Ho‘opili (D.R. Horton), Honolulu Electric Company, Campbell Hawai‘i, Saint Francis Healthcare System, University of Hawai‘i West O‘ahu, and Hawaiian Golf Properties, LLC
Agencies	State of Hawai‘i Department of Health/Office of Environmental Quality Control (DOH/OEQC)
Project Description	The City DDC is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.
Project Acreage	The total project acreage for the 3.1-mile roadway alignment is approximately 149.7 acres (60.58 hectares).
Area of Potential Effect (APE) and Survey Acreage	For the purposes of this CIA, the APE is considered to be the entire 3.1-mile roadway alignment project area. While this investigation focused on the project APE, the study area included the entire *ahupua‘a* (land division usually extending from the uplands to the sea) of Honouliuli.
Document Purpose	The project requires compliance with the State of Hawai‘i environmental review process (Hawai‘i Revised Statutes [HRS] §343), which requires consideration of a proposed project’s effect on traditional cultural practices. Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project’s impacts to cultural practices (per the OEQC’s *Guidelines for Assessing Cultural Impacts*). The

	document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS §6E-42 and Hawai‘i Administrative Rules (HAR) §13-275. This CIA investigation may also be used to support the National Historic Preservation Act (NHPA) Section 106 and the National Environmental Policy Act (NEPA) consultation, but does not, in itself, satisfy the consultation requirements of either Section 106 or NEPA.
Results of Background Research	Background research for this project yielded the following results, presented in approximate chronological order: 1. Honouliuli Ahupua‘a had a tremendous and varied amount of resources that was attractive and readily available for early habitation. Honouliuli consists of 12 miles of coastline with a continuous shallow fringing reef, which offers rich marine resources. The West Loch of Pu‘uloa (commonly known as Pearl Harbor) offered another 4 miles of waterfront that boasted extensive fisheries, fishponds, and salt pans. 2. The ‘Ewa plain consists of a flat, karstic raised limestone reef forming a level, nearly featureless "desert" marked in pre-Contact times by a thin or non-existent soil mantle. Many sinkholes dot the plain and offered a nesting home for a large population of avifauna. 3. The lower portion of Honouliuli Stream fed the Honouliuli Taro Lands and eventually drained into West Loch. The earliest documentation of the Honouliuli Taro Lands can be seen in Charles R. Malden's map in 1825. The area around the Honouliuli Taro Lands and near West Loch would have been ideal for habitation and a logical response due to the abundance of fish and other aquaculture as well as the close proximity to well-irrigated bottomlands. 4. John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails, which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘uokapolei and Waimānalo Gulch to the Wai‘anae coast and onward, circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96–98). 5. Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor to Wai‘anae. A *heiau* (pre-Christian place of worship) was once on the summit of the hill, however, by the time of McAllister's survey of O‘ahu it had been destroyed (McAllister 1933:108). The hill was also used as a point of solar reference or as a place for celestial observations of the winter and summer solstice. A ceremony at a *heiau* on Pu‘uokapolei provides a vantage point to capture the sun setting directly behind Pu‘ulailai, a peak farther west in the

	Wai‘anae range. A coinciding ceremony at Kūpalaha Heiau in Waikīkī captures the same essence as the sun sets behind Pu‘uokapolei.
Results of Community Consultation	From September 2013 to March 2014, CSH attempted to contact 74 Native Hawaiian organizations (NHOs), agencies, and community members in order to identify individuals with cultural expertise and/or knowledge of the project area and its vicinity. Of the 12 individuals and/or organizations that responded, three *kama‘āina* (native-born) and/or *kūpuna* (elders) provided written testimony and four participated in formal interviews for more in-depth contributions to the CIA. Below is a list of individuals who shared their *mana‘o* (thought, opinion) and *‘ike* (insight, knowledge) about the project area: 1. Keola Lindsey and Momilani Lanzi on behalf of Ka Pouhana (Chief Executive Officer), Dr. Kamana‘opono Crabbe of the Office of Hawaiian Affairs (OHA) 2. Keawe Vredenburg, cultural practitioner and author 3. Tom Lenchanko, caretaker of Kūkaniloko Heiau 4. Mel Kalahiki, member of ‘Ahahui Mālama o Kaniakapūpū 5. Jan Becket, author, photographer, and retired teacher from Kamehameha Schools; former Kona Moku Representative, Council of Hawaiian Civic Club’s Committee on the Preservation of Historic Sites and Cultural Properties 6. Shad Kāne, member of the Kapolei Hawaiian Civic Club, Chair of the O‘ahu Council of Hawaiian Civic Clubs Committee on the Preservation of Historic Sites and Cultural Properties, Ali‘i Ai Moku of the Kapuāiwa Chapter of the Royal Order of Kamehameha Ekahi, and ‘Ewa Moku Representative on the State Aha Moku Advisory Committee 7. Kawika McKeague, cultural practitioner; Honouliuli historian and longtime resident

Impacts and Recommendations	During community consultation, participants identified potential impacts, articulating their concerns within a cultural context. Based on information gathered from the cultural and historical background, and the community consultation, potential impacts were identified, and the following preliminary recommendations were made. 1. CSH recommends that should historic, cultural, or burial sites or artifacts be identified during ground disturbance, the personnel involved with project construction activities should immediately cease all work and the appropriate agencies be notified pursuant to applicable law. In the event of discoveries of burials during project construction activities, recognized cultural and lineal descendants should be notified and consulted on matters of burial treatment. 2. Additionally, CSH recommends that cultural and lineal descendants be granted access rights to *iwi kūpuna* (Native Hawaiian skeletal remains) to conduct traditional and customary burial practices on-site.

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Section 1 Introduction

1.1 Project Background

At the request of Group 70 International, Inc (G70), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this cultural impact assessment (CIA) for the Farrington Highway Improvements project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-1-016, 017, and 018. The project area is located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road. The project area is depicted on a portion of the 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 through Figure 4), and a 2014 aerial photograph (Figure 5). Client-provided project plans indicating the proposed area of potential effect (APE) are provided in Figure 6 through Figure 11.

The City and County of Honolulu (City), Department of Design and Construction (DDC), is proposing improvements to the two-lane section of Farrington Highway between Kapolei Golf Course Road and Old Fort Weaver Road. The proposed action may include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip. The proposed action would provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area such as the University of Hawai‘i West O‘ahu, the Ho‘opili master planned community, and a section of the Honolulu Rail Transit project.

1.2 Document Purpose

The project requires compliance with the State of Hawai‘i’s environmental review process (Hawai‘i Revised Statutes [HRS] §343), which requires consideration of a proposed project’s effect on traditional cultural practices. Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project’s impacts to cultural practices (per the OEQC’s *Guidelines for Assessing Cultural Impacts*). The document is intended to support the project’s environmental review and may also serve to support the project’s historic preservation review under HRS §6E-42 and Hawai‘i Administrative Rules (HAR) §13-275.

This CIA investigation may also be used to support the National Historic Preservation Act (NHPA) Section 106 and the National Environmental Policy Act (NEPA) consultation, but does not, in itself, satisfy the consultation requirements of either Section 106 or NEPA.

1.3 Scope of Work

The scope of work for this CIA includes the following:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, 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.

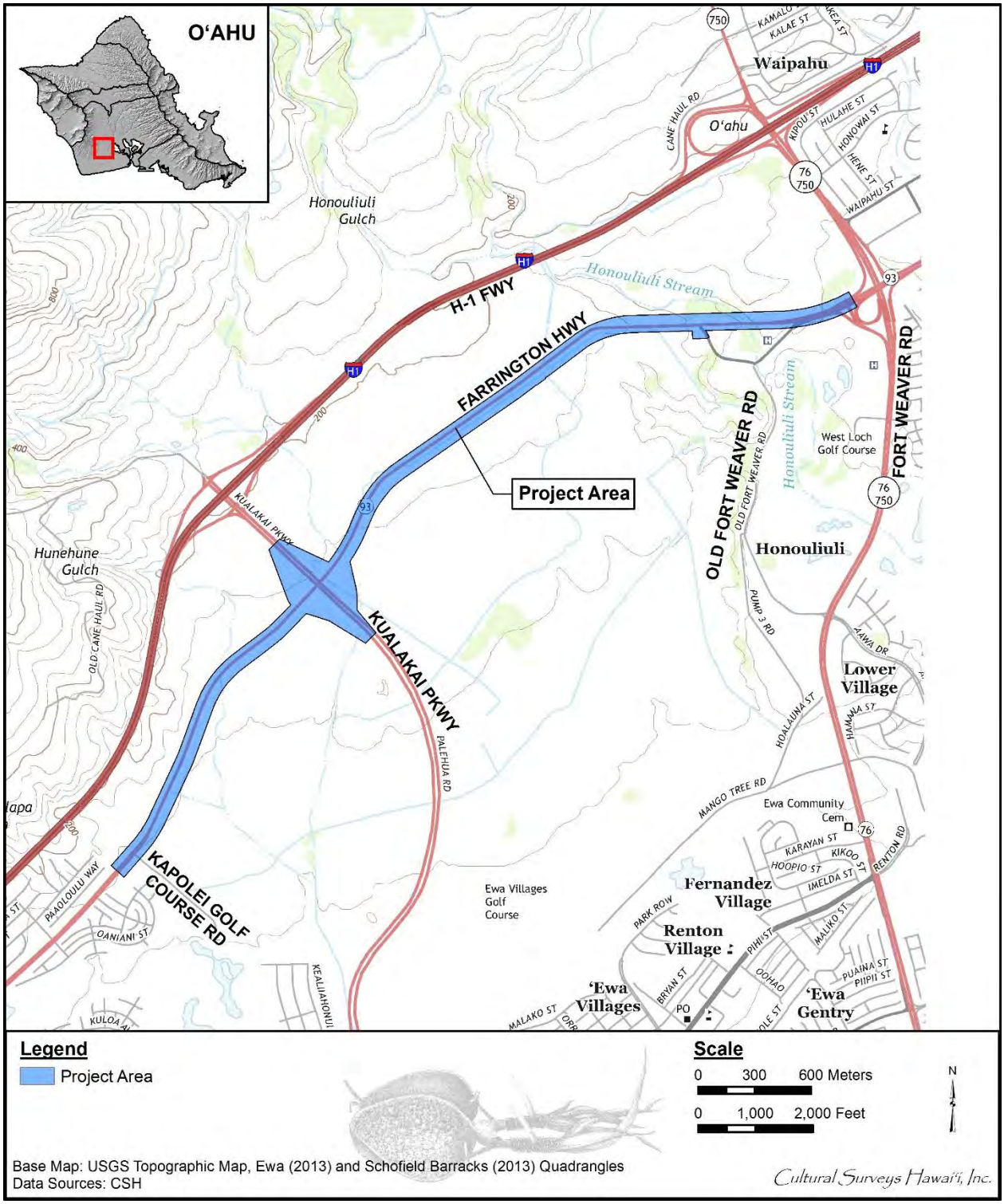

Figure 1. Portion of the 2013 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing the location of the project area

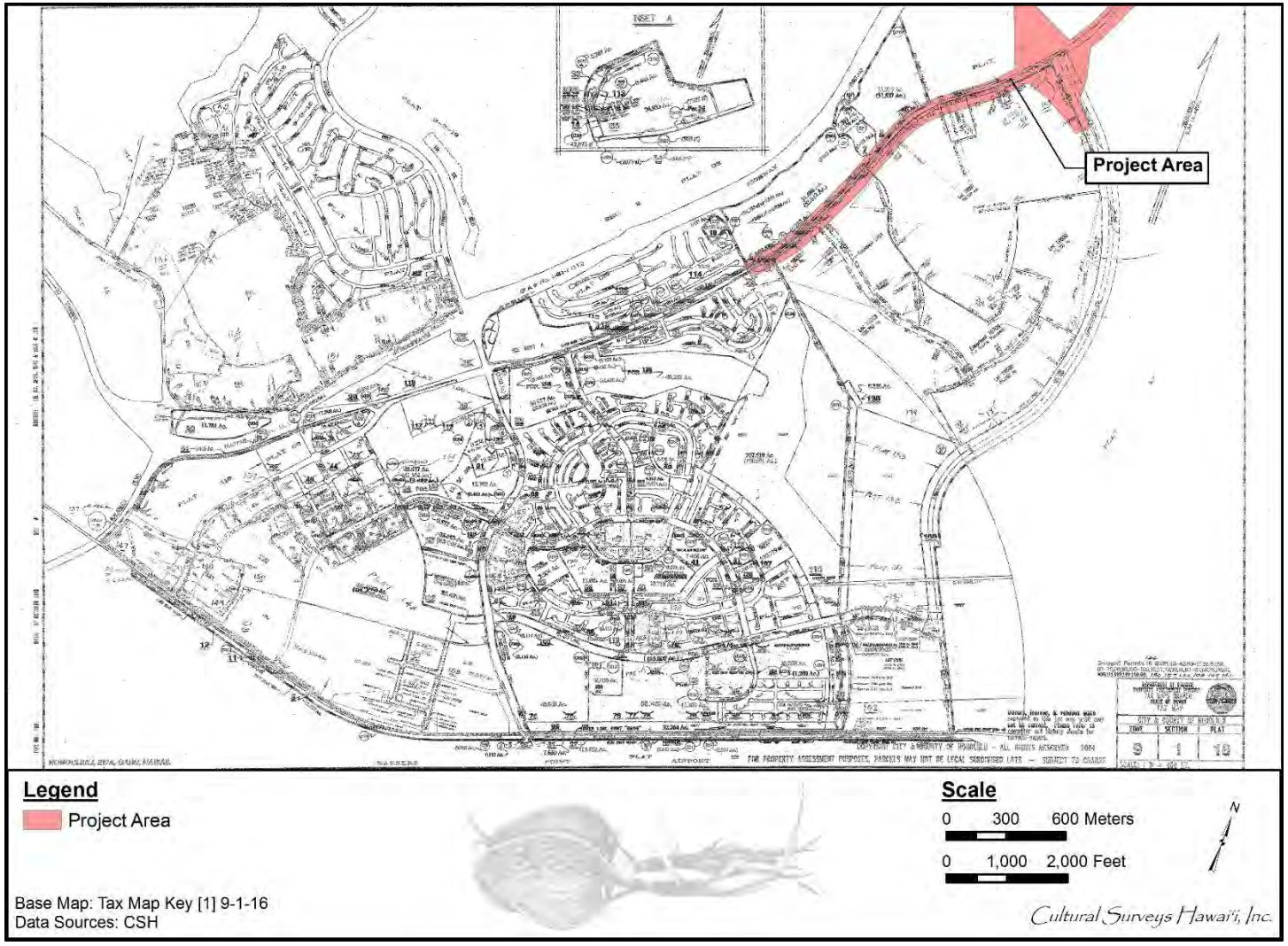

Figure 2. Tax Map Key (TMK) [1] 9-1-016 showing portion of the project area (Hawai‘i TMK Service 2014)

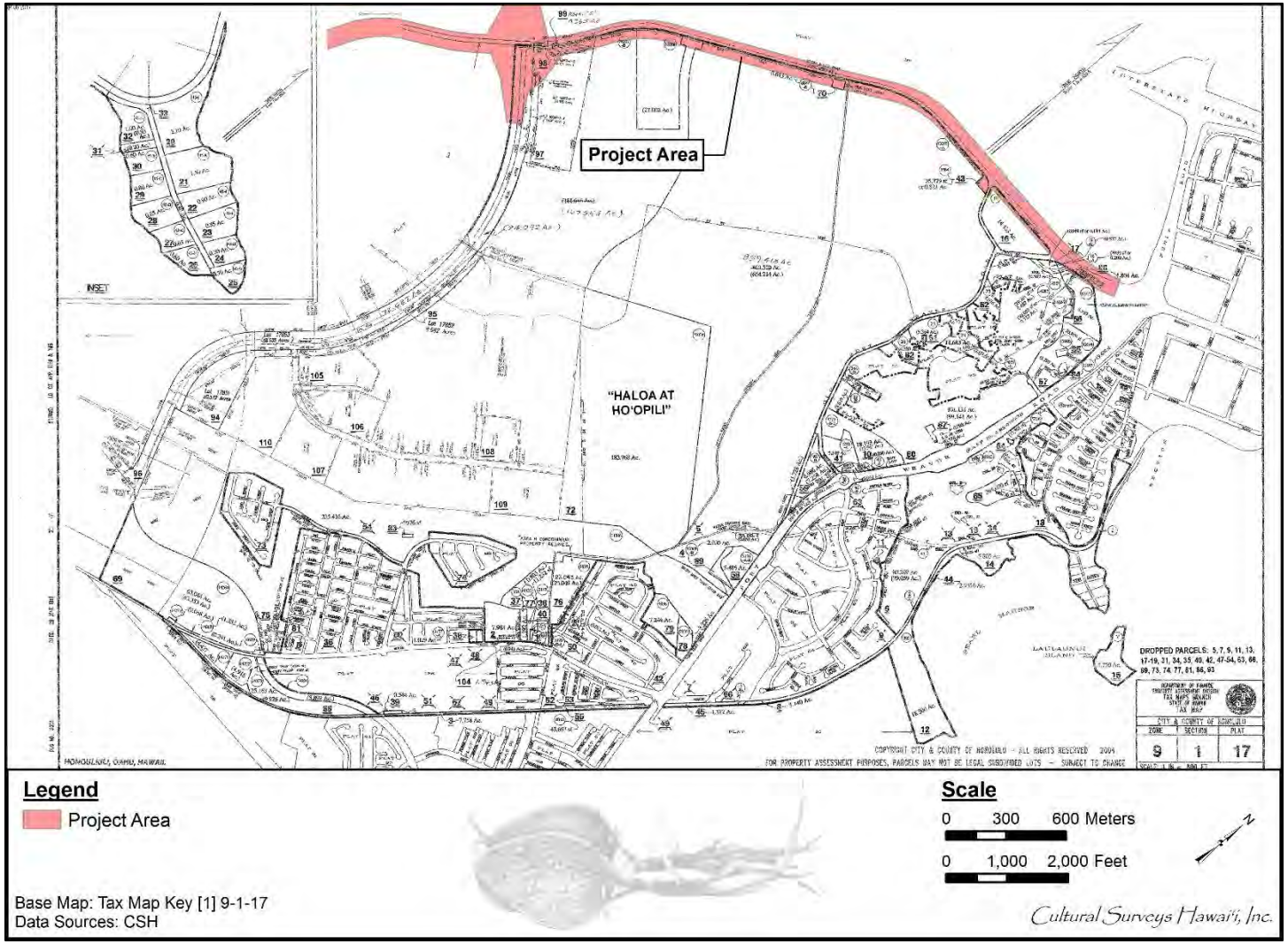

Figure 3. TMK: [1] 9-1-017 showing portion of the project area (Hawai‘i TMK Service 2014)

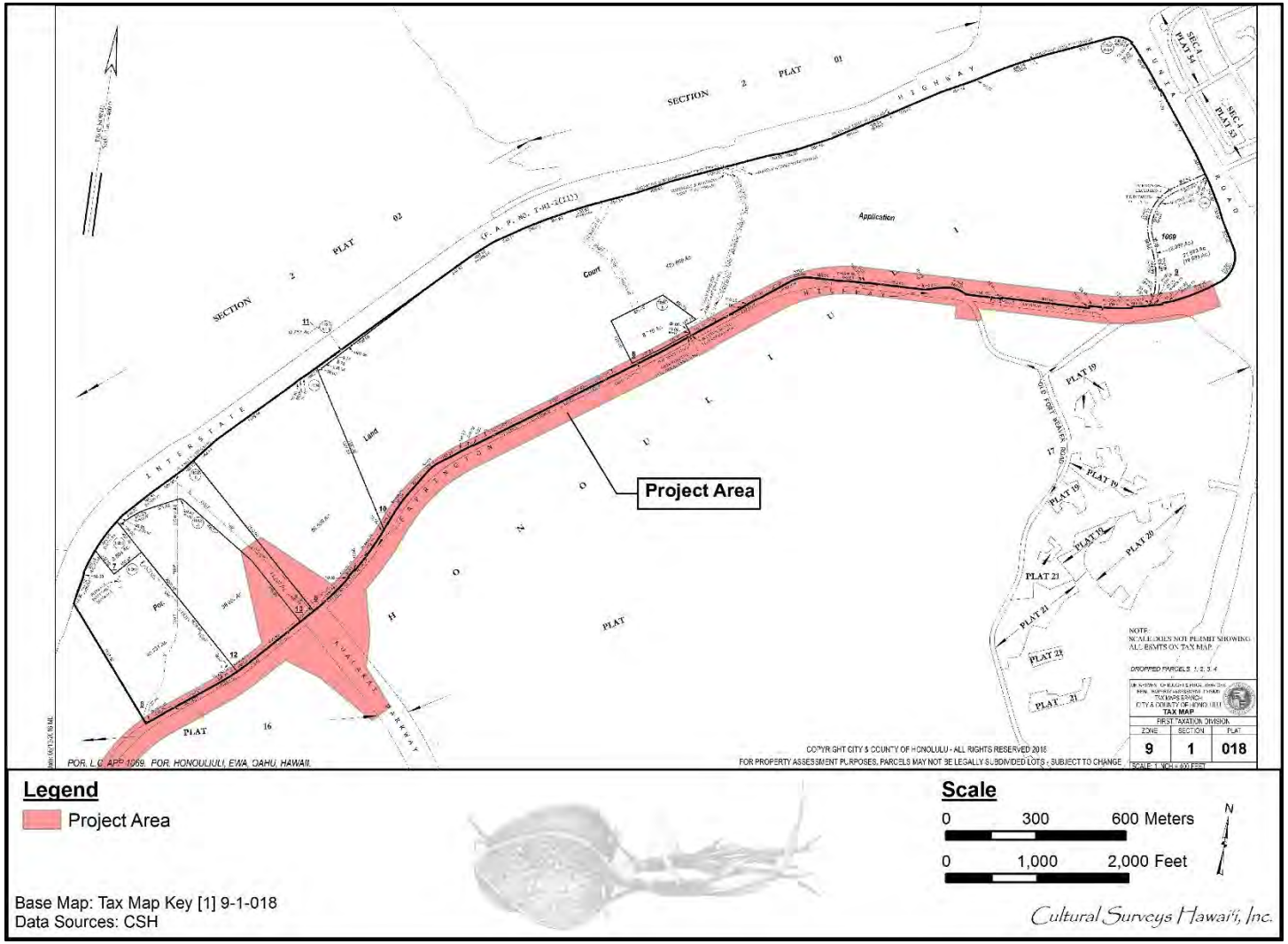

Figure 4. TMK: [1] 9-1-018 showing portion of the project area (Hawai‘i TMK Service 2014)

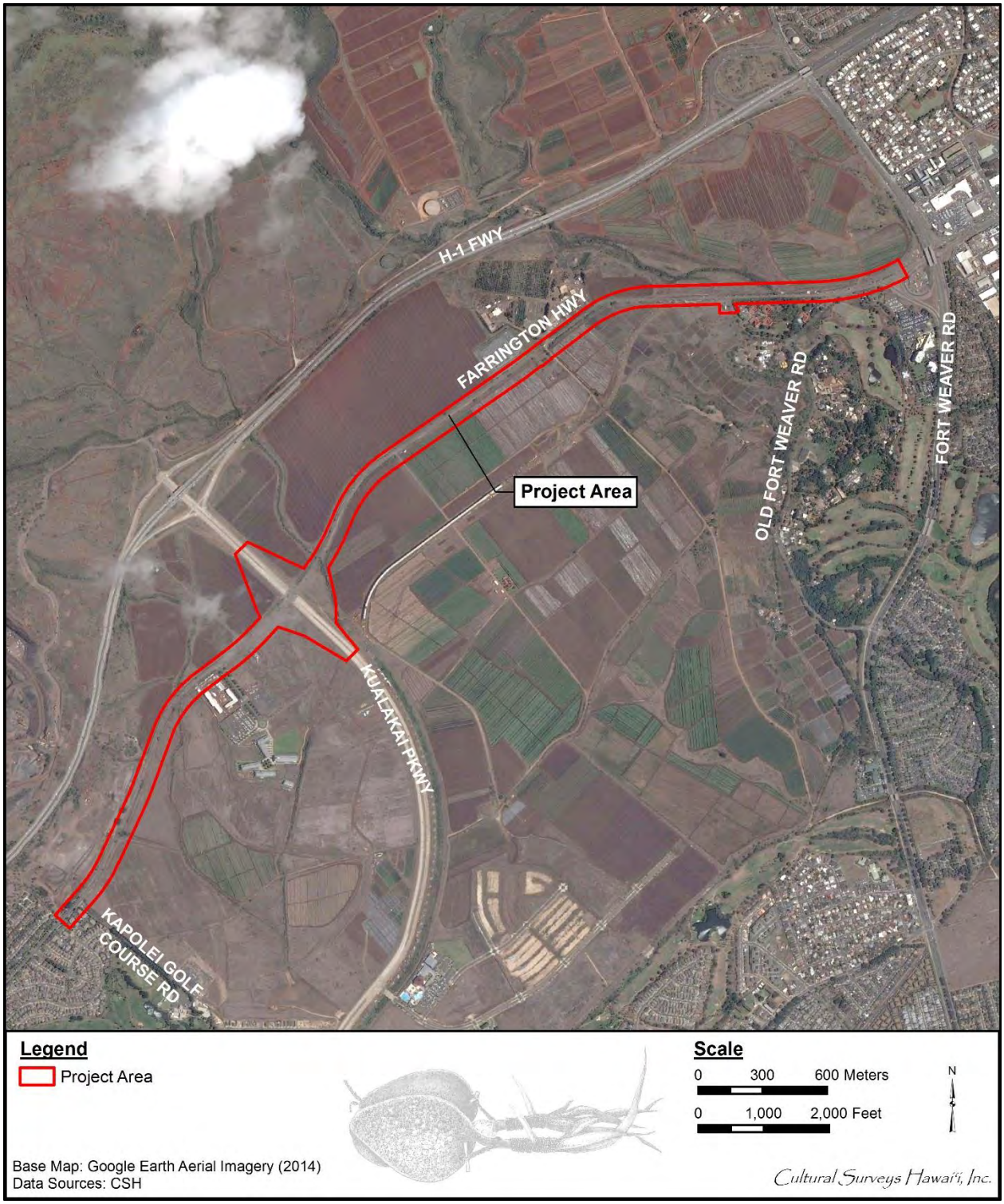

Figure 5. Aerial photograph of the project area (Google Earth Imagery 2014)

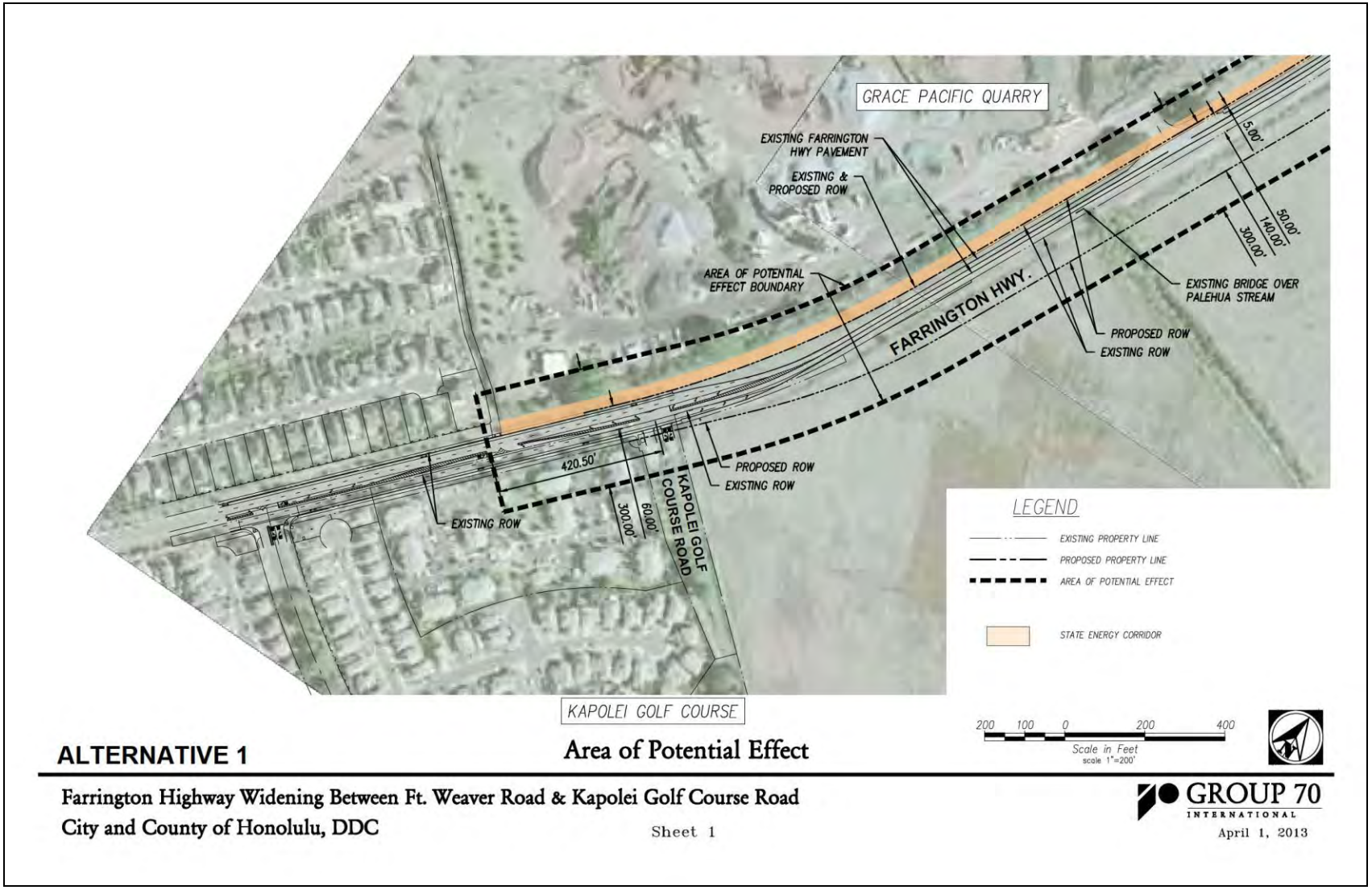

Figure 6. Project plan, sheet 1 (courtesy of client)

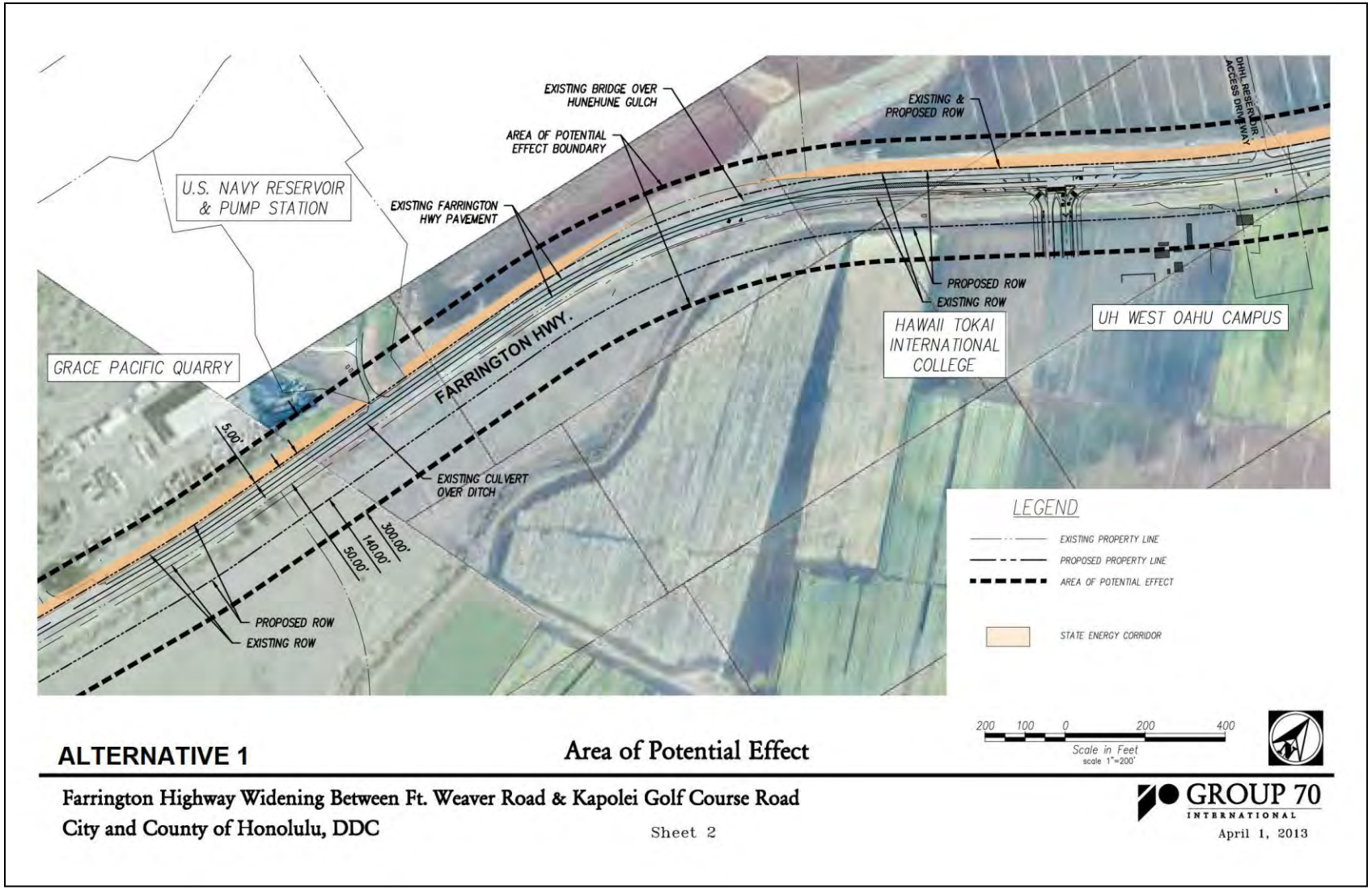

Figure 7. Project plan, sheet 2 (courtesy of client)

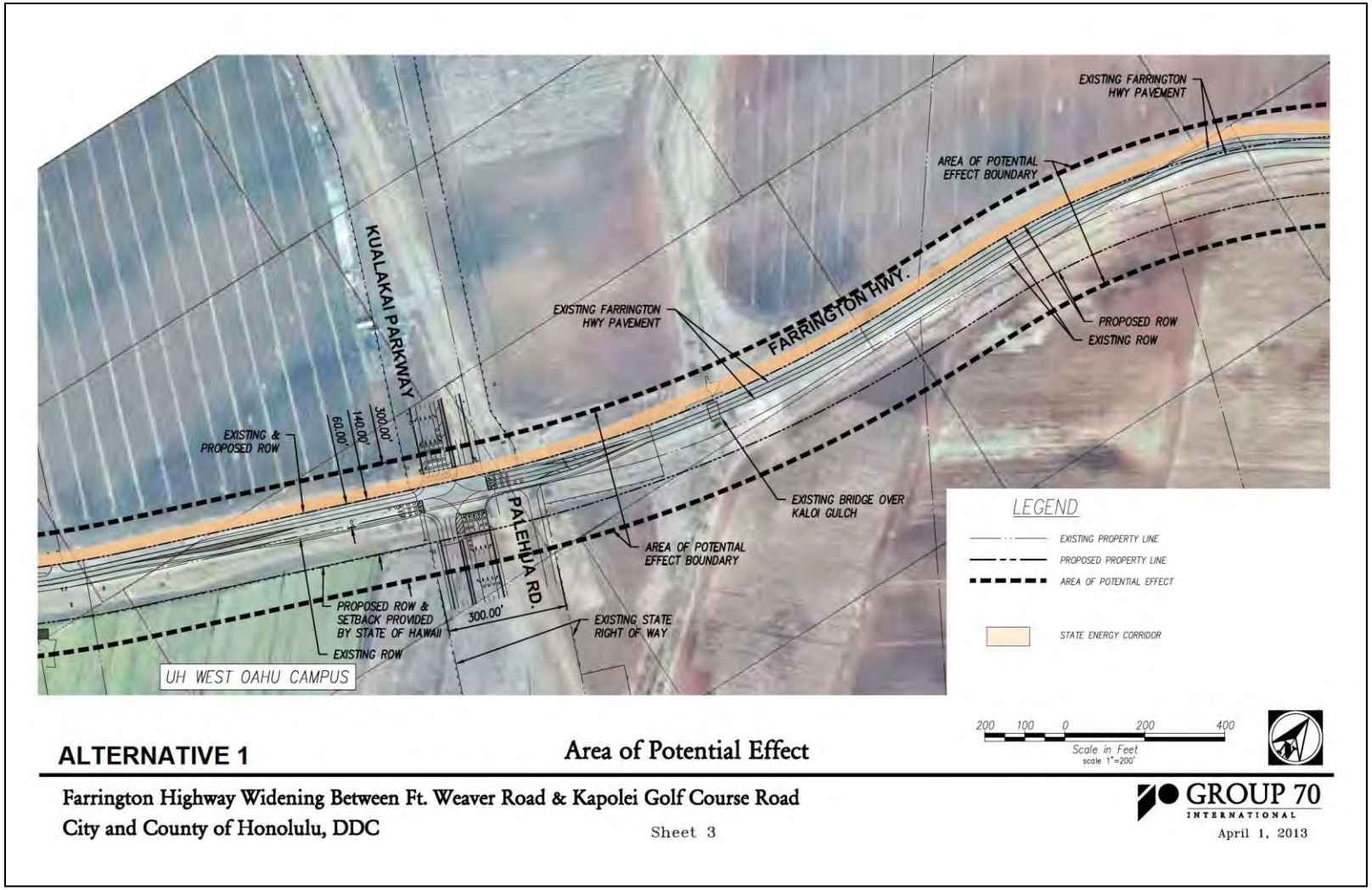

Figure 8. Project plan, sheet 3 (courtesy of client)

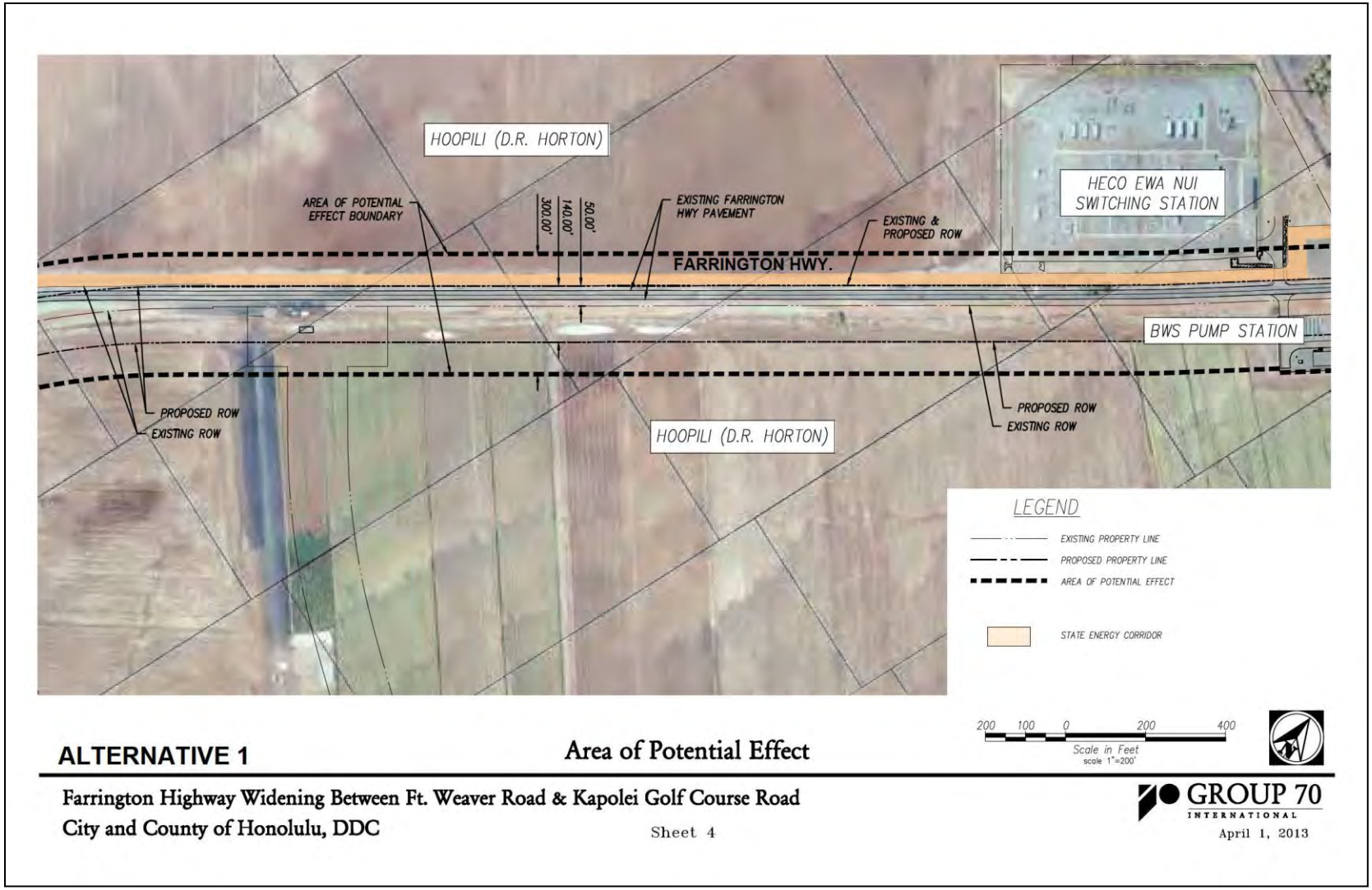

Figure 9. Project plan, sheet 4 (courtesy of client)

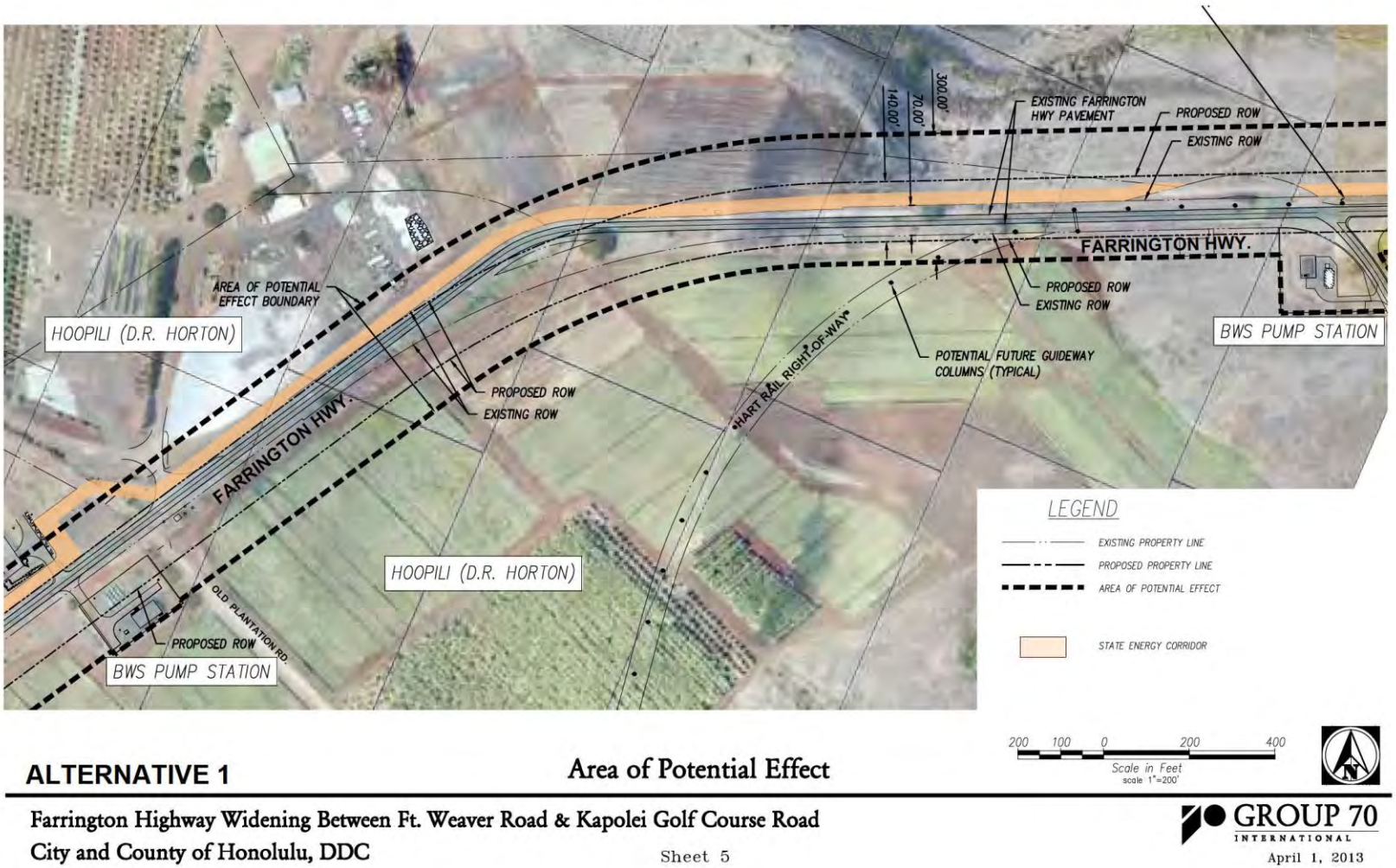

Figure 10. Project plan, sheet 5 (courtesy of client)

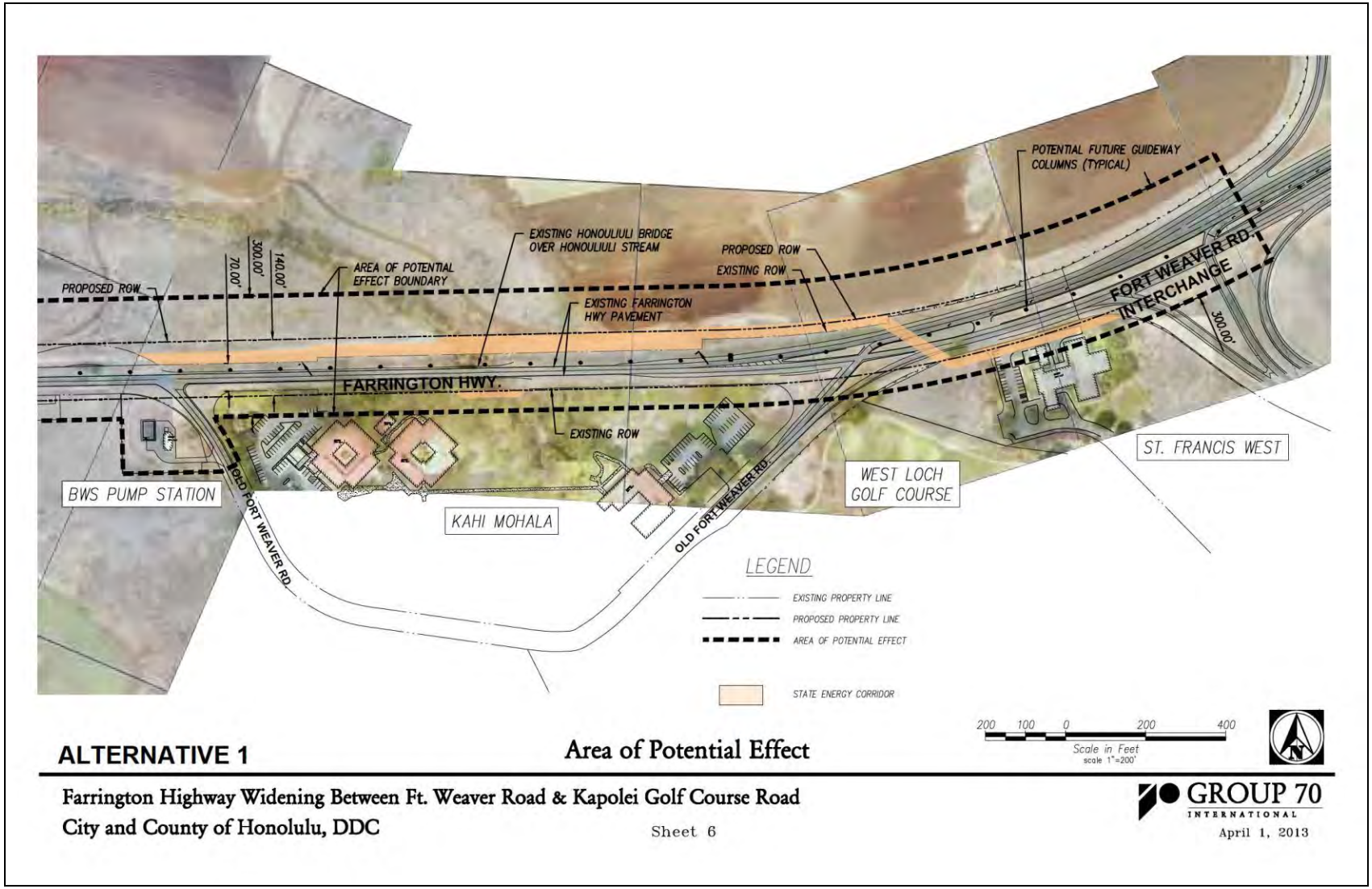

Figure 11. Project plan, sheet 6 (courtesy of client)

2. Review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding cultural and natural resources and practices at or near the parcel; present and past uses of the parcel; and/or other practices, uses, or traditions associated with the parcel and environs.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

The environmental setting draws from previous environmental and historical surveys conducted throughout the Hawaiian archipelago (Foote et al. 1972; Giambelluca 1986; Nakuina 1992) as well as cultural sources and may be thought of as being divided into two sections. The natural environment begins with a discussion of geologic history and the 1972 soil surveys conducted by the Foote et al. research team, and then shifts to a description of prevailing winds, precipitation, streams, and coastal/marine environment found within and in proximity to the project area. Throughout these subsections, an effort is made to ground scientific knowledge within traditional cultural frameworks or knowledge systems. Understandings of the Honouliuli or ‘Ewa environment have also been informed by various traditional sources, including *mo‘olelo* (stories), *mele* (songs), or *oli* (chant). As pointed out by anthropologist Laura Nader and reiterated by Dr. Kathleen Kawelu, “science is not free of culture; rather, it is full of it” (Kawelu 2015:6; Nader 1996: xiii). The second section concludes with a description of the built environment, emphasizing a transitional change into modernity.

1.4.1 Natural Environment

The project area extends through the ‘Ewa Plain, *makai* (seaward) of the Wai‘anae Mountains. The ‘Ewa Plain is a Pleistocene (>38,000 years old) reef platform overlain by alluvium. The terrain consists of limestone and alluvial deposits, which overlie flows of the Wai‘anae volcanic series (Macdonald et al. 1983:423). A reconstruction of the pre-Contact landscape reveals that the project area would have been covered by lowland dry shrub and grassland; however, the area has been extensively disturbed and transformed by human activity and is now dominated by a variety of exotic grasses, weeds, and shrubs.

1.4.1.1 *Ka Lepo* (Soils)

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the project area is composed of 12 soil types: Ewa silty clay loam (3 to 6% slopes, EaB), Ewa stony silty clay (6 to 12% slopes, EwC), Mahana silty clay loam (12 to 20% slopes, eroded, McD2), Honouliuli clay (0 to 2% slopes, HxA), Honouliuli clay (2 to 6% slopes, HxB), Kawaihapai clay loam (0 to 2% slopes, KIA), Kunia silty clay (0 to 3% slopes, KyA), Water (W), Waialua stony silty clay (3 to 8% slopes, WIB), Waialua silty clay (0 to 3% slopes, WkA), Waipahu silty clay (0 to 12% slopes, WzA), and Waipahu silty clay (6 to 12% slopes, WzC) (Figure 12 and Figure 13).

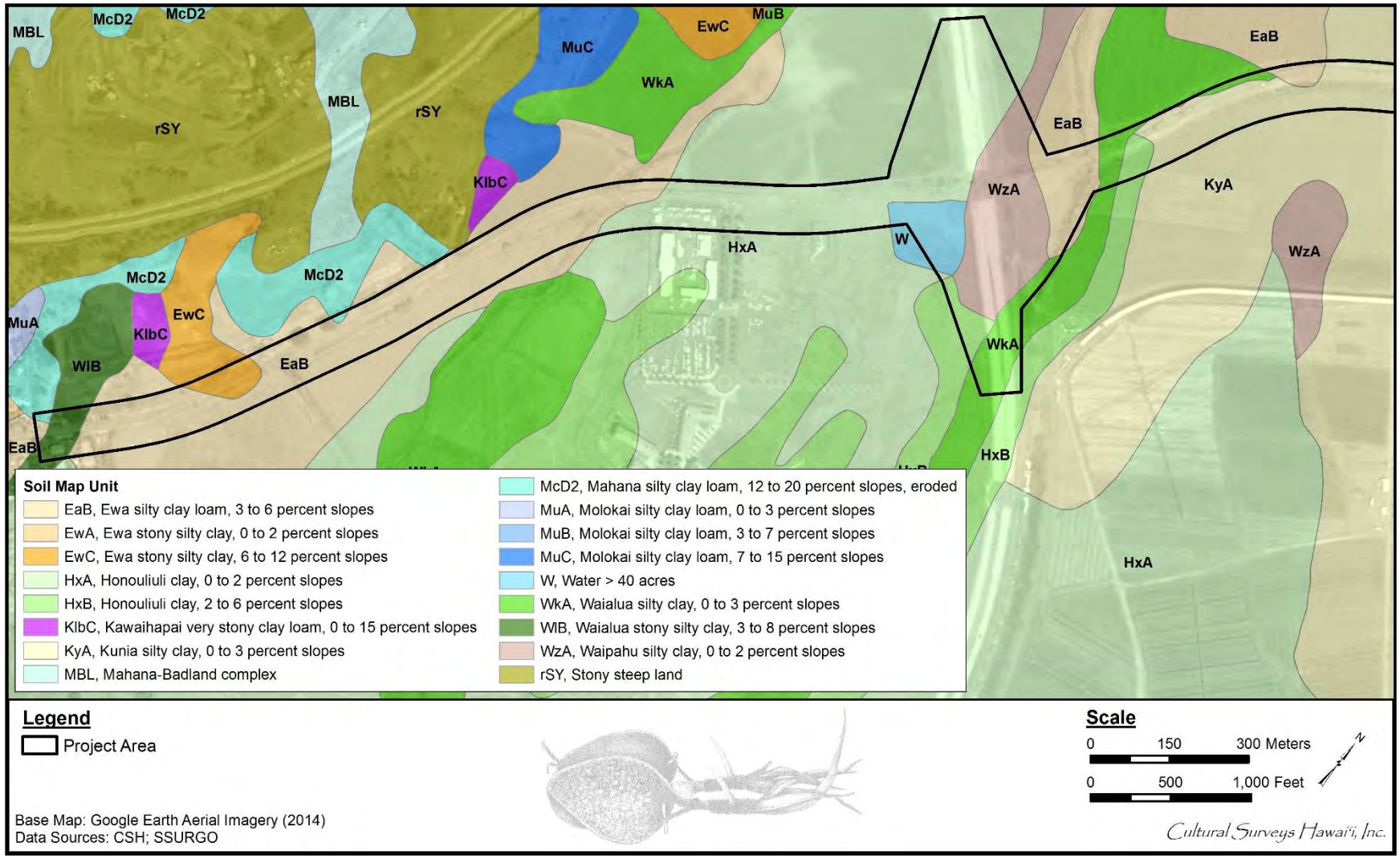

Figure 12. Aerial photograph with Foote et al. 1972 and USDA soil survey and project area overlaid (2013 Google Earth)

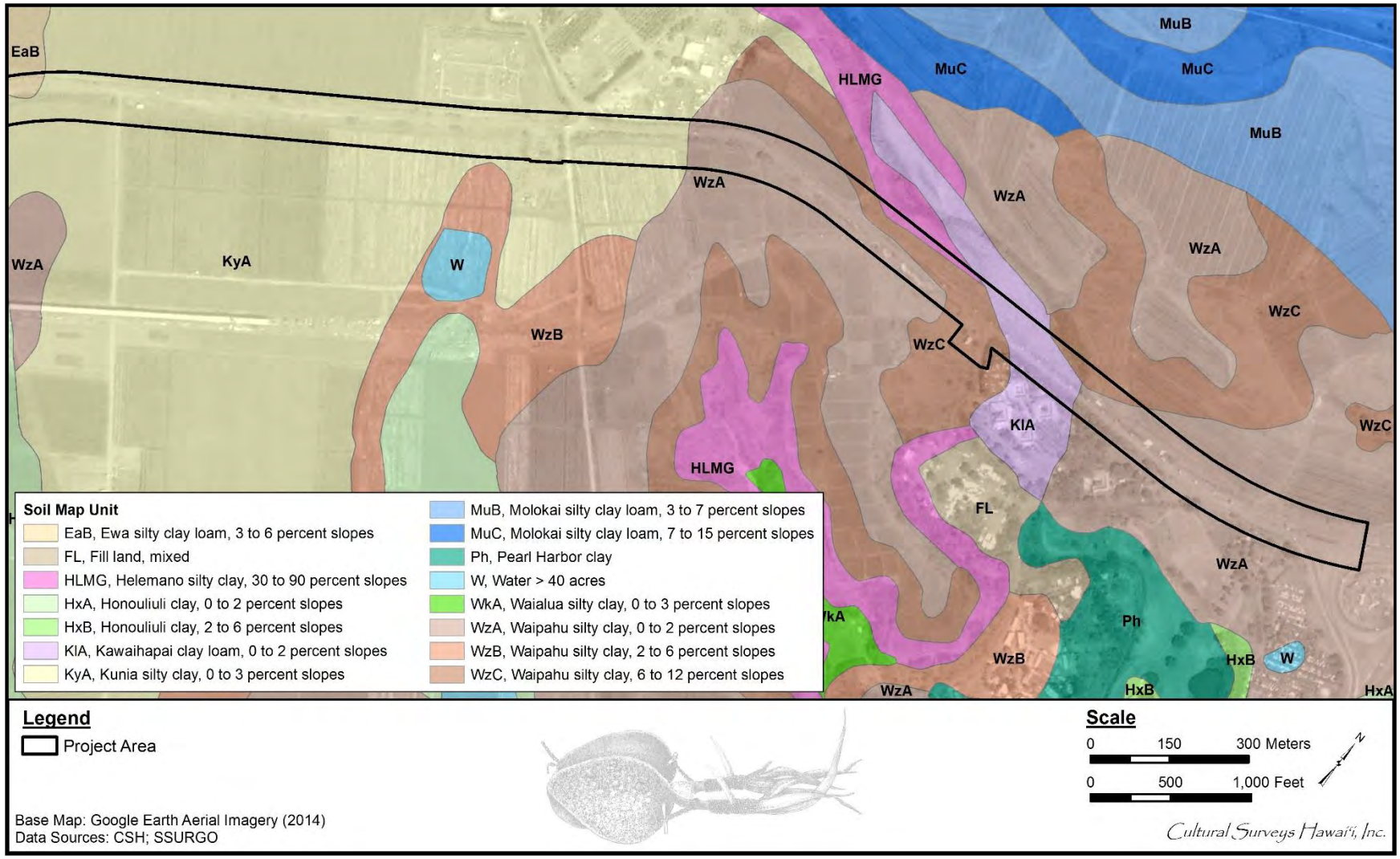

Figure 13. Aerial photograph with Foote et al. 1972 and USDA soil survey and project area overlaid (2013 Google Earth)

Soils of the Ewa Series are described as follows:

> . . . consists of well-drained soils in basins and on alluvial fans on the islands of Maui and Oahu. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from near sea level to 150 feet. The annual rainfall amounts to 10 to 30 inches. Most of it occurs between November and April. The mean annual soil temperature is 73° F. Ewa soils are geographically associated with Honouliuli, Mamala, Molokai, Pulehu, and Waiakoa soils.
>
> These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of fingergrass, kiawe [*Prosopis pallida*; Algaroba], koa haole [*Leucaena leucocephala*], klu [*Acacia farnesiana*], and ‘uhaloa [*Waltheria indica var. Americana*] [Foote et al. 1972:29]

Soils of the Mahana Series are described as follows:

> . . .consists of well-drained soils on uplands on the islands of Kauai and Oahu. These soils developed in volcanic ash. They are gently sloping to very steep. Elevations range from 1,000 to 3,000 feet. The annual rainfall amounts to 30 to 45 inches. The mean annual soil temperature is 67° F. Mahana soils are geographically associated with Oli and Puu Opae soils on Kauai and with Kolekole soils on Oahu.
>
> These soils are used for pasture, woodland, wildlife habitat, irrigated sugarcane, and water supply. The natural yegetation consists of puakeawe [also known as *pūkiawe*; *Leptecophylla tameiameiae*], aa1ii [*Dodonaea viscosa*], rice grass [*Oryzopsis hymenoides*], molasses grass [*Melinis minutiflora*], silver oak [also known as silk oak; *Grevillea robusta*], yellow foxtail [*Setaria pumila*], lantana [*Verbenaceae*], joee [*Stachytarpheta dichotoma*], Japanese tea, passion flower [also known as *liliko‘i*; *passiflora edulensis*], and associated plants. [Foote et al. 1972:85]

Soils of Honouliuli Series are described as follows:

> This series consists of well-drained soils on coastal plains on the island of O‘ahu in the ‘Ewa area. These soils developed in alluvium derived from basic igneous material. They are nearly level and gently sloping. Elevations range from 15 to 125 feet. The annual rainfall amounts to 18 to 30 inches and occurs mainly between November and April. The mean annual soil temperature is 74° F. Honouliuli soils are geographically associated with ‘Ewa, Lualualei, Mamala, and Waialua soils.
>
> These soils are used for sugar cane, truck crops, orchards, and pasture. The natural vegetation consists of kiawe, koa haole, finger grass, bristly foxtail [*Setaria verticillata*], and Bermuda grass [also known as crab grass; *Cynodon dactylon*]. [Foote et al. 1972:43]

Soils of the Kawaihapai Series are described as follows:

> This series consists of well-drained soils in drainage ways and on alluvial fans on the coastal plains on the islands of O‘ahu and Moloka‘i. These soils formed in alluvium derived from basic igneous rock in humid uplands.
>
> They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. The mean annual soil temperature is 73° F. Kawaihapai soils are geographically associated with Haleiwa, Waialua, and Jaucas soils.
>
> These soils are used for sugar cane, truck crops, and pasture. The natural vegetation consists of kiawe, koa haole, lantana, and Bermuda grass. [Foote et al. 1972:63–64]

Soils of the Kunia Series are described as follows:

> This series consists of well-drained soils on upland terraces and fans on the island of Oahu. These soils developed in old alluvium. They are nearly level to moderately sloping. Elevations range from 700 to 1,000 feet. The mean annual rainfall amounts to 30 to 40 inches, most of which occurs from November to April. The mean annual soil temperature is 71° F. Kunia soils occur on the foot slopes of the Waianae Range, near Schofield Barracks. They are geographically associated with Kolekole, Lahaina, and Wahiawa soils.
>
> These soils are used for sugarcane, pineapple, home sites, and military reservations. Most areas are cultivated, and the natural vegetation is not significant. [Foote et al. 1972:77]

Soils of the Waialua Series are described as follows:

> This series consists of moderately well drained soils on alluvial fans on the island of Oahu. These soils developed in alluvium weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 100 feet. The annual rainfall amounts to 25 to 50 inches; most of it occurs between November and April. The mean annual soil temperature is 73° F. Waialua soils are geographically associated with Honouliuli, Kaena, and Kawaihapai soils.
>
> These soils are used for sugarcane, truck crops, orchards, and pasture. The natural vegetation is swollen finger grass [*chloris barbata*], koa haole, and uhaloa. [Foote et al. 1972:128]

Soils of the Waipahu Series are described as follows:

> This series consists of well-drained soils on marine terraces on the island of O‘ahu. These soils developed in old alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from nearly sea level to 125 feet. Rainfall amounts to 25 to 35 inches annually; most of it occurs between November and April. The mean annual soil temperature is 75° F. Waipahu soils are geographically associated with Hanalei, Honouliuli, and Waialua soils. [Foote et al. 1972:134]

The project area extends alongside a number of active agricultural fields. Vegetation outside the cultivated fields consists predominantly of introduced perennial grasses and weeds, along with *kiawe* (*Prosopis pallida*) and *koa haole* (*Leucaena leucocephala*).

1.4.1.2 Ka Makani (Winds)

Makani is the general Hawaiian term for the wind. *A‘e loa* is another of the Hawaiian names given to the prevailing northeasterly trade winds (Nakuina 1992:138) along with A‘e (Pukui and Elbert 1986:3), Moa‘e, and Moa‘e Lehua (Pukui and Elbert 1986:249). In the traditional story *The Wind Gourd of La‘amaomao*, Pāka‘a and his son Kuāpāka‘a are descendants of the wind goddess La‘amaomao whose traditional home was in a wooden calabash (bowl), a gourd that also contained all of the sacred winds of Hawai‘i. La‘amaomao controlled and called forth the winds by chanting their names (Nakuina 1990). Pāka‘a’s chant traces the winds from the *moku* (district) of ‘Ewa. The winds of the Kapolei region are poetically recalled as follows:

Moa‘e-ku is of Ewaloa

Kēhau is of Waiopua

Waikōloa is of Līhu‘e

Kona is of Pu‘uokapolei.

[Nakuina 1990:51]

In *The Epic Tale of Hi‘iakaikapoliopele*, Hi‘iaka watches as her beloved friend Hōpoe is killed by the embers of her sister Pele. She chants atop of Pōhākea and tells of the winds of Waikōloa and Wai‘ōpua.

KAU HO‘OKAHI HANERI A	CHANT ONE HUNDRED
ME KANALIMAKUMAMĀKOLU	AND FIFTY-THREE
Aloha ku‘ u hoa i ka pū‘ali lā	Alas my friend of the rugged mountain pass
A luna i Pōhākea, he luna o Kamaoha	On high at Pohakea, above Kamaoha
He lae ‘ino ‘o Maunauna	Maunauna is a dangerous escarpment
‘O Līhu‘e ke hele ‘ia	Lihu‘e’s high plain yet to be traversed
Honi i ke ‘ala mau‘u	Inhaling the scent of the grasses
I ke ‘ala o ke kupukupu	The fragrance of *kupukupu* fern
E linoa ala e ka Waikōloa	Entwined by the Waikoloa breeze
E ka makani he Wai‘ōpua	By the wind called Wai‘ōpua
Ku‘u pua, me he pua lā i ku‘u maka	My blossom, like a flower in my sight
Ka ‘oni i ka haku ‘ōnohi, kā ka wai lā i li‘u	Moving before my eyes, washed salty by tears
I ku‘u maka lā, e uē au lā.	There in my sight, I weep.

[Ho‘oulumahiehie 2008:262]

1.4.1.3 *Ka Ua* (Rains)

Precipitation is a major component of the water cycle and is responsible for depositing *wai* (fresh water) on local flora. Pre-Contact *kānaka* (Native Hawaiians) recognized two distinct annual seasons. The first, known as *kau* (period of time, especially summer) lasts typically from May to October and is a season marked by a high-sun period corresponding to warmer temperatures and steady trade winds. The second season, *ho‘oilo* (winter, rainy season) continues through the end of the year from November to April and is a much cooler period when trade winds are less frequent, and widespread storms and rainfall become more common (Giambelluca et al. 1986:17). Being on the leeward side of O‘ahu, ‘Ewa is typically very hot and dry. Honouliuli receives an annual rainfall of about 550 mm (22 inches) on the coastal and inland region of the *ahupua‘a* (traditional land division) and about 1,200 mm (39 inches) in the northern region up into the Wai‘anae mountain range (Giambelluca 2013).

Each small geographic area on O‘ahu had a Hawaiian name for its own rains. According to Akana and Gonzalez (2015),

> Rain names are a precious legacy from our kūpuna who were keen observers of the world around them and who had a nuanced understanding of the forces of nature. They knew that one place could have several types of rain, each distinct from the other. They knew when a particular rain would fall, its color, its duration, its intensity, its path, its sound, its scent, and its effect on the land and their lives . . . Rain names are a treasure of cultural, historical, and environmental information. [Akana and Gonzalez 2015:n.p.]

Honouliuli was no exception to this naming practice. Despite the relative lack of rainfall in this area, the Nāulu rain is known to be associated with the *ahupua‘a* of Honouliuli. This rain is generally understood as a sudden shower, and more commonly associated with Kawaihae, Hawai‘i and Ni‘ihau (notoriously dry locations as well) (Akana and Gonzalez 2015:187). The Nāulu rain is mentioned in a chant offered by Hi‘iakaikapoliopele, the young sister of the fire goddess Pele. In *Ka Mo‘olelo o Hi‘iakaikapoliopele*, the goddess Hi‘iaka, born an egg and carefully warmed and nourished by Pele herself (Westervelt 1916:69), embarks on a quest to retrieve her older sister’s lover, Lohi‘auipo. While traversing the island chain, Hi‘iaka encounters various gods and demi-gods, spirits and shapeshifters, as well as chiefs and commoners.

During Hi‘iaka’s travel through ‘Ewa she recites this affectionate *oli* (chant) as she recalls the Kai‘okia edict placed on her and Lohi‘au by Pele:

‘A‘ole au e hele i ke kaha o Kaupe‘a	I shall not tread Kaupe‘a’s expanse
Kēlā kaha kūpā koili a ka lā i ke kula	That stretch where the sun beats down on the plain
Ua kūpono a‘ela ka lā i ka piko o Wākea	The sun is right overhead, at the navel of Wākea
Ola i ke ahe aka makani Māunuunu	I am spared by the Māunuunu wind
I ka hapahapai mai aka makani ‘Ao‘aoa	By the uplifting ‘Ao‘aoa breeze

Ke koi lā i ke ao o ka Nāulu	Urging the Nāulu storm clouds
e hanini i ka wai	to pour down their waters
Ola ihola nā kupa kama‘āina i ka wai	The natives here survive on water
a ka ‘ōpua	from the clouds
Ke halihali a‘ela nā ‘ōpua i ke awa lau	Which billowing clouds carry along to the branching lochs
E koi mai ana iā Hi‘iaka e kūo‘e hele	Compelling Hi‘iaka to trudge that
i ke kula	open stretch
I kuleana i lāhui ai ka moe i Laila	Duty making rest forbidden there
I laila au lohe i ke kani leo le‘a a ka	There I heard the happy trill of the
‘ō‘ō i ke kula	*‘ō‘ō* bird on the plain
Ho‘āikāne ana lāua me ke kai o	Befriending the sea of
Wāwaemoku	Wawaemoku
Mokumokuāhua loko, kupākupā koili	My heart grieves, thrashed by harm
i ka ‘ino	
I ‘ino ho‘i au i kēia kanaka i ka hiki	I may be harmed by this person upon
‘ana mai	arrival
I kahela a‘ela ka ‘ai a ka manu	Leaving the birds to feed
	expansively
I ka pua o ka wiliwili	On the blossoms of the *wiliwili* trees
Wili a‘ela nā ‘ōpua i luna	The clouds spin above
No luna wau	I am from above
Wili a‘ela nā ‘ōpua i lalo	The clouds spin below
Lalo ē!	Below indeed!
Lilo i lalo ka hele ‘ana a ke kanaka	The movement of mankind is cast down
Kalakala ke ao no Hawai‘i	Craggy are the clouds from Hawai‘i
I ka pā ‘ia mai e kēia makani	Blown here by this wind
‘A‘ole a‘u makana i ka lā o ka hilahila	I have no gift to offer on this day of shame
E hili hewa paha auane‘i au	I shall perhaps end up astray
Wilia i na‘e, wilia i lalo	Spiraling windward, or to the lee

Wilia i kai, wilia i uka	Spinning toward the sea, toward the highlands
‘O kauhale a ka ‘ōlelo	O house made of words
Ho‘ohiki ihola i kānāwai	Utter as an edict
Kau ihola i kānāwai	Place as a law
He kānāwai ‘okia	An order of separation
‘Ālina ihola ka ‘o Pu‘uloa	Thus Pu‘uloa is branded by epithet
He ‘āina kauā.	A land of outcasts and slaves.

[Ho‘oulumāhiehie 2008a:294–295; Ho‘oulumāhiehie 2008b:275–276]

The general lack of rain names is indicative of historic environmental conditions within the *ahupua‘a*; these conditions, in turn, shaped agricultural practices in the area. Environmental limitations invariably resulted in innovation. McAllister provides written evidence of the innovative ways in which Honouliuli’s *kama‘āina* (native-born) approached agricultural activities:

> . . . It is probable that the holes and pits in the coral were formerly used by Hawaiians. Frquently the soil on the floor of the larger pits was used for cultivation, and even today one comes upon bananas and Hawaiian sugar cane still growing in them. They afford shelter and protection, but I doubt if previous to the time of Cook there was ever a large population here. [McAllister 1933:109]

1.4.1.4 *Kahawai* and *Pūnāwai* (Streams and Springs)

Honouliuli Ahupua‘a, and the encompassing ‘Ewa District, are notoriously dry. In traditional Hawaiian times, the areas of exposed coral (Pleistocene limestone) outcrop were undoubtedly more extensive. Limestone outcrop, composed of detritus, calcareous sand, reef dwelling organisms, and coralline algae, is subject to dissolution from water. This dissolution has formed a series of connected and isolated caves under the ‘Ewa Plains. Although invisible to human eyes, streams flow under the surface of Honouliuli via the karstic system.

The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua‘a* as a whole. A broad limestone plain with innumerable limestone sinkholes offered a nesting home for a large population of avifauna, in addition to providing agricultural opportunities. This resource may have been one of the early attractions to human settlement. The lower portion of Honouliuli Valley in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley, consisting of an extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. As Handy and Handy (1972:469) have pointed out, the forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the *ahupua‘a* contained biologically diverse forest with *kukui* (*Aleurites moluccana;* candlenut), *‘ōhi‘a lehua* (*Metrosideros macropus*), *‘iliahi* (*Santalum* spp.; sandalwood), *hau* (*Hibiscus tiliaceus*; beach hibiscus), tī (*Cordyline terminalis*), and banana. These valuable resources contributed to the richness of Honouliuli and the ‘Ewa *moku* (district).

Proceeding *mauka* (toward the mountain) from the ‘Ewa Plain, a series of gulches mark the landscape. The largest of these is Honouliuli Gulch toward the east side of the plain that drains into West Loch. The gulch is bisected by the Honouliuli Stream, the primary water body of the Honouliuli Watershed. The “perennial/intermittent” Honouliuli Stream and its tributaries “have a total stream length of 32.5 miles” (O‘ahu Resource Conservation and Development Council 2013:16).

To the west are fairly steep gradient gulches forming a more linear than dendritic drainage pattern. The major gulches from east to west are Awanui, Pālailai, Makaīwa, Waimānalo, and Limaloa. These gulches are steep-sided in the uplands and generally of a high gradient until they emerge onto the flat ‘Ewa plain. The alluvium they have carried has spread out in delta fashion over the *mauka* portions of the plain, which comprises a dramatic depositional environment at the stream gradient change. These gulches are generally dry, but during seasonal Kona storms they carry immense quantities of runoff onto the plain and into the ocean. As typical drainages in arid slopes, they are either raging uncontrollably or are dry, and do not form stable water sources for traditional agriculture in their upper reaches. The western Honouliuli gulches, in contrast to those draining into Pu‘uloa (Pearl Harbor) to the east, do not have valleys suitable for extensive irrigated agriculture. However, this lack is more than compensated by the rich watered lowlands at the base of Honouliuli Gulch.

The lowlands fronting the west loch of Pu‘uloa (Kaihuopala‘ai) were suitable for the cultivation of the traditional Hawaiian staple crop, *kalo* (taro; Colocasia esculenta). For spiritual and dietary reasons, *kalo* was a sacred staple in the Hawaiian diet. According to Hawaiian mythology, man was born from the taro plant.

The *Kumulipo* (“origin, genesis”) details this kinship. Hāloa, “he of the long breath,” is the second son of Wākea and Papa. Wākea and Papa’s first born, Hāloa-naka was born premature and died shortly after his birth (Kanahele 1995:17). After burying Hāloa-naka, a *kalo* plant sprouted at his grave. Shortly after, a second son (Hāloa) was born. A human child, Hāloa symbolizes *kalo* and man. *Kalo* is a metaphor for life, Kanahele explains as follows:

> In the mythologies of many cultures, plants have been used to symbolize human spiritual growth. Hawaiians made taro a metaphor for life because, like the taro plant, it needs to be rooted in good soil and to be constantly nourished with the waters of Kāne. As the stalk grows taller with its leaves reaching toward the light of the sun, symbolized by Wākea, so Hawaiians grow aspiring to be closer to their heavenly spirit. Just as every young shoot can become a full-grown plant, so can they become gods as descendants of Hāloa. As every plant must die, however, they too must die. And from the remains a new plant lives again. In this continuity of life, both plant and man repeat the mystery of the unending cycle. [Kanahele 1995:18]

However, by the mid-nineteenth century traditional agriculture was becoming quickly supplanted by large-scale commercial ventures. The focus of agricultural production soon shifted towards sugarcane and pineapple, with concerted efforts made to turn open space into plantations. The drilling for artesian wells began in 1879 with cattle rancher James Campbell on the ‘Ewa Plains (Board of Water Supply, City and County of Honolulu 2017). Utilizing a well driller, Campbell drilled several hundred feet down until reaching a large supply of pure, fresh water

(Board of Water Supply, City and County of Honolulu 2017). According to the Board of Water Supply (2017):

> This discovery led to a water boom on the island, as ranchers and plantation developers began drilling furiously for more of the precious resource. Within 20 years, the boom came to a bust. Artesian wells, abandoned and neglected, wasted millions of gallons of water. By the turn of the century, Oahu suffered a water panic. Wells were salting up. Water levels were dropping. The problem was that the system had grown too much, too fast and too haphazardly. [Board of Water Supply 2017]

Campbell’s first well was named Waianiani (“crystal waters”) by the *kama‘āina* of Honouliuli (Nellist 1925). By 1930, Ewa Plantation had drilled 70 artesian wells to irrigate cane lands; artesian wells provided fresh water to Honouliuli for nearly 60 years (Ho‘okuleana 2014). Campbell’s original Honouliuli well was finally sealed by the City and County of Honolulu in 1939 (Ho‘okuleana 2014).

1.4.1.5 *Lihikai ame ka Moana* (Seashore and Ocean)

Several naming traditions exist for Honouliuli. One tradition notes that Honouliuli means “dark water,” “dark bay,” or “blue harbor,” and was named for the waters of Pu‘uloa (Jarrett 1930:22), which marks the eastern boundary of the *ahupua‘a*. According to *mo‘olelo* (stories), Pu‘uloa was a storied place due to the presence of Ka‘ahupāhau. Ka‘ahupāhau, queen of all sharks of O‘ahu, dwelled in a large cavern on the Honouliuli side of Pearl Harbor (Clark 1977:69).

Traditionally, the seashore and ocean areas were vitally important for resource extraction in the early days of settlement; these areas provided both physical and spiritual sustenance (NOAA 2017) to the people of Honouliuli. Within the *ahupua‘a* there are 12 miles of coastline with continuous shallow fringing reef, which offers rich marine resources in addition to the 4 miles of waterfront along the west side of the West Loch of Pu‘uloa that offered extensive fisheries (mullet, *awa* [*Chanos chanos*; milkfish], shellfish) as well as frontage suitable for development of fishponds (e.g., Laulaunui). Fishermen along the coast maintained a respected status within traditional Hawaiian society; Kanahele asserts that “early Hawaiians regarded fishing as the oldest, and hence the most prestigious of professions” (Kanahele 1995:17).

According to Charles Howard Edmondson (1946:5), the coastal waters of Pearl Harbor were “a natural aquarium for many varieties of marine animals.” Titcomb (1952:7) identifies the Pearl Harbor area as the only large natural inland lagoon, famous for its fish and fishponds. The *nehu* (anchovy; *Anchoviella purpurea*) was said to fill the lochs of Pearl Harbor. Citing Kamakau, Margaret Titcomb writes that the *nehu*, “filled the lochs from the channel of Pu‘uloa (Pearl Harbor) inland to the Ewas” (Titcomb 1952:97). Due to the presence of the *nehu*, the *kama‘āina* of Honouliuli and ‘Ewa developed this saying,

> *He kai puhi nehu, puhi lala ke kai o ‘Ewa e, e noho i ka la‘i o ‘Ewa nui a La‘akona* (“A sea that blows up nehu, blows them up in rows, is ‘Ewa, until they rest in the calm of great ‘Ewa-a-La‘akona”). [Kamakau 1964:84]

Moving westward from Pu‘uloa are Iroquis Beach, Keahi Point, ‘Ewa Beach Park, and One‘ula Beach Park. The use of these beaches increased during the plantation era when employees of the nearby sugar plantations utilized the coastal areas for subsistence and recreation.

1.4.2 Built Environment

In the late nineteenth and early twentieth centuries, the Ewa Plantation Company installed ditches running from the lower slopes of the Wai‘anae Mountains to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17). These activities relocated sediments from the higher, soil-rich slopes of the Wai‘anae Mountains down to the soil-poor Pleistocene limestone plains of the Kalaeloa area. Portions of the agricultural lands in Honouliuli were developed from this arable land expansion program.

The project area contains a 3.1-mile-long portion of Farrington Highway. The immediate vicinity of the project area has been drastically altered by historic and modern land use including intensive commercial sugarcane cultivation. In recent years, the construction of the Kūalaka‘i Parkway and related infrastructure improvement projects has altered a portion of the project area. Aside from Kūalaka‘i Parkway, development within the immediate vicinity of the project area includes the University of Hawai‘i–West O‘ahu, Aloun Farm, and the Kahi Mohala Behavioral Health Center. Generally, the vicinity of the project area consists of rural agricultural lands.

Section 2 Methods

2.1 Archival Research

Research centers on Hawaiian activities including *ka‘ao* (legends), *wahi pana* (storied places), *‘ōlelo no‘eau* (proverbs), *oli* (chants), *mele* (songs), traditional *mo‘olelo* (stories), traditional subsistence and gathering methods, ritual and ceremonial practices, and more. Background research focuses on land transformation, development, and population changes beginning with the early post-Contact era to the present day.

Cultural documents, primary and secondary cultural and historical sources, historic maps, and photographs were reviewed for information pertaining to the study area. Research was primarily conducted at the CSH library. Other archives and libraries including the Hawai‘i State Archives, the Bishop Museum Archives, the University of Hawai‘i at Mānoa’s Hamilton Library, Ulukau, The Hawaiian Electronic Library (Ulukau 2014), the State Historic Preservation Division (SHPD) Library, the State of Hawai‘i Land Survey Division, the Hawaiian Historical Society, and the Hawaiian Mission Houses Historic Site and Archives are also repositories where CSH cultural researchers gather information. Information on Land Commission Awards (LCAs) were accessed via Waihona ‘Aina Corporation’s Māhele database (Waihona ‘Aina 2000), the Office of Hawaiian Affairs (OHA) Papakilo Database (Office of Hawaiian Affairs 2015), and the Ava Konohiki Ancestral Visions of ‘Āina website (Ava Konohiki 2015).

2.2 Community Consultation

2.2.1 Scoping for Participants

We begin our consultation efforts with utilizing our previous contact list to facilitate the interview process. We then review an in-house database of *kūpuna* (elders), *kama‘āina*, cultural practitioners, lineal and cultural descendants, Native Hawaiian Organizations (NHOs; includes Hawaiian Civic Clubs and those listed on the Department of Interior’s NHO list), and community groups. We also contact agencies such as SHPD, OHA, and the appropriate Island Burial Council where the proposed project is located for their response on the project and to identify lineal and cultural descendants, individuals and/or NHOs with cultural expertise and/or knowledge of the study area. CSH is also open to referrals and new contacts.

2.2.2 “Talk Story” Sessions

Prior to the interview, CSH cultural researchers explain the role of a CIA, how the consent process works, the project purpose, the intent of the study, and how their *‘ike* (knowledge) and *mana‘o* (thought, opinion) will be used in the report. The interviewee is given an Authorization and Release Form to read and sign.

“Talk Story” sessions range from the formal (e.g., sit down and *kūkākūkā* [consultation, discussion] in participants choice of place over set interview questions) to the informal (e.g., hiking to cultural sites near the study area and asking questions based on findings during the field outing). In some cases, interviews are recorded and transcribed later.

CSH also conducts group interviews, which range in size. Group interviews usually begin with set, formal questions. As the group interview progresses, questions are based on interviewee's answers. Group interviews are always transcribed and notes are taken. Recorded interviews assist the cultural researcher in 1) conveying accurate information for interview summaries, 2) reducing misinterpretation, and 3) catching missing details to *mo‘olelo*.

CSH seeks *kōkua* (assistance) and guidance on identifying past and current traditional cultural practices of the study area. Those aspects include general history of the *ahupua‘a*; past and present land use of the study area; knowledge of cultural sites (for example, *wahi pana*, archaeological sites, and burials); knowledge of traditional gathering practices (past and present) within the study area; cultural associations (*ka‘ao* and *mo‘olelo*); referrals; and any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the study area.

2.2.3 Completion of Interview

After an interview, CSH cultural researchers transcribe and create an interview summary based on information provided by the interviewee. Cultural researchers give a copy of the transcription and interview summary to the interviewee for review and any necessary edits. Once the interviewee has made those edits, we incorporate their *‘ike* and *mana‘o* into the report. When the draft report is submitted to the client, cultural researchers then prepare a finalized packet of the participant's transcription, interview summary, and any photos that were taken during the interview. We also include a thank you card and honoraria. This is for the interviewee's records.

It is important to CSH cultural researchers to cultivate and maintain community relationships. The CIA report may be completed, but CSH researchers continuously keep in touch with the community and interviewees throughout the year—such as checking in to say hello via email or by phone, volunteering with past interviewees on community service projects, and sending holiday cards to them and their *‘ohana* (family). CSH researchers feel this is an important component to building relationships and being part of an *‘ohana* and community.

"*I ulu no ka lālā i ke kumu*—the branches grow because of the trunk," an *‘ōlelo no‘eau* (#1261) shared by Mary Kawena Pukui with the simple explanation: "Without our ancestors we would not be here" (Pukui 1983:137). As cultural researchers, we often lose our *kūpuna* but we did not lose their wisdom and words. We routinely check obituaries and gather information from other informants if we have lost our *kūpuna*. CSH makes it a point to reach out to the *‘ohana* of our fallen *kūpuna* and pay our respects including sending all past transcriptions, interview summaries, and photos for families to have on file for genealogical and historical reference.

Section 3 *Ka‘ao* and *Mo‘olelo*

Hawaiian storytellers of old were greatly honored; they were a major source of entertainment and their stories contained lessons while interweaving elements of Hawaiian lifestyles, genealogy, history, relationships, arts, and the natural environment (Pukui and Green 1995:IX). According to Pukui and Green (1995), storytelling is better heard than read for much becomes lost in the transfer from the spoken to the written word and *ka‘ao* (legends) are often full of *kaona* or double meanings.

Ka‘ao are defined by Pukui and Elbert (1986:108) as a "legend, tale […], romance, [and/or], fiction." *Ka‘ao* may be thought of as oral literature or legends, often fictional or mythic in origin, and have been "consciously composed to tickle the fancy rather than to inform the mind as to supposed events" (Beckwith 1970:1). Conversely, Pukui and Elbert (1986:254) define *mo‘olelo* as a "story, tale, myth, history, [and/or] tradition." The *mo‘olelo* are generally traditional stories about the gods, historic figures or stories which cover historic events and locate the events with known places. *Mo‘olelo* are often intimately connected to a tangible place or space (*wahi pana)*.

In differentiating *ka‘ao* and *mo‘olelo* it may be useful to think of *ka‘ao* as expressly delving into the *wao akua* (realm of the gods), discussing the exploits of *akua* (gods) in a primordial time. *Mo‘olelo* on the other hand, reference a host of characters from *ali‘i* to *akua; kupua* (supernatural beings) to *maka‘āinana* (commoners); and discuss their varied and complex interactions within the *wao kānaka* (realm of man). Beckwith elaborates, "In reality, the distinction between *ka‘ao* as fiction and *mo‘olelo* as fact cannot be pressed too closely. It is rather in the intention than in the fact" (Beckwith 1970:1). Thus a so-called *mo‘olelo*, which may be enlivened by fantastic adventures of *kupua*, "nevertheless corresponds with the Hawaiian view of the relation between nature and man" (Beckwith 1970:1).

Both *ka‘ao* and *mo‘olelo* provide important insight into a specific geographical area, adding to a rich fabric of traditional knowledge. The preservation and passing on of these stories through oration remains a highly valued tradition. Additionally, oral traditions associated with the study area communicate the intrinsic value and meaning of a place, specifically its meaning to both *kama‘āina* as well as others who also value that place.

The following section presents traditional accounts of ancient Hawaiians living in the vicinity of the project area. Many relate an age of mythical characters whose epic adventures inadvertently lead to the Hawaiian race of *ali‘i* (chiefs) and *maka‘āinana* (commoners). The *ka‘ao* in and around the project area shared below are some of the oldest Hawaiian stories that have survived; they still speak to the characteristics and environment of the area and its people.

The traditions of Honouliuli Ahupua‘a have been compiled by several authors, in studies by Sterling and Summers (1978), Hammatt and Folk (1981), Kelly (1991), Charvet-Pond and Davis (1992), Maly (1992), and Tuggle and Tomonari-Tuggle (1997). Some of the traditional themes associated with this area include connections with Kahiki, the traditional homeland of Hawaiians in central Polynesia. There are several versions of the chief Kaha‘i leaving from Kalaeloa for a trip to Kahiki; on his return to the Hawaiian Islands he brought back the first breadfruit (Kamakau 1991a:110) and planted it at Pu‘uloa, near Pearl Harbor in ‘Ewa (Beckwith 1940:97). Several stories associate places in Honouliuli with the gods Kāne and Kanaloa, with the Hawaiian pig god

Kamapua‘a and the Hina family, and with the sisters of Pele, the Hawaiian volcano goddess, all of whom have strong connections with Kahiki (Pukui et al. 1974:200).

3.1 Ka‘ao

3.1.1 Kāne and Kanaloa and the Boundaries of ‘Ewa

Pukui translates the name ‘Ewa as “crooked” in reference to a legend where the brother gods Kāne and Kanaloa threw stones to mark boundaries of land. The ‘Ewa stone was lost, but later found to be at Pili-o-Kahe (Pukui et al. 1974:28).

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ewa. To mark boundaries of land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere in the Waimanalo section. When they went to find it, they could not locate the spot where if fell. So Ewa (strayed) became known by that name. The stone that strayed. [Sterling and Summers 1978:1]

3.1.2 Kāne and Kanaloa and the *Loko I‘a* (Fishpond) of Pu‘uloa

According to an account in the Hawaiian newspaper *Ka Loea Kālai‘āina* (10 June 1899), several of the fishponds in the Pu‘uloa area were made by the gods, Kāne and Kanaloa. A fisherman living in Pu‘uloa, named Hanakahi, prayed to unknown gods, until one day two men came to his house. They revealed to him that they were the gods to whom he should pray. Kāne and Kanaloa then built fishponds at Ke‘anapua‘a, but were not satisfied. Then they built the fishpond Kepo‘okala, but were still not satisfied. Finally, they made the pond Kapākule, which they stocked with all manner of fish. They gifted all of these fishponds to Hanakahi and his descendants (Handy and Handy 1972:473; *Ka Loea Kālai‘āina*, 8 July 1899).

Mary Pukui (1943:56–57), who visited Kapākule Fishpond when she was young, writes that the pond was built by the *menehune* (legendary race of small people who worked at night, building fishponds, roads, temples) under the direction of the gods Kāne and Kanaloa. Pukui describes several unique aspects of this pond:

> On the left side of the pond stood the stone called Hina, which represented a goddess of the sea by that name. Each time the sea ebbed, the rock became gradually visible, vanishing again under water at high tide. Ku, another stone on the right, was never seen above sea level. This stone represented Ku‘ula, Red Ku, a god for fish and fishermen. From one side of the pond a long wall composed of driven stakes of hard wood, ran toward the island [Laulaunui] in the lochs. When the fish swam up the channel and then inside of this wall, they invariably found themselves in the pond. A short distance from the spot where the pond touched the shore was a small koa or altar composed of coral rock. It was here that the first fish caught in the pond was laid as an offering to the gods. [Pukui 1943:56]

The fishpond contained many fish, especially the *akule* (bigeye scad; *Selar crumenophthalmus*), thus its name, “the enclosure for *akule* fish” (Pukui 1943:56–57). The pond was destroyed when the channel to Pearl Harbor was dredged in the early twentieth century. The caretaker of the pond took the stones Kū and Hina to a deep place in the ocean and sunk them so “none would harm or defile them.” Cobb (1903:733) writes that the pond was used to catch the larger *akule* (goggler), *‘ōpelu* (mackerel scad; *Decapterus macarellus*), *weke* (goat fish; *Mullidae*), *kawakawa* (bonito; *Euthynnus affinis*), and sharks. It was unusual for having walls made of coral. This contradicts much of the *mo‘olelo* saying that sharks were not killed in Pearl Harbor. However, Kamakau does relate that Kekuamanoha and Kauhiwawaeono, two conspirators against Kamehameha I, lived at Pu‘uloa. The chief Kauhiwawaeono was known to murder people and use their bodies as shark bait (Kamakau 1992:182, 232).

3.1.3 Kamaunuaniho at Pu‘u-o-Kapolei

Pu‘uokapolei was the home of Kamaunuaniho, the grandmother of Kamapua‘a, the pig god. She was one of the three migrants from Kahiki who were ancestors to the people of O‘ahu. The following excerpt tells of taking his grandmother to Pu‘uokapolei (Fornander 1919:5:318; Kahiolo 1978:81, 107).

> Kamapua‘a subsequently conquered most of the island of O‘ahu, and, installing his grandmother [Kamaunuaniho] as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Wai‘anae Mountain Range, and made her establish her court there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all. [Nakuina 1904:50]

Emma Nakuina goes on to note, “A very short time ago [prior to 1904] the foundations of Kamaunuaniho’s house could still be seen at Puuokapolei” (Nakuina 1904:50). Another account in the Hawaiian newspaper *Ka Loea Kālai‘āina* (13 January 1900 in Sterling and Summers 1978:34) speaks of Kekele‘aikū, the older brother of Kamapua‘a, who also lived on Pu‘uokapolei. Kamapua‘a was born and raised in Kaluanui, an *ahupua‘a* located in the *moku* of Ko‘olauloa, but later escaped to ‘Ewa when he was pursued by the chief Olopana.

In Lilikalā Kame‘eleihiwa’s version of the *mo‘olelo* of Kamapua‘a, Pele and Kamapua‘a meet and a battle ensues on Hawai‘i Island between the two. Kamapua‘a tells Kekele‘aikū, “Listen to me, elder brother. You wait here. When you smell the stench of burning bristles, then you must assume I am dead. However, if indeed you do not smell the stench of the bristles, you will know that your younger brother has not been harmed and that he has ‘eaten of the cooked taro’” (Kame‘eleihiwa 1996:62). Kamapua‘a travels to Hawai‘i Island where Pele chases him with fire out of the *lehua* (*Metrosideros*) forest. Kamapua‘a ran from Pele but could only cling to an *‘ama‘uma‘u* (*Sadleria cyatheoides*) fern (Kame‘eleihiwa 1996:95). The fire continued to burn around Kamapua‘a as he clung on for his life. His bristles began to burn as well, sending a stench of burning pig bristles around the Hawaiian Islands. Kekele‘aikū smelled the stench of burning pig bristles and began to cry, thinking that his brother perished in battle with Pele (Kame‘eleihiwa 1996:95). Kekele‘aikū then hung himself, deeply saddened for the loss of his beloved brother, Kamapua‘a. Kekele‘aikū’s body was left at Pu‘uokapolei with their grandmother.

Kamapua‘a eventually makes his way back to O‘ahu where he begins to call to Kekele‘aikū’s spirit:

Ho‘ālohaloha main a ana ia‘u ku‘u kaikua‘ana

Show me your love and compassion, O my elder brother

‘O ka pili manu kahi a kāua e haele pū ai

In the bird-catching places where we two have traveled together

I ke kula o Kahinahina

On the plain of Kahinahina

Iā ‘Oloheimiki

At ‘Oloheimiki

Iā ‘olua la ke kia holomanu

You two had the bird-snaring rod

Ia‘u la ke kia mahi‘ai

I had the farming rod

I na kea ali‘i kaikaina

Made by the younger brother chief

‘O koko maka pehupehu i ka lā e—

Of the bloody eyes, swollen in the sun

E ha‘a—e, ha‘a kai ‘a ha‘o o Ko‘olina—e

Dancing, dancing is the humble fish of Ko‘olina

‘O nā pa‘ako pani ua o Waiku‘i la

Of the rain-filled coral beds of Waiku‘i

Iā Waku‘i ho‘i e—

Yes, at Waiku‘i!

Ho‘ohali i kana i‘a ma waho

Bearing his fish outside

Ma loko ka ‘i‘o, ma waho ka iwi

Inside is the flesh, outside are the bones

‘O ka pipipi kai welawela

O the *pipipi* of the burning sea

‘O Kahunaiki‘ulalena nei la e—

O this Kahunaiki‘ulalena

> *‘O kou inoa ia, e ō mai ‘oe!*
>
> Her is your name chant—answer!
>
> [Kame‘eleihiwa 1996:130]

The spirt of Kekele‘aikū returned and Kamapua‘a urged his brother’s spirit to return to Pu‘uokapolei to where his body lay with his grandmothers, Kamaunuaniho and Wahineokama‘o (Kame‘eleihiwa 1996:131). Kamapua‘a traveled to ‘Ewa when he saw several canoes filled with calabashes of food. Kamapua‘a watched the people eat until they were full and slept in a comfortable area (Kame‘eleihiwa 1996:132). Of the eight canoes that landed, Kamapua‘a raided six canoes for their provisions. Kamapua‘a filled the empty calabashes of food with his excrement and filled the water gourds with his urine. When the people awoke the next morning, they thought they did something wrong until they came across the remaining food in two canoes. The people began to realize this was the doing of Kamapua‘a. The two canoes with provisions left for Kou (Honolulu) while those who had come from the six canoes hiked *mauka* to gather more food. As the two canoes began to set sail, a pig appeared on the peninsula crying. The visitors grabbed Kamapua‘a and planned to roast him for the *ali‘i* (Kame‘eleihiwa 1996:134). Kamapua‘a jumped out of the canoe near Kepo‘okalā and swam to Honouliuli Pond (Kalo‘i) where a woman was gathering *‘ohā*, taro that grows from an older root (Kame‘eleihiwa 1996:135).

3.1.4 The Realm of Homeless Souls on the ‘Ewa Plain

There are several places on the ‘Ewa coastal plain associated with *ao kuewa*, the realm of the homeless souls. Samuel Kamakau (1991) explains the Hawaiian beliefs in the afterlife:

> There were three realms (*ao*) for the spirits of the dead. . . . There were, first, the realm of the homeless souls, the *ao kuewa*; second, the realm of the ancestral spirits, the *ao ‘aumakua*; and third, the realm of Milu, *ke ao o Milu* . . .
>
> The *ao kuewa*, the realm of homeless souls, was also called the *ao ‘auwana*, the realm of wandering souls. When a man who had no rightful place in the *‘aumakua* realm (*kanaka kuleana ‘ole*), his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Hālawa, ‘Ewa near Red Hill], there he would find the breadfruit tree of Leiwalo, *ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, *the pō pau ‘ole o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, a *leina a ka ‘uhane*. . . . [Kamakau 1991b:47]
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could not go far in the places mentioned earlier before they would be found catching spiders by *‘aumakua* souls, and be helped to escape. [Kamakau 1991b:49]

The breadfruit tree Leilono was said to have been located on the ‘Ewa-Kona border, above Āliamanu. In another section of his account of the dead, Kamakau (1991b:29) calls the plain of

wandering souls the "plain at Pu‘uokapolei." Fornander (Fornander 1919:6[2]:292) states Pu‘uokapolei may have been a jumping off place (also connected with the setting sun) and associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill. Kamakau also writes,

> There are many who have died and have returned to say that they had no claim to an *‘aumakua* [realm] (*kuleana‘ole*). These are the souls, it is said, who only wander upon the plain of Kama‘oma‘o on Maui or on the plain at Pu‘uokapolei on Oahu. Spiders and moths are their food. [Kamakau 1991b:29]

3.2 Mo‘olelo

3.2.1 Legend of Lepeamoa

Another explanation for the name Honouliuli comes from the "Legend of Lepeamoa," the *kupua* (demigod or cultural hero, especially a supernatural being possessing several forms) of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Westervelt 1923:164–184). One translation of the name for this district is given as "unequal" (*Saturday Press*, 11 August 1883). Others translate the word as "strayed" and associate it with the legends of the gods Kāne and Kanaloa who surveyed the islands and marked land boundaries with large stones, as told in the associated *ka‘ao* in the previous sub-section.

According to S.K. Nawaa (22 March 1954) in Sterling and Summers, the stone that was found at Pili o Kahe and is the dividing marker between two hills that run parallel, the hill on the ‘Ewa side was considered male and on the Wai‘anae side marking the boundary between Nānākuli and Honouliuli was interpreted as female. The name "Pili o Kahe (Pili = cling to, Kahe = flow) refers, therefore, to the female or Waianae side hill. And that is where the boundary between the two districts runs" (Sterling and Summers 1978:1). The boundaries of Honouliuli Ahupua‘a extend from Paupauwela in the north, Ho‘ae‘ae to the east, and Pu‘uloa to the south with the coastline on the southern border.

3.2.2 Coastal Village of Kūalaka‘i

"Legend of the Children" is a tale that foretold the breaking of the eating *kapu* (taboo) by the *ali‘i*. A young brother and sister always fished at Kūalaka‘i, a beach area on the southern coast of Honouliuli. On this day, they laid out their nets, but all they caught was one *palani* (surgeonfish; *Acanthurus dussumieri*), a fish that was *kapu* for men; only women could eat it.

> . . . They fished again and again until the afternoon and nothing was caught. The children were weary and went home without fish. When they came as far as Pu‘u-o-Kapolei where the blossoms of the ma‘o looked golden in the sunlight, the sister sat down to make ma‘o leis for themselves. When the leis were made they went across the breadth of Kaupe‘a to Waipio. [*Ka Loea Kālai‘āina*, 22 July 1899:15; translation in Sterling and Summers 1978:7]

They stopped at the stream of Ka‘aimalu on the way to their home and the sister convinced her brother to share the fish between the two, thus breaking the *kapu*. "Because these children ate fish secretly, the spot is called Ka‘ai-malu (Secret eating) to this day" (Sterling and Summers 1978:7).

3.2.3 The Death of Kahahana at Hō‘ae‘ae

The association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu who was killed by his foster father, the Maui chief Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

E newa ai o hea make i ka la,	Go carefully lest you fall dead in the sun,
Akua noho la i Puuokapolei.	The god that dwells on Kapolei hill
E hanehane mai ana ka la i na	The sun is wailing on account of the
wahine o Kamao,	women of Kamao,
Akua pee,	A hiding god, blossoming
pua ohai o ke kaha,	*ohai* of the banks,
I walea wale i ke a-	Contented among the stones—
I ka ulu kanu a Kahai.	Among the breadfruit planted by Kahai.
Haina oe e ka oo— T	hou wast spoken of by the *oo*—
E ka manu o Kanehili.	By the bird of Kanehili.
[Fornander 1919:6:297]	

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association between wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919).

> Upon the arrival here at O‘ahu of Kahekili, Kahahana fled, with his wife Kekuapoi, and friend Alapa‘i, and hid in the shrubbery of the hills. They went to Āliamanu, Moanalua, to a place called Kinimakalehua; then moved along to Keanapua‘a, and Kepo‘okala, at the lochs of Pu‘uloa, and from there to upper Waipi‘o; thence to Wahiawā, Helemano, and on to Līhu‘e; thence they came to Po‘ohilo, at Honouliuli, where they first showed themselves to the people and submitted themselves to their care.
>
> While they were living there, report thereof was made to Kahekili, the King, who thereupon sent Kekuamanoha, elder brother of Kekuapoi, the wife of Kahahana, with men in double canoes from Waikiki, landing first at Kupahu, Hanapouli, Waipio, with instructions to capture and put to death Kahahana, as also his friend Alapa‘i, but to save alive Kekuapoi. When the canoes touched at Hanapouli, they proceeded thence to Waikele and Hoaeae, and from there to Poohilo, Honouliuli, where they met in conference with Kahahana and his party. At the close of the day Kekuamanoha sought by enticing words to induce his brother-in-law to go up with him and see the father King and be assured of no death condemnation, and by skilled flattery he induced Kahahana to consent to his proposition; whereupon preparation was made for the return. On the following morning, coming along and

> reaching the plains of Hoaeae, they fell upon and slew Kahahana and Alapa‘i there. [Fornander 1919:6:304]

Through deceit, Kahahana was induced to leave Po‘ohilo, Honouliuli and was killed on the plains of Hō‘ae‘ae (Thrum 1907:213–214).

3.2.4 The Traveling Mullet of Honouliuli

The story of (Ka) Ihuopala‘ai is also associated with the tradition of the *‘anae-holo* or traveling mullet (Thrum 1906:270–272):

> The home of the anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopalaai. They make periodical journeys around to the opposite side of the island, starting from Puuloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai, and so on, around to the Koolau side, ending at Laie, and then returning by the same course to their starting point. [Thrum 1907:271]

In Thrum’s account, Ihuopala‘ai is a male who possesses a *kū‘ula*, or fish god, which supplied the large mullet known as *‘anae*. His sister lived in Lā‘ie and there came a time when there were no fish. She sent her husband to visit Ihuopala‘ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā‘ie.

This story is associated with a poetical saying documented by Mary Kawena Pukui (1983:145) about Honouliuli:

Ka i‘a hali a ka makani	The fish fetched by the wind.

Pukui explains, “The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong” (Pukui 1983:145).

3.2.5 *He Mo‘olelo Ka‘ao no Keaomelemele*

In recounting the legend of Keaomelemele, Moses Manu makes a reference to a *mo‘o* (supernatural water spirit or lizard) named Maunauna who lived above Līhu‘e (presumably at the landform of that name in extreme northern Honouliuli) and who was regarded as a bad lizard (Manu 2002:161).

3.2.6 Kanekua‘ana

Kanekua‘ana is a *kia‘i*, a guardian in the form of a *mo‘o*, of ‘Ewa that took care of the people that lived from Hālawa to Honouliuli. Even those who were not her descendants were cared for in times of need. When *i‘a* (fish) became scarce they would build a *waihau heiau* (a temple where hogs, bananas, and coconuts were sacrificed, but not human beings; a *heiau* for *mo‘o* spirits) and pray for Kanekua‘ana’s blessing. She would in turn, bless them with an abundance of *i‘a*.

> The *pipi* (pearl oyster)—strung along from Namakaohalawa to the cliffs of Honouliuli, from the *kuapa* fishponds of inland ‘Ewa clear out to Kapakule. That was the oyster that came in from deep water to the mussel beds near shore, from the channel entrance of Pu‘uloa to the rocks along the edges of the fishponds. They

> grew right on the *nahawele* mussels, and thus was this *i‘a* obtained. Not six months after the *hau* branches [that placed a *kapu* on these waters until the *pipi* should come in] were set up, the *pipi* were found in abundance—enough for all ‘Ewa—and fat with flesh. Within the oyster was a jewel (*daimana*) called a pearl (*momi*), beautiful as the eyeball of a fish, white and shining; white as the cuttlefish, and shining with the colors of the rainbow—reds and yellows and blues, and some pinkish white, ranging in size from small to large. They were of great bargaining value (*he waiwai kumuku‘ai nui*) in the ancient days, but were just ‘rubbish’ (*‘opala*) in ‘Ewa. [Kamakau 1991b:83]

The people were also blessed with many other *i‘a*, including *‘ōpae huna* (transparent shrimp), *‘ōpae kakala*, spiked shrimp, *nehu maoli* (anchovy), *nehu pala* (anchovy), *mahamoe*, and *‘okupe*. Some of these marine resources are no longer seen today (Maly and Maly 2003:60).

3.2.7 The First *‘Ulu* (Breadfruit) Brought from Kahiki

The chief Kaha‘i left from Kalaeloa, a coastal area in Honouliuli Ahupua‘a, for a trip to Kahiki. On his return to the Hawaiian Islands, he brought back the first breadfruit (Kamakau 1991a:110) and planted it near the waters of Pu‘uloa or “long hill,” now known as Pearl Harbor (Beckwith 1940:97).

3.2.8 Palila

In the *mo‘olelo* of the hero Palila, the famous warrior had a supernatural war club. He could throw the club a long distance, hang on to the end of it, and fly along the club’s path. Using this power, he touched down in several places in Honouliuli, Waipi‘o, and Waikele. One day he used his supernatural war club to carry himself to Ka‘ena Point at Wai‘ānae, and from there east across the district of ‘Ewa. Fornander writes,

> *Ha‘alele keia ia Ka‘ena, hele mai la a Kalena, a Pōhākea, Maunauna, Kānehoa, a ke kula o Keahumoa, nana ia ‘Ewa. Kū kēia i laila nānā i ke kū a ka ea o ka lepo i nā kānaka, e pahu aku ana kēia i ka la‘au palau aia nei i kai o Honouliuli, kū ka ea o ka lepo, nu lalo o ka honua, me he olai la, makau nā kānaka holo a hiki i Waikele. A hiki o Palila, i laila, e pa‘apu ana nā kānaka i ka nānā lealea a ke ‘li‘i o O‘ahu nei, oai o Ahuapau.*
>
> After leaving Ka‘ena, he came to Kalena, then on to Pōhākea, then to Manuauna [a peak in Honouliuli], then to Kānehoa [a peak in Honouliuli], then to the plain of Keahumoa [upland plain from Honouliuli to Waipi‘o] and looked toward ‘Ewa. At this place he stood and looked at the dust as it ascended into the sky caused by the people who had gathered there; he then pushed his war club toward Honouliuli. When the people heard something roar like an earthquake they were afraid and they all ran to Waikele. When Palila arrived at Waikele he saw the people gathered there to witness the athletic games that were being given by the king of O‘ahu, Ahupau by name. [Fornander 1918:142–143]

3.2.9 Kākuhihewa

The Hawaiian *ali‘i* (royalty) were also attracted to Honouliuli Ahupua‘a. One historical account of particular interest, appearing in the newspaper *Ke Au Hou*, refers to an *ali‘i* residing in Ko‘olina, to the west of the project area:

> Ko‘olina is in Waimānalo near the boundary of ‘Ewa and Wai‘ānae. This was a vacationing place for chief Kākuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko‘olina is not situated in the Waimānalo on the Ko‘olau side of the island but the Waimānalo in ‘Ewa. It is a lovely and delightful place and the chief, Kākuhihewa loved this home of his. [*Ke Au Hou* 13 July 1910 in Sterling and Summers 1978:41]

3.3 *Wahi Pana* (Storied Places)

Wahi pana are legendary or storied places of an area. These legendary or storied places may include a variety of natural or human-made structures. Oftentimes dating to the pre-Contact period, most *wahi pana* are in some way connected to a particular *mo‘olelo*, however, a *wahi pana* may exist without a connection to any particular story. Davianna McGregor outlines the types of natural and human-made structures that may constitute *wahi pana*:

> Natural places have mana, and are sacred because of the presence of the gods, the akua, and the ancestral guardian spirits, the ‘aumakua. Human-made structures for the Hawaiian religion and family religious practices are also sacred. These structures and places include temples, and shrines, or heiau, for war, peace, agriculture, fishing, healing, and the like; pu‘uhonua, places of refuge and sanctuaries for healing and rebirth; agricultural sites and sites of food production such as the lo‘i pond fields and terraces slopes, ‘auwai irrigation ditches, and the fishponds; and special function sites such as trails, salt pans, holua slides, quarries, petroglyphs, gaming sites, and canoe landings. [McGregor 1996:22]

As McGregor makes clear, *wahi pana* can refer to natural geographic locations such as streams, peaks, rock formations, ridges, offshore islands and reefs, or they can refer to Hawaiian land divisions such as *ahupua‘a* or *‘ili* (land division smaller than an *ahupua‘a*), and man-made structures such as fishponds. In this way, the *wahi pana* of Honouliuli tangibly link the *kama‘āina* of Honouliuli to their past. It is common for places and landscape features to have multiple names, some of which may only be known to certain *‘ohana* or even certain individuals within an *‘ohana*, and many have been lost, forgotten or kept secret through time. Place names also convey *kaona* (hidden meanings) and *huna* (secret) information that may even have political or subversive undertones. Before the introduction of writing to the Hawaiian Islands, cultural information was exclusively preserved and perpetuated orally. Hawaiians gave names to literally everything in their environment, including individual garden plots and *‘auwai* (water courses), house sites, intangible phenomena such as meteorological and atmospheric effects, *pōhaku* (rock, stone), *pūnāwai* (freshwater springs), and many others. According to Landgraf (1994), Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v).

3.3.1 Place Names of Honouliuli

Below in Table 1, *wahi pana* within Honouliuli Ahupua‘a are listed. The table displays the McAllister (1933) site number (if applicable), and identifies the place name, significance, and source. Figure 14 depicts the locations of *wahi pana* throughout Honouliuli Ahupua‘a. In-depth descriptions of prominent *wahi pana* follows.

Table 1. Place names with significance including McAllister site number (if available) and source

Site # (if available)	Place Name	Significance	Source
N/A	Awanui Gulch	Gulch located north of Pu‘u Pālailai	Sterling and Summers 1978
135	Enclosures	A number of enclosures sit inland from the old ranch house on the land of Kukuilua; leveled-off areas; the largest enclosure is 85 ft x 100 feet (ft) with low walls and facings; probably *kuleana* (land claim) sites	McAllister 1933
N/A	‘Ēkahanui Gulch	Gulch in Honouliuli; literally “large bird’s-nest fern”	Pukui et al. 1974
133	Heiau	A small enclosure said to be a *heiau* on a slight elevation in the gulch at the foot of Pu‘u Kanehoa; one of McAllister’s informants, Reiney, recalls old Hawaiians respecting the area; enclosure is approx. 25 ft x 30 ft; inside, walls are between 2-3 ft high with width ranging from 2-5 ft depending on the slope of the land; walls evenly faced with fill of smaller stones; site surrounded by lantana and thick grass; a few guava trees grow inside the *heiau*; possibly not a *heiau*, but a small enclosure	McAllister 1933
N/A	Honouliuli Stream	The stream passes through the eastern portion of project area and Honouliuli Taro Lands eventually drain into West Loch	USGS Orthoimagery aerial photographs 2005
N/A	Honouliuli Taro Lands	See Section 4.1.1.2	N/A
N/A	Kahe, Kahe Point	Beach park (approx. 4.5 acres), ideal for diving; close to Nānākuli Ahupua‘a; also known as Electric Beach as it is adjacent to the Hawaiian Electric Company Power Plant; literally means “flow”	Clark 2002

Site # (if available)	Place Name	Significance	Source
N/A	Kalaeloa (Barbers Point)	Regional park consisting of approx. 120 acres; formerly Barbers Point Naval Air Station, turned over to the state on 2 July 1999; literally meaning “long point,” probably named for the view of the point from the east (Diamond Head) end of Māmala Bay, from which it appears to be an extremely long point	Clark 2002
139	Kalanamaihiki Fishing Shrine (*ko‘a*)	Located at Kapapapuhi, Honouliuli; two large rough stones near the end of the small tongue of land that juts out opposite Laulaunui Island in West Loch; approx. 2.5 ft in size with six or seven smooth stones averaging 1 ft in size in a small pile adjoining the larger stones; entire site is covered in *‘ākulikuli* (general name for succulent plants)	McAllister 1933
N/A	Kalo‘i Gulch	Gulch in Honouliuli; literally “the taro patch”	Pukui et al. 1974
N/A	Kānehili	An *‘ili* extending south of project area to shoreline	Sterling and Summers 1978
N/A	Kapapapuhi Point	Translates to “the numerous eels”; a land section southeast of the project area; point located on West Loch	Pukui and Elbert 1986
N/A	Kaupe‘a	Plain; where ghosts wandered to catch night moths and spiders for food; extending from *wiliwili* (*Erythrina sandwicensis*; Hawaiian leguminous tree) trees of Kaupea to Kānehili	*Ke Au Hou*, 12 July 1911 in Sterling and Summers 1978
N/A	Ko‘olina	Beaches, man-made lagoons, private marina, gated community, and hotels; literally “delightful, lovely”	Clark 2002
N/A	Kualaka‘i	Area near Barbers Point; a spring here is called Hoaka-lei (“lei reflection”) because Hi‘iaka picked *‘ōhi‘a lehua* flowers here to make a lei (garland, wreath) and saw her reflection in the water; literally “Tethys” (a sea creature)	Pukui et al. 1974
N/A	Kupehau	Translates to “hibiscus canoe-rim,” this is an *‘ili* in the *mauka* section of Honouliuli Ahupua‘a	Pukui and Elbert 1986
N/A	Līhu‘e	Former land division near Schofield Barracks; literally “cold chill”	Pukui et al. 1974

Site # (if available)	Place Name	Significance	Source
N/A	Limaloa Gulch	Gulch located in Nānākuli; Limaloa is the name of a luckless lover in the Kamapua‘a legend; literally “long arm”	Pukui et al. 1974
N/A	Makaīwa Gulch	Gulch near Barbers Point; literally “mother-of-pearl eyes” (as an image)	Pukui et al. 1974
N/A	Mauna Kapu	Mountain in the Wai‘anae Range separating Nānākuli and Honouliuli forest reserves	Pukui et al. 1974
N/A	Maunauna	Hill in Honouliuli Ahupua‘a standing approx. 1,769 ft high; literally “mountain sent [on errands]”; the *mo‘olelo* behind this feature is of two servant *mo‘o* (lizard) who lived here and had no keepers to supply their needs	Pukui et al. 1974; Sterling and Summers 1978
N/A	Namo‘opuna	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2005
N/A	One‘ula	Beach park located in Honouliuli Ahupua‘a; literally “red sand”	Pukui et al. 1974
N/A	Pālehua	Land division, hill (elevation 2,566 ft), and road; literally “lehua flower enclosure”	Pukui et al. 1974
N/A	Palikea	Peak above Lualualei (approx. 3,098 ft high) in the Wai‘anae Mountains; literally “white cliff”	Pukui et al. 1974
N/A	Paupauwela	Northernmost *‘ili* within Honouliuli Ahupua‘a; near Wai‘anae Uka	Sterling and Summers 1978
N/A	Pili o Kahe	Land section; literally “clinging to Kahe”	Pukui et al. 1974
136	Platform	Located near Mauna Kapu on the ridge that divides ‘Ewa and Wai‘anae District	McAllister 1933
N/A	Pōhākea Pass	Mountain and pass (approx. 2,200 ft high) in Wai‘anae Mountains; from this point, Hi‘iaka saw by cloud omens that her *lehua* groves on Hawai‘i Island had been burned by her sister Pele, and that her friend Hōpoe had been turned to stone; this is where Ka-uhi brutally murdered his wife, Ka-hala-o-Puna, because he thought she had been defiled; literally “white stone” (*pōhā* is short for *pōhaku*, which means stone or rock)	Pukui et al. 1974

Site # (if available)	Place Name	Significance	Source
N/A	Pouilihale	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery aerial photographs 2005
N/A	Pu‘u Hāpapa	Literally translates to “rock stratum,” this mountain converges at the border of Honouliuli, Wahiawā, and Wai‘anae Districts	Sterling and Summers 1978
N/A	Pu‘u Kānehoa	Peak (approx. 2,728 ft high) in Honouliuli Ahupua‘a; named for native shrubs	Pukui et al. 1974
138	Pu‘u o Kapolei and Heiau	The stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side; formerly a rock shelter was on the *makai* side where Kamapua‘a is said to have lived with his grandmother; hill located in Honouliuli; Kamapua‘a, the pig-man demigod, established his grandmother as queen here after conquering most of O‘ahu	McAllister 1933; Pukui et al. 1974
N/A	Pu‘u Kapua‘i	Hill (approx. 1,047 ft high); literally “foot print hill”	Pukui et al. 1974
137	Pu‘u Kaua	*Heiau* located on the ridge, overlooking Nānākuli, as well as Honouliuli, at approx. height of 1,800 ft; most of the *heiau* stones were used for a cattle pen located on the sea side of the site; portion of the *heiau* not been cleared for pineapples has been planted in ironwoods; peak; literally “war hill” or “fort hill”; place where chiefs lived in ancient times; see Section 4.1.1.3 for an expanded account	McAllister 1933; Pukui et al. 1974
134	Pu‘u Ku‘ina Heiau	Aikukai, Honouliuli, located in a gulch at foot of Mauna Kapu; suggestion of a terrace is about all that remains; no idea of the size of the *heiau* or number of terraces can be obtained	McAllister 1933
N/A	Pu‘u Ku‘ua Heiau	Hill located in Honouliuli Ahupua‘a; Pele’s sister, Kapo, once left her flying vagina (*kohe lele*) there; literally “relinquished hill”	Pukui et al. 1974
N/A	Pu‘u Makakilo	Hill near Honouliuli Ahupua‘a; literally “observing eyes hill”	Pukui et al. 1974

Site # (if available)	Place Name	Significance	Source
N/A	Pu‘u Manawahua	Peak (approx. 2,401 ft high) located in Nānākuli Ahupua‘a; literally “great grief hill” or “nausea hill”	Pukui et al. 1974
N/A	Pu‘u Pālailai	Hill (approx. 492 ft high) located in ‘Ewa; literally “young lai fish hill”	Pukui et al. 1974
N/A	Waimānalo	Land division, road, gulch near Barbers Point; also the site of Chief Kākuhihewa’s home; literally “potable water”	Pukui et al. 1974

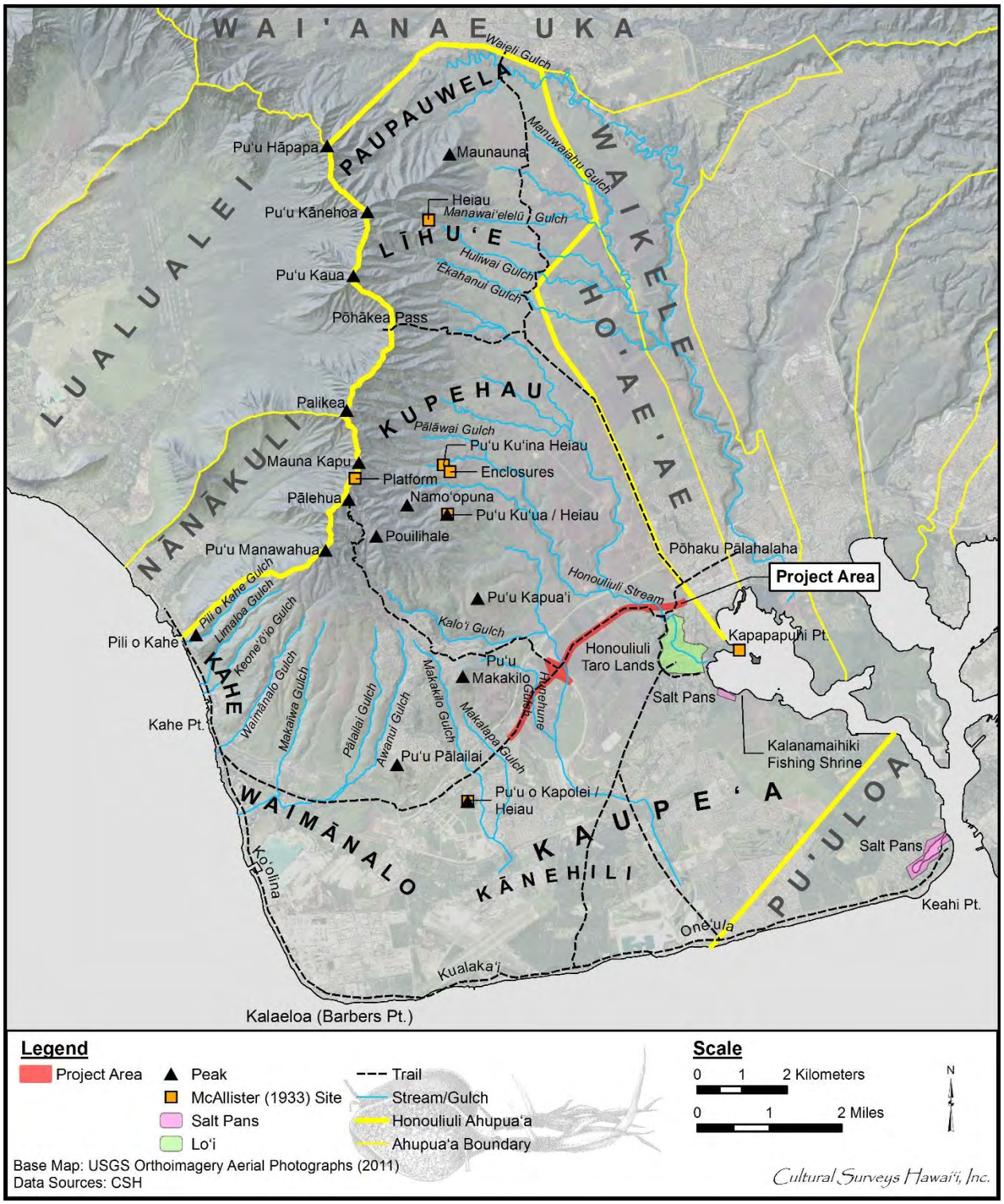

Figure 14. 2005 USGS Orthoimagery aerial photograph depicting project area with *wahi pana*

3.3.2 Pu‘uokapolei

Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor west to Wai‘anae (Sterling and Summers 1978:34). *Pu‘u* means “hill” and Kapolei means “beloved Kapo,” a reference to the sister of the Hawaiian volcano goddess, Pele.

As mentioned earlier in Section 3.1.4, Kamakau illustrates that Pu‘uokapolei and Kānehili were associated with wandering souls. This association is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu, who was killed by his father, Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

Go carefully lest you fall dead in the sun,	*E newa ai o hea make i ka lā,*
The god that dwells on Kapolei hill.	*Akua noho la i Pu‘uokapolei.*
The sun is wailing on account of the women of Kamao,	*E hanehane mai ana ka lā i nā wahine o Kamao*,
A hiding god, blossoming *‘ohai* of the banks,	*Akua pe‘e, pua ‘ohai o ke kaha*,
Contented among the stones-	*I walea wale i ke a-*
Among the breadfruit planted by Kahai.	*I ka ulu kanu a Kahai*.
Thou hast spoken of by the *oo-*	*Haina ‘oe e ka oo-*
By the bird of Kānehili.	*E ka manu o Kānehili.*

[Fornander 1919:6(2):297]

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association with wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919:6 [2]:304).

Pukui (1983:180) offers this Hawaiian saying, which places the wandering souls in a *wiliwili* grove at Kaupe‘a.

The *wiliwili* grove of Kaupe‘a	*Ka wiliwili of Kaupe‘a*.

In ‘Ewa, O‘ahu. Said to be where homeless ghosts wander among the trees.

Beckwith (1970:154) has stressed that “the worst fate that could befall a soul was to be abandoned by its ‘aumakua and left to stray, a wandering spirit (kuewa) in some barren and desolate place.” These wandering spirits were often malicious, so the places where they wandered were avoided.

In a chant by Hi‘iaka, the sister of the Hawaiian volcano goddess, Pele, several place names in ‘Ewa are mentioned as Hi‘iaka travels from Pu‘uokapolei toward the ‘Ewa coast. In the chant, Hi‘iaka is moving downhill from Kaupe‘a, probably the plains adjacent to Pu‘uokapolei, toward the coast, to the plains of Kānehili. The chant also refers to Pe‘e-kaua, which may be a variation of Kau-pe‘e or Kaupe‘a. Hi‘iaka sang this bitter chant addressed to Lohi‘au and Wahine‘ōma‘o,

and it uses the association of the Plains of Kaupe‘a as a place for the wandering of lost souls. The name Kānehili also refers to wandering, as the word *hili* means “to go astray” (Emerson 1915:162).

Ku‘u aikana i ke awa lau o Pu‘uloa,

Mai ke kula o Pe‘e-kaua, ke noho oe,

E noho kaua e kui, e lei i ka pua o ke kauno‘a,

I ka pua o ke akuli-kuli, o ka wili-wili;

O ka iho‘na o Kau-pe‘e i K-hili,

Ua hili au; akahi no ka hili o ka la pomaika‘i;

E Lohiau ipo, e Wahine-oma‘o,

Hoe ‘a mai ka wa‘a i a‘e aku au.

We meet at Ewa’s leaf-shaped lagoon, friends;

Let us sit, if you will on this lea

And bedeck us with wreaths of Kauno‘a,

Of akuli-kuli and wili-wili,

My soul went astray in this solitude;

It lost the track for once, in spite of luck,

As I came down the road to Kau-pe‘a.

No nightmare dream was that which tricked my soul.

This way, dear friends; turn the canoe this way;

Paddle hither and let me embark.

[Emerson 1915:167–168]

Samuel Kamakau says that ancient Hawaiians also used Pu‘uokapolei as an astronomical marker to designate the seasons:

> . . . the O‘ahu people who reckoned the time (*O‘ahu po‘e helu*) called the season Kau [summer] for the setting of the sun from Pu‘uokapolei, a hill in Honouliuli, ‘Ewa, to the opening of Mahinaona (*i ke kawaha o Mahinaona*). When the sun moved south from Pu‘uokapolei—and during the season of the sun in the south—for the coming of coolness and for the sprouting of new buds on growing things—the season was called Ho‘oilo [winter, rainy, season]. [Kamakau 1976:14]

A *heiau* was once on Pu‘uokapolei, but it had been destroyed by the time of McAllister’s (1933:108) survey of the island in 1930. The hill was used as a point of solar reference or as a place for such observations (Fornander 1919:6[2]:297). Pu‘uokapolei may have been regarded as the gate of the setting sun, just as the eastern gate of Kumukahi in Puna is regarded as the gate of the rising sun; both places are associated with the Hawaiian goddess Kapo (Emerson 1915:41). This somewhat contradicts some Hawaiian cosmologies, in which Kū was the god of the rising

sun, and Hina, the mother of Kamapua‘a, was associated with the setting of the sun. Fornander (1919:6[2]:292) states that Pu‘uokapolei may have been a jumping off point associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill.

A ceremony commemorating the changing of the seasons is still observed each year in the beginning of May at Waikīkī and Honouliuli. This ceremony was documented in a previous cultural impact assessment conducted by CSH (Genz et al. 2012). Sam ‘Ohukani‘ōhi‘a Gon III, Na Wa‘a Lalani Kahuna O Pu‘u Kohola, and the late Kumu Hula John Keola Lake’s *hula hālau* (hula instruction) perform *‘oli* and *hula*, explaining that the *kilo hōkū* (astronomers) of O‘ahu observed how, from the perspective of Waikīkī, the sun sets in a southerly direction over the ocean during the winter solstice and in a northerly direction behind the ‘Ewa ridgeline during the summer solstice. During the springtime, the position of the setting sun marches steadily northward each day, and at the beginning of May, the sun sets behind Pu‘uokapolei, perfectly centered within its depression from the vantage point of Kūpalaha Heiau just west of the Waikīkī Aquarium. A coinciding ceremony at a *heiau* on Pu‘uokapolei similarly views the setting of the sun behind Pu‘ula‘ila‘i farther west, and a line of sight extending eastward from Pu‘ula‘ila‘i, Pu‘uokapolei, and the former site of Kūpalaha Heiau ends at the closely associated Papa‘ena‘ena Heiau. Mr. Gon suggests Papa‘ena‘ena Heiau may have been part of the ceremonies of this astronomical event.

3.3.3 Plains of ‘Ewa

Portions of the ‘Ewa plains were understood as the plains of Kaupe‘a, the plains of Pukaua, and the plains of Keahumoa.

3.3.3.1 The Plain of Kaupe‘a

Several places on the ‘Ewa coastal plain are associated with *ao kuewa*, the realm of the homeless souls (see Section 3.1.4 and Section 3.3.2). Pukui (1983:180) offers this Hawaiian saying, which places the wandering souls in a *wiliwili* grove at Kaupe‘a.

> *‘Ōlelo No‘eau* #1666
>
> *Ka wiliwili o Kaupe‘a.*
>
> The *wiliwili* grove of Kaupe‘a
>
> In ‘Ewa, O‘ahu. Said to be where homeless ghosts wander among the trees.

Beckwith (1970:154) has stressed that “the worst fate that could befall a soul was to be abandoned by its *‘aumakua* (family or personal gods) and left to stray, a wandering spirit (*kuewa*) in some barren and desolate place.” These wandering spirits were often malicious, so the places where they wandered were avoided.

3.3.3.2 The Plains of Pukaua

The Hawaiian language newspaper *Ka Loea Kālai‘āina* (13 January 1900) relates that near Pu‘uokapolei, on the plain of Pukaua, on the *mauka* side of the road, there was a large *pōhaku* (rock). This *mo‘olelo* suggests the plain around Pu‘uokapolei was called Pukaua. The *mo‘olelo* is as follows:

> If a traveler should go by the government road to Waianae, after leaving the village of gold, Honouliuli, he will first come to the plain of Puu-ainako and when that is passed, Ke-one-ae. Then there is a straight climb up to Puu-o-Kapolei and there look seaward from the government road to a small hill. That is Puu-Kapolei. . . You go down some small inclines, then to a plain. This plain is Pukaua and on the mauka side of the road, you will see a large rock standing on the plain . . . There were two supernatural old women or rather peculiar women with strange powers and Puukaua belonged to them. While they were down fishing at Kualaka‘i [near Barbers Point] in the evening, they caught these things, ‘a‘ama crabs, pipipi shellfish, and whatever they could get with their hands. As they were returning to the plain from the shore and thinking of getting home while it was yet dark, they failed for they met a one-eyed person [bad omen]. It became light as they came near to the plain, so that passing people were distinguishable. They were still below the road and became frightened lest they be seen by men. They began to run—running, leaping, falling, sprawling, rising up and running on, without a thought of the ‘a‘ama crabs and seaweeds that dropped on the way, so long as they would reach the upper side of the road. They did not go far for by then it was broad daylight. One woman said to the other, ‘Let us hide lest people see us,’ and so they hid. Their bodies turned into stone and that is one of the famous things on this plain to this day, the stone body. This is the end of these strange women. When one visits the plain, it will do no harm to glance on the upper side of the road and see them standing on the plain. [*Ka Loea Kālai‘āina*, 13 January 1900, translation in Sterling and Summers 1978:39]

In another version of this story, the two women met Hi‘iaka as she journeyed toward the ‘Ewa coast. The women were *mo‘o* (supernatural beings) and were afraid that Hi‘iaka would kill them, so they changed into their lizard form. One of the lizards hid in a little space on a stone beside the coastal trail, and the other hid nearby (*Ka Hōkū o Hawai‘i*, 15 February 1927, translated in Maly 1997:19). From that time on the stone was known as “Pe‘e-kāua,” meaning “we two hidden.” Hi‘iaka greeted the two women but did not harm them, and passed on.

When she reached Pu‘uokapolei, she also greeted two old women who lived at an *‘ohai* (*Sesbania tomentosa*) grove on the hill. These women were named Pu‘uokapolei and Nāwahineokama‘oma‘o (*Ka Hōkū o Hawai‘i*, 22 February 1927, translated in Maly 1997:19). As she continued her travels, she looked to the ocean and saw the canoe carrying Lohi‘au:

Ku‘u kāne i ke awa lau o Pu‘uloa	My man on the many harbored sea of Pu‘uloa
Mai ke kula o Pe‘ekāua ke noho	As seen from the plain of Pe‘ekāua
E noho kāua i ke kaha o ka ‘ōhai	Let us dwell upon the *‘ōhai* covered shore
I ka wiliwili i ka pua o ka lau noni	Where the *noni* blossoms are twisted together
O ka ihona i Kānehili la	Descending along Kānehili
Ua hili ho‘i au-e	I am winding along.

[*Ka Hōkū o Hawai‘i*, 22 February 1927, translated in Maly 1997:20]

3.3.3.3 The Plains of Keahumoa

In several *mo‘olelo* of ‘Ewa, mention is made of the "plain of Keahumoa." John Papa ‘Ī‘ī (1959:96) has this plain opposite the trail to Pōhākea Pass, stretching across the *ahupua‘a* of Honouliuli and Hō‘ae‘ae. McAllister (1933:107) states the plain was west of Kīpapa Gulch in Waikele; it is also mentioned in the *mo‘olelo* of Waipi‘o. Thus, this is probably a general name for the flat plain *mauka* of the productive floodplain area directly adjacent to Pearl Harbor.

According to the Hi‘iaka legend, the goddess passed through ‘Ewa and met women stringing *ma‘o* (Hawaiian cotton; *Gossypium tomentosum*) flowers to make *lei* (garland). Hi‘iaka offered a chant, making known her desire to wear this *lei* around her own neck. Keahumoa is mentioned in the chant:

E lei ana ke kula o Ke‘ahumoa i ka ma‘o	The plains of Keahumoa are garlanded with *ma‘o*
‘Ohu‘ohu wale nā wāhine kui lei o ka nahele	The *lei*-stringing women of the forest are festively adorned

[Ho‘oulumahiehie 2008a:268; 2008b:287]

3.3.4 *Nā Ala Hele* (Trails)

John Papa ‘Ī‘ī described a network of Leeward O‘ahu *ala hele* (trails), which in historic times encircled and crossed the Wai‘anae Range, allowing passage from Lualualei to Honouliuli by three different trails (‘Ī‘ī 1959:96-98). The following description of the trails is provided by ‘Ī‘ī:

> The trail went down to the stream and up again, then went above the taro patches of Waiau, up to a makai field, to Waimano, to Manana, and to Waiawa; then to the stream of Kukehi and up to two other maika [ancient Hawaiian game suggesting bowling] fields, Pueohulunui and Haupuu. At Pueohulunui was the place where a trail branched off to go to Waialua and down to Honouliuli and on to Waianae. As mentioned before, there were three trails to Waianae, one by way of Pu‘u o Kapolei, another by way of Pohakea, and the third by way of Kolekole. [‘Ī‘ī 1959:97]

The cross-*ahupua‘a* (east-west) trail that skirted Pearl Harbor, passed north of Pu‘uokapolei, and continued along the coast to Wai‘anae, is depicted in an 1825 map of the South Coast of O‘ahu by Charles Malden of the British ship, the *Blonde* (Figure 15). The trail generally follows the route of the modern Farrington Highway. Malden's 1825 map also shows a *mauka-makai* (north-south) trail with two spurs that extend from the cross-*ahupua‘a* (east-west) trail to settlements at the coast.

3.3.5 *Ka-lua-ōlohe* (Caves) of Honouliuli

‘Ewa was famous for the many limestone caves that had formed in the uplifted coral. Some of these caves, called "*ka-lua-ōlohe*" were inhabited by the *ōlohe*, also known as Ha‘a people who are said to have arrived during the fifth period of the *Kumulipo* (origin, genesis) (Beckwith 1940:343). According to Beckwith,

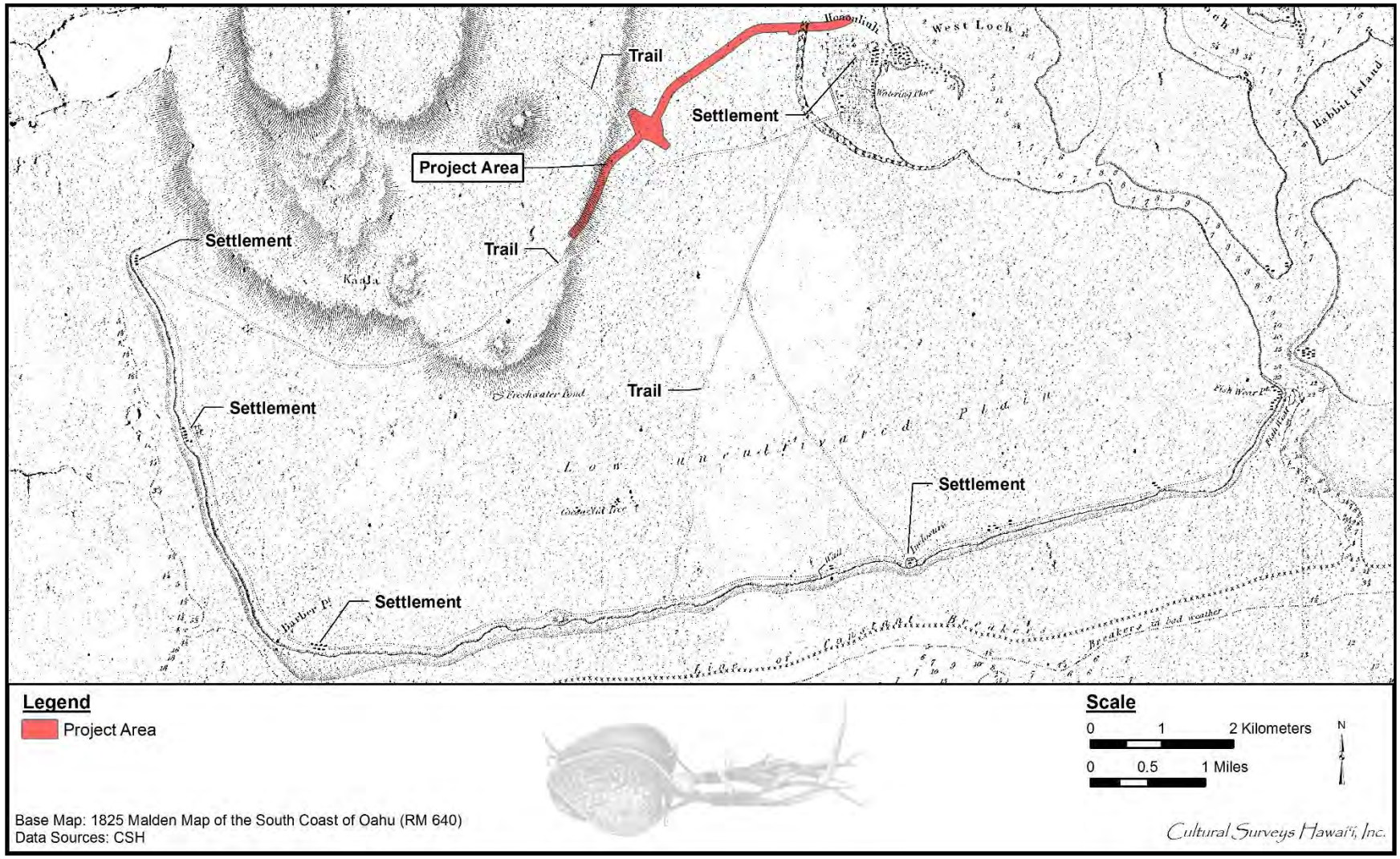

Figure 15. 1825 Malden map of the southern coast of O'ahu with project area; note the faint lines from West Loch stretching northwest, west, and south depict ancient foot trails

> Olohe, or Ha‘a people, were hence a well-recognized class in old days, skilled in wrestling and bone breaking (lua) and with their hairless bodies. It is said that they used to pull out their hair and smear their bodies with oil in order to give no hold to an antagonist [Beckwith 1940:343]

3.3.6 *Heiau*

Heiau were pre-Christian places of worship. Human-made structures utilized for religious purposes were also considered sacred sites or *wahi kapu*. Construction of some *heiau* were elaborate, consisting of large communal structures while others were simple earth terraces or shrines (McAllister 1933:8). *Heiau* are most commonly known to be where important ceremoies took place, and are large structures with platforms or altars comprised of one or more terraces (McAllister 1933:8). McAllister reports on two known *heiau* in the *ahupua‘a* of Honouliuli as well as two other sites that could have possibly been *heiau*. These *heiau* were located on Pu‘u Kuua, Pu‘u o Kapolei, at the foot of Pu‘u Kanehoa, and at the foot of Mauna Kapu (McAllister 1933).

3.3.6.1 Pu‘u o Kapolei Heiau

McAllister writes that the stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side. There was once a large rock shelter on the *makai* side said to have been the residence of Kamapua‘a and his grandmother (McAllister 1933:108). After conquering the majority of O‘ahu, he established his grandmother as queen of this *wahi* (place) (Pukui et al. 1974:203).

3.3.6.2 Pu‘u Ku‘ua Heiau

Pu‘u Ku‘ua Heiau located in Palikea, Honouliuli, overlooks both Honouliuli and Nānākuli, and is at the height of approximately 1,800 ft. Most of the stones from the *heiau* were used for a cattle pen located on the *makai* side of the site. The part of the *heiau* that hadn’t been cleared for pineapples has been planted in ironwoods (McAllister 1933:108)

3.3.6.3 Unidentified *Heiau* at the Foot of Pu‘u Kanehoa

Located at the foot of Pu‘u Kanehoa is a small inclosure thought to have possibly been a *heiau*. McAllister writes,

> My informant, Reiney, recalls the respect the old Hawaiians had for the place when he was punching cattle with them in his youth. It is a walled inclosure 2 by 3 feet. On the inside the walls are between 2 and 3 feet high, and on the outside they range from 2 to 5 feet, depending upon the slope of the land. On three sides the walls are 2 feet wide, but the fourth is 3 feet wide. The walls are evenly faced with a fill of smaller stones. At present the site is surrounded with a heavy growth of Lantana; but only a thick growth of grass and two small guava bushes are in the interior, which is most unusual unless human hands keep the interior clear. Possibly this is not a heiau but a small inclosure considered sacred for some reason. [McAllister 1933:107]

3.3.6.4 Unidentified *Heiau* at the Foot of Pu‘u Kuina

Located in Aikukai, Honouliuli, at the foot of Pu‘u Kuina what looked to be a terrace is all that remained when McAllister cataloged Site 134. He notes the inability to determine the size of the *heiau* or the number of terraces that once stood (McAllister 1933:107).

3.4 *‘Ōlelo No‘eau* (Proverbs)

3.4.1 Concerning Sharks

The eastern coast of Honouliuli Ahupua‘a lies adjacent to Pu‘uloa which has many *mo‘olelo* about sharks, particularly Ka‘ahupāhau, the queen shark of O‘ahu and the most famous guardian shark who lived in Pu‘uloa. Thus, Honouliuli is closely associated with shark *‘aumākua*. According to *mo‘olelo*, the *kama‘āina* of ‘Ewa were said to be protected by sharks. The shark was one of the many animal forms (*kinolau*) that *‘aumākua*, or ancestor gods, could take. The *‘aumākua* was a revered intercessor, providing the “closest man-with-god relationship” (Pukui et al. 1972:123). As Pukui et al. (1972) also note,

> For these deities had once been living beings; they were long departed ancestors become gods. From the long corridors of time the *‘aumākua* watched their descendants. And though they judged and punished, they were also special advocates and protectors. For *‘ohana* (family) loyalty continued into eternity. [Pukui et al. 1972:123]

The following *‘ōlelo no‘eau* are associated with sharks.

3.4.1.1 ***‘Ōlelo No‘eau* #105**

Alahula Pu‘uloa he alahele na Ka‘ahupāhau.

Everywhere in Pu‘uloa is the trail of Ka‘ahupāhau.

Said of a person who goes everywhere, looking, peering, seeing all, or of a person familiar with every nook and corner of a place. Ka‘ahupāhau is the shark goddess of Pu‘uloa (Pearl Harbor) who guarded the people from being molested by sharks. She moved about, constantly watching. [Pukui 1983:14]

3.4.1.2 ***‘Ōlelo No‘eau* #1014**

Ho‘ahewa na niuhi ia Ka‘ahupāhau.

The man-eating sharks blamed Ka‘ahupāhau

Evil-doers blame the person who safeguards the rights of others. Ka‘ahupāhau was the guardian shark goddess of Pu‘uloa (Pearl Harbor) who drove out or destroyed all the man-eating sharks. [Pukui 1983:108]

3.4.1.3 ***‘Ōlelo No‘eau* #2152**

Mehameha wale no o Pu‘uloa i ka hele a Ka‘ahupāhau.

Pu‘uloa became lonely when Ka‘ahupāhau went away

The home is lonely when a loved one has gone. Ka‘ahupāhau, guardian shark of Pu‘uloa (Pearl Harbor), was dearly loved by the people. [Pukui 1983:234]

3.4.1.4 ***‘Ōlelo No‘eau* #2111**

Make o Mikololou a ola i ke ale lo.

Mikololou died and came to life again through his tongue

Said of one who talks himself out of a predicament. [Pukui 1983:229]

3.4.2 Concerning the *Pipi* of Pu‘uloa

Pearl Harbor or Pu‘uloa, derived from the name Waimomi, or "water of the pearl," an alternate name for the Pearl River. The harbor was thus named after the *pipi* or pearl oysters of the family *Pteriidae* (mainly *Pinctada radiata*), which were once abundant on the harbor reefs and after which many *‘ōlelo no‘eau* were generated.

3.4.2.1 ***‘Ōlelo No‘eau* #1331**

Ka i‘a hāmau leo o ‘Ewa.

The fish of ‘Ewa that silences the voice.

The pearl oyster, which has to be gathered in silence. [Pukui 1983:144]

Handy and Handy (1972) offer a different interpretation: "The pipi was sometimes called ‘the silent fish,’ or, *‘i‘a hamau leo o ‘Ewa*,’ ‘Ewa's silent sea creature since the collectors were supposed to stay quiet while harvesting the shells" (Handy and Handy 1972:471).

3.4.2.2 ***‘Ōlelo No‘eau* #493**

Haunāele ‘Ewa i ka Moa‘e.

‘Ewa is disturbed by the Moa‘e wind.

Used about something disturbing, like a violent argument. When the people of ‘Ewa went to gather the *pipi*, they did so in silence, for if they spoke, a Moa‘e breeze would suddenly blow across the water, rippling it, and the oysters would disappear. [Pukui 1983:59]

3.4.2.3 ***‘Ōlelo No‘eau* #274**

E hāmau o makani mai auane‘i

Hush, lest the wind rise

Hold your silence or trouble will come to us. When the people went to gather pearl oysters at Pu‘uloa, they did so in silence, for they believed that if they spoke, a gust of wind would ripple the water and the oysters would vanish. [Pukui 1983:34]

3.4.2.4 ***‘Ōlelo No‘eau* #1357**

Ka i‘a kuhi lima o ‘Ewa.

The gesturing fish of ‘Ewa.

> The *pipi*, or pearl oyster. Fishermen did not speak when fishing for them but gestured to each other like deaf-mutes. [Pukui 1983:148]

3.4.3 Concerning the *‘Anaeholo* of Honouliuli

The *‘anaeholo* of Honouliuli is described in the following excerpt from which the *‘ōlelo no‘eau* below derives:

> The home of the ‘anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopala‘ai. They make periodical journeys around to the opposite side of the island, starting from Pu‘uloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kālia, Waikīkī, Ka‘alāwai, and so on, around to the Ko‘olau side, ending at Lā‘ie, and then returning by the same course to their starting point. [Nakuina 1998:271]

3.4.3.1 ***‘Ōlelo No‘eau* #1330**

> *Ka i‘a hali a ka makani*
>
> The fish fetched by the wind
>
> The *‘anaeholo*, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u, on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong. [Pukui 1983:145]

3.4.4 Concerning *Kalo*

A rare *kalo* called the “Kāī o ‘Ewa,” was grown in mounds in marshy locations in ‘Ewa (Handy and Handy 1972:471). The cultivation of this prized and delicious taro inspired the following saying.

3.4.4.1 ***‘Ōlelo No‘eau* #2770**

> *Ua ‘ai i ke kāī-koi o ‘Ewa.*
>
> He has eaten the *kāī-koi* taro of ‘Ewa
>
> *Kāī* is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of a youth or a maiden of ‘Ewa, who, like the *kāī* taro, is not easily forgotten. [Pukui 1983:305]

3.5 *Oli* (Chants)

Oli, according to Mary Kawena Pukui (Pukui 1995:xvi–xvii), are often grouped according to content. Chants often were imbued with *mana* (spiritual power); such *mana* was made manifest through the use of themes and *kaona*. According to Pukui, chants for the gods (prayers) came first, and chants for the *ali‘i*, “the descendants of the gods,” came second in significance. Chants “concerning the activities of the earth peopled by common humans,” were last in this hierarchy (Pukui 1995:xvi–xvii). Emerson conversely states,

> In its most familiar form the Hawaiians—many of whom [were lyrical masters]—used the oli not only for the songful expression of joy and affection, but as the vehicle of humorous or sarcastic narrative in the entertainment of their comrades.

> The dividing line, then, between the oli and those other weightier forms of the mele, the inoa, the kanikau (threnody), the pule, and that unnamed variety of mele in which the poet dealt with historic or mythologic subjects, is to be found almost wholly in the mood of the singer. [Emerson 1965:254]

While *oli* may vary thematically, subject to the perspective of the *ho‘opa‘a* (chanter), it was undoubtedly a valued art form used to preserve oral histories, genealogies, and traditions, to recall special places and events, and to offer prayers to *akua* and *‘aumākua* alike. Perhaps most importantly, as Alameida (1993:26) writes, “chants . . . created a mystic beauty . . . confirming the special feeling for the environment among Hawaiians: their *one hānau* (birthplace), their *kula iwi* (land of their ancestors).”

3.5.1 Oli for Kūali‘i

A chant for the chief Kūali‘i, an ancient chief of O‘ahu, mentions the *ahupua‘a* names of the ‘Ewa District including Honouliuli Ahupua‘a. Each phrase usually contains a play on words, as the place name and one meaning of the word, or portion of the word, appears on each line, for example, “*kele*” in Waikele means “slippery.” However, these word plays are not necessarily related to the actual place name meanings of the *ahupua‘a*.

Uliuli ka poi e piha nei—o Honouliuli;	Blue is the *poi* [pounded taro] which appeases [the hunger] of Honouliuli;
Aeae ka paakai o Kahuaiki—Hoaeae;	Fine the salt of Kahuaike—Hoaeae;
Pikele ka ia e Waikele—o Waikele;	Slippery the fish of Waikele—Waikele;
Ka hale pio i Kauamoa—o Waipio;	The arched house at Kauamoa—Waipio;
E kuu kaua i ka loko awa—o Waiawa;	Let us cast the net in the *awa*-pond—of Waiawa;
Mai hoomanana ia oe—o Manana.	Do not stretch yourself at—Manana.
He kini kahawai,	Many are the ravines,
He lau kamano—o Waimano;	Numerous the sharks, at Waimano;
Ko ia kaua e ke au—o Waiau;	We are drawn by the current of Waiau;
Kukui malumalu kaua—Waimalu;	In the *kukui* grove we are sheltered—in Waimalu;
E ala kaua ua ao-e—o Kalauao;	Let us arise, it is daylight—at Kalauao;
E kipi kaua e ai-o Aiea;	Let us enter and dine-at Aiea;
Mai hoohalawa ia oe—O Halawa.	Do not pass by—Halawa.

[Fornander 1917:400–401]

A chant for the Kaua‘i chief of Kaumuali‘i, a rival of Kamehameha I, also mentions place names of the ‘Ewa District. In a portion of this chant, the wind that blows from one end of ‘Ewa to the other is compared to love.

3.5.2 The Splendor of Kānehoa

Pu‘u Kānehoa is mentioned in the following *hula* chant.

Mele Ku-pe‘e	Anklet Song
Aala kupukupu ka uka o Kane-hoa	Fragrant the grasses of high Kanehoa.
E ho-a!	Bind on the anklets, bind!
Hoa na lima o ka makani, he Wai- kaloa.	Bind with finger deft as the wind
He Wai-kaloa ka makani anu Lihue.	That cools the air of this bower.
Alina lehua i kau ka opua-	Lehua blooms pale at my flower,
Ku‘u pua,	O sweet heart of mine,
Ku‘u puai‘ini e ku-i a lei.	Bud that I'd pluck and wear in my wreath.
Ina ia oe ke lei ‘a mai la.	If thou wert but a flower!

[Emerson 1965:49]

A similar chant is found in the Legend of Pamano, which mentions the *kupukupu* (sword fern; *Nephrolepis exaltata*), a fragrant flowering shrub.

Aala kupukupu ka uka o Kanehoa la!	The uplands of Kanehoa are scented with *kupukupu*.
Hoa! Hoa na lima o ka makani Waikoloa,	Bind on, the hands of the Waikoloa wind are binding,
He Waikoloa ka makani anu, o Lihue,	The Waikoloa wind is the cold wind of Lihue [Honouliuli],
Weli no loha ka uka o Waiopua la,	Withering the branches in the uplands of Waiopua,
Kuu pua i i ai e kui e lei,	My flower I said I would string into garlands.
I na ia oe ke lei ia ala	If you have it, you would have worn it.

[Fornander 1919:5(2):310–311]

3.5.3 Paupauwela and Līhu‘e

Paupauwela (also spelled Popouwela) is the name of the land area in the extreme *mauka* section of Honouliuli Ahupua‘a. The land area of Līhu‘e is just *makai* of this land, and extends into the *ahupua‘a* of Waipi‘o (adjacent to the eastern border of Honouliuli). Both place names are

mentioned in a chant recorded by Abraham Fornander (1917), which was composed as a *mele* for the O‘ahu king, Kūali‘i, as he was preparing to battle Kuiaia, the chief of Wai‘anae:

Ihea, ihea la ke kahua,	Where? Where is the battle field
Paio ai o ke koa-a?	Where the warrior is to fight?
I kai i kahua i Kalena,	On the field of Kalena,
I Manini, i Hanini	At Manini, at Hanini,
I ninia i ka wai akua,	Where was poured the water of the god
I ko hana i Malamanui	By your work at Malamanui;
Ka luna o Kapapa, i Paupauwela,	On the heights of Kapapa, at Paupauwela,
I ka hilinai i ke kalele,	Where they lean and rest;
Ka hala o Halahalanui maauea,	At the *hala* trees of indolent Halahalanui,
E kula ohia ke Pule-e,	At the *ohia* grove of Pule-e
Ke ‘kua o Lono o Makalii	The god of Lono, of Makalii
Ka lala aalao Ukulonoku,	The fragrant branch of the Ukulonoku,
No Kona paha, no Lihue.	Mayhap from Kona, from Lihue,
No ka la i Maunauna,	For the day at Maunauna

[Fornander 1917:384–385]

3.6 *Mele* (Songs)

There exist a few *mele* that concern or mention Honouliuli. These particular *mele* may also be classified as *mele wahi pana* (songs for legendary or historic places). *Mele wahi pana* such as those presented here may or may not be accompanied by *hula* (dance) or *hula wahi pana* (dance for legendary or historic places). As the Hula Preservation Society notes,

> Hula Wahi Pana comprise a large class of dances that honor places of such emotional, spiritual, historical, or cultural significance that chants were composed for them. Only the composers of the chants could know the deepest meanings, as they would be reflections of their feelings and experiences . . . Since the subjects of Wahi Pana compositions are extremely varied, their implementation through hula are as well. Coupled with the differences from one hula style and tradition to the next, Hula Wahi Pana can be exceptionally diverse. They can be done sitting or standing, with limited body movement or wide free movement; with or without the use of implements or instruments; with the dancers themselves chanting and/or playing an implement or being accompanied by the *ho‘opa‘a* [drummer and *hula* chanter (memorizer)]. Beyond the particular hula tradition, what ultimately

determines the manner in which a Hula Wahi Pana is performed are the specific place involved, why it is significant, the story being shared about it, and its importance in the composer's view. [Hula Preservation Society 2014]

3.6.1 Mele for Kūali‘i

The icy winds of Honouliuli are also noted in a *mele* for the high king Kūali‘i. In this *mele*, the cold winds of Kumomoku and Leleiwe, near Pu‘uloa in Honouliuli are compared unfavorably to the god Kū:

Aole i like Ku.	Not like these are thou, Ku
Ia ua hoohali kehau,	[Nor] the rain that brings the land breeze,
Mehe ipu wai ninia la,	Like a vessel of water poured out.
Na hau o Kumomoku;	Nor to the mountain breeze of Kumomoku,
Kekee na hau o Leleiwi,	[The] land breeze coming round to Leleiwi.
Oi ole ka oe i ike	Truly, have you not known?
I ka hau kuapuu	The mountain breezes, that double up your back,
Kekee noho kee, o Kaimohala,	[That make you] sit crooked and cramped at Kaimohala,
O Kahili i Kaupea-la	The Kahili at Kaupea?
Aole i like Ku	Not like these are thou, Ku

[Fornander 1917:4(2):390–391]

3.6.2 Eia mai Au ‘o Makalapua

This particular *mele* pays homage to the royal train called *Lanakila*. In paying homage to this train, the *mele* also pays homage to its most honored and well-known passenger, Queen Lili‘uokalani. This *mele* may also be understood as a protest song.

In analyzing this *mele*, cultural historian Kīhei de Silva notes that "Eia mai Au ‘o Makalapua" is the second of three chants that make up *hō‘alo i ka ihu o ka Lanakila* (Three Train Chants for Lili‘uokalani). He adds that these songs, "when considered in chronological succession . . . add a Hawaiian dimension to the story of B.F. Dillingham's Oahu Railway and Land Company (OR&L), a story that otherwise reads far too much like an early script of *How the West was Won*" (de Silva 2003). De Silva provides a chronology of Benjamin Franklin (B.F.) Dillingham's rise to influence within Hawaiian political spheres, and his eventual founding and construction of the OR&L line. Dillingham also figures prominently within Honouliuli Ahupua‘a (see Section 4.3.4). Dillingham's personal history is described by de Silva as follows:

- Arrived in Honolulu in 1865 as first mate of the *Whistler*.
- He promptly fell off a horse and broke his leg. When his ship left without him, he took a job as a clerk in a hardware store.

- 20 years later, in 1885, he had become Hawai‘i’s first big-time land speculator, buying and leasing vast tracts of property in West O‘ahu in hopes of reselling it to housing and ag. interests.
- When no one, in fact, took interest in his largely inaccessible property, he decided to build a railroad through it.
- In 1888, Dillingham convinced Kalākaua to sign a franchise giving him three years to build a line running from Honolulu to the far end of Pearl River Lagoon. His critics called it ‘Dillingham’s Folly,’ but Dillingham boasted that he would put his railroad into operation by Sept. 4, 1889, his 45th birthday.
- Things did not go well in the early months of construction, and in order to fulfill this boast, Dillingham had to fire up a miniscule saddle-tank engine named *Kauila*, hitch it to a flatcar that carried his passengers on jury-rigged seats, and send it bucking, wheezing, and spewing greasy foam down a mile-and-a-half of track that ended in the rice paddies of Pālama.
- Despite this farcical beginning, the construction of Dillingham’s railroad then proceeded in rather impressive fashion: the line was opened to ‘Aiea in November 1889, to Mānana in January 1890, to Honouliuli and ‘Ewa Mill in June and July 1890, to Wai‘anae in July 1895, to Waialua in June, 1898, and to Kahuku in January 1899. [de Silva 2003]

In 1890, as construction of the railway moved forward, B.F. Dillingham bought and shipped to Hawai‘i a passenger coach named *The Pearl* and a locomotive named *General Valleho.* According to de Silva (2003), the *Pearl* was built in San Francisco and was “paneled in rich woods and outfitted with plush chairs, velvet drapes, electric lights, a kitchen, a lānai with a striped canvas awning, and a new-fangled contraption called a flush toilet.” The *General Valleho* was renamed the *Lanakila* by Dillingham:

> … [He] gave it the number 45, a tribute to his 45th birthday boast and erstwhile victory in the rice paddies of Pālama. The Lanakila became Dillingham’s 4th locomotive—after the Kauila, Leahi, and Ka‘ala—and for many years it was regarded as the most attractive engine in the OR&L stable. Dillingham apparently wasted no time in hitching the Pearl to the Lanakila and using the pair as his wine-‘em and dine-‘em celebrity train, the vehicle in which he wooed financial and political support for his business ventures. [de Silva 2003]

As part of Dillingham’s plans to woo the influential, he invited King Kalākaua on the inaugural ride on the *Lanakila*. Dillingham also insisted the luxury coach *Pearl* serve as the king’s own royal car. De Silva (2003) notes it is “safe for us to assume that Queen Lili‘u[okalani] rode in the Pearl when the *Lanakila* took her on the train rides.” With the opening of the Ewa Mill station, Queen Lili‘uokalani once again embarked on a journey on the *Lanakila*; this particular journey took her through “the lowlands of Honouliuli, and finally to the exposed coral plain of Pōlea on which the ‘Ewa Mill Station was located” (de Silva 2003).

Eia mai au ‘o Makalapua	Here I am, Makalapua
Hō‘alo i ka ihu o ka Lanakila.	Traveling where the *Lanakila* goes.
‘O ke ku‘e a ka hao a i Kūwili	The piston works at Kūwili

Ka hiona ‘olu a‘o Hālawa.	And down the pleasant descent of Hālawa.
Ua lawa ka ‘ikena i ke awalau	Satisfying is the view of the lochs
Iā ‘Ewa ka i‘a hāmau leo.	Of ‘Ewa, ‘land of the silent fish.’
Ua piha ka uahi a i Mānana	The smoke rises at Mānana
Aweawe i ke kula o Waipi‘o.	And streams along at Waipi‘o.
I kai ho‘i au a Honouliuli	Then I reached the lowlands of Honouliuli
Ahuwale ke ko‘a o Pōlea.	Where the corals of Pōlea lie exposed.
Ha‘ina ‘ia mai ana ka puana	This is the conclusion of the song
Hō‘alo i ka ihu a ka Lanakila.	Of traveling where the *Lanakila* goes.

[de Silva 2003]

De Silva (2003) provides a remarkable breakdown of this *mele*, delving into the subtext to reveal another layer of understanding, of *kaona*:

> ‘Makalapua’ shares . . . the sense of awesome efficiency and harmony . . . These are apparent in ‘Makalapua’s’ description of the working of the train’s piston at Kūwili, in the rising and billowing of steam at Mānana and Waipi‘o, and especially in the sense of speed with which the mele whisks us from Honolulu to Pōlea in the space of its six, two-line verses. Efficiency and harmony, however, are not at the heart of ‘Makalapua;’ it is inspired and driven, instead, by *aloha ‘āina*—love for the land—and by *kū‘ē ho‘ohui ‘āina*—resistance to annexation. In my reading of the mele, the dominant imagery is that of flower-stringing. The train and track serve as the contemporary equivalent of lei needle and thread; with them, Lili‘u sews a series of beloved place-names and place-associations into a lei of adornment and protection for Ke-awalau-o-Pu‘uloa. Keawalauopu‘uloa, the many-harbored sea of Pu‘uloa, is the old name for Pearl Harbor. The cession of Pearl Harbor to America in return for sugar reciprocity was one of the hottest political issues of ‘Makalapua’s’ day. Lili‘u was absolutely opposed to any Keawalau deals; her brother, on the other hand, had regularly waved this bait at the American nose; he was even rumored, on his Nov. 1890 departure to San Francisco, to have harbored a hidden Pearl Harbor agenda. The key lines of ‘Makalapua’ are ‘Ua lawa ka ‘ikena i ke awalau / Iā ‘Ewa ka i‘ā hāmau leo . . . I kai ho‘i au a Honouliuli / Ahuwale ke ko‘a o Pōlea.’ In my reading, these lines say: ‘We hold to our knowledge of Keawalau, we are like its closed-mouthed pipi, its oysters; we will never give up the pearl that we contain; here at the shoreline of Honouliuli we normally silent fish reveal this deeply held conviction.’ [de Silva 2003]

Section 4 Traditional and Historical Accounts

4.1 Pre-Contact to Early Post-Contact Period

4.1.1 Settlement Patterns of Honouliuli

Archaeological and traditional sources show a general pattern of three main areas of settlement within Honouliuli Ahupua‘a—the coastal zone, the Honouliuli taro lands, and the inland settlement at Pu‘u Ku‘ua.

4.1.1.1 The Coastal Zone (Kalaeloa, Barbers Point)

Archaeological research at Barbers Point has focused on the areas in and around the Deep Draft Harbor (Barrera 1975; Davis and Griffin 1978; Hammatt and Folk 1981). Series of small clustered shelters, enclosures, and platforms show limited but recurrent use at the shoreline zone for marine-oriented exploitation. This settlement covers much of the shoreline, with more concentrated features around small marshes and wet sinks. Immediately behind the shoreline, under a linear dune deposit, is a buried cultural layer believed to contain some of the earliest habitation evidence in the area.

The attraction of the area to early Hawaiians may have been the plentiful and easily exploited bird population. Particular evidence for the taking of petrel occurs at State Inventory Historic Places (SIHP) # 50-80-12-2763 (Hammatt and Folk 1981). Initial heavy exploitation of nesting seabirds and other species, in conjunction with habitat destruction, may have contributed to some avian extinctions.

There is some indication of limited agriculture in mulched sinkholes and limited soil areas. Considering the lack of rainfall, this activity would have been limited, but probably involved tree crops and roots (sweet potatoes). The archaeological content of the sites indicates a major focus on marine resources.

Davis and Griffin (1978) distinguish functional classes of sites based on surface area size and argue that the Barbers Point settlement consists of functionally integrated, multi-household residence groups. Density contours of midden (by weight) and artifacts (by numbers) plotted for residence sites by Hammatt and Folk (1981) generally indicate narrowly defined spatial foci of discard, possibly indicating continuous use, or at least with no refurbishing or additions to the structures over time. The focus is small habitation sites, typically lacking the full range of features found in large permanent residence complexes such as high platforms, complex enclosures, and conspicuous ceremonial sites.

4.1.1.2 The Honouliuli Taro Lands

Centered around the west side of Pu‘uloa at Honouliuli Stream and its broad outlet into the West Loch are the rich irrigated lands of the *‘ili* of Honouliuli, which give the *ahupua‘a* its name. The major archaeological reference to this area is Dicks et al. (1987), who documented remnants of a once widespread wetland system consisting of *lo‘i* (irrigated terrace) and fishponds, as well as dryland cultivation of the adjacent slopes (Figure 16).

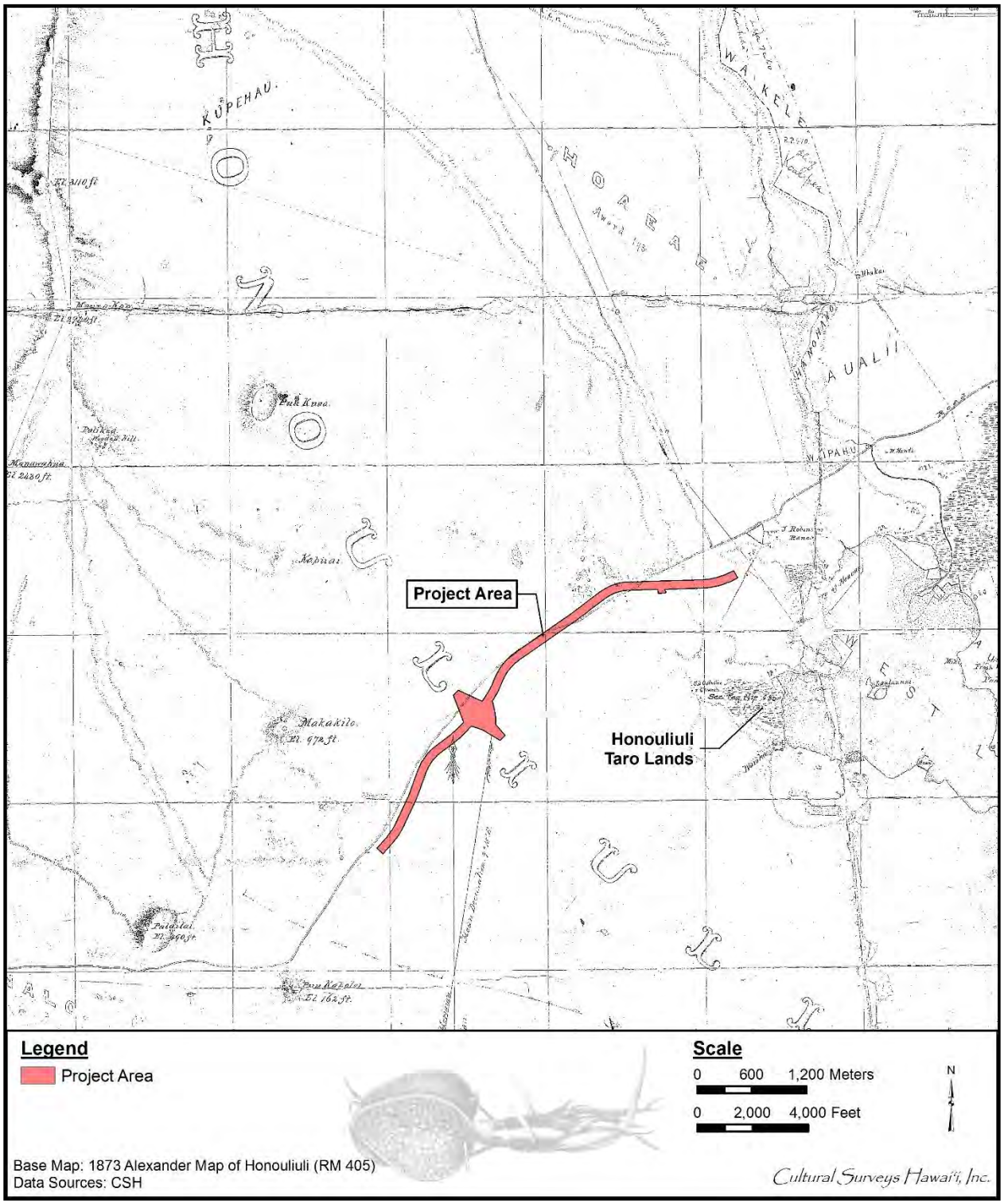

Figure 16. 1873 Alexander map of Honouliuli depicting project area; note the Honouliuli Taro Lands lie to the southeast of the project area

According to Carol Silva’s “Historic Research Relative to the Land of Honouliuli” (in Dicks et al. 1987), the Honouliuli area bordering West Loch was clearly a major population center, a logical response to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomlands suitable for wetland taro cultivation. The earliest detailed map by Malden (from 1825) shows all the roads of southwest O‘ahu coalescing and descending the *pali* (cliff) as they funnel into the area of Honouliuli Village. Dicks et al. (1987:78–79) conclude on the basis of 19 carbon isotope dates and three volcanic glass dates that “agricultural use of the area spans over 1,000 years.” Undoubtedly, Honouliuli was a locus of habitation for thousands of Hawaiians. ‘Ewa was also famous for a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marshy locations (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

> *Ua ‘ai i ke kāī-koi o ‘Ewa.*
>
> He has eaten the Kāī-koi taro of ‘Ewa.
>
> Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it.
>
> Said of a youth of a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

According to Handy and Handy (1972), the irrigated lowlands were suitable for wetland taro cultivation, as well as the lower forest area of the mountain slopes for the procurement of forest resources. The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges with steep sides, but a very gradual increase of altitude. The lower part of the valley sides were excellent for cultivating yams and bananas. Farther inland grew the *‘awa* (*Piper methysticum*; kava) for which the area was famous (Handy and Handy 1972:429).

In addition, breadfruit, coconuts, *wauke* (*Broussonetia papyrifera*; paper mulberry), bananas, *olonā* (*Touchardia latifoldia*), and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (*Pipturus* spp.).

4.1.1.3 Pu‘u Ku‘ua: Inland Settlement

Documentation of inland settlement in Honouliuli Ahupua‘a is more problematic in that there are relatively few documented archaeological sources. However, it is probable the area around Pu‘u Ku‘ua, on the east side of the Wai‘anae Ridge, 7 miles inland of the coast, was a place of some importance for Hawaiians.

In 1899, the Hawaiian newspaper *Ka Loea Kalaiaina* relates a story of Pu‘u Ku‘ua as “a place where chiefs lived in ancient times” and a “battle field,” “thickly populated.” The article summarizes that “this place was entirely deserted and left uninhabited and it seems that this happened before the coming of righteousness to Hawai‘i Nei. Not an inhabitant is left” and that “the descendants of the people of this place were so mixed that they were all of one class. Here the gods became tired and returned to Kahiki” (Sterling and Summers 1978:33).

McAllister recorded three sites in this area, two *heiau* (Site 134, Pu‘u Kuina, and Site 137, Pu‘u Ku‘ua; both destroyed) and a series of enclosures in Kukuilua which he calls “kuleana sites” (McAllister 1933:107). On the opposite side of the Wai‘anae range, Cordy states “Kākuhihewa

was said to have built (or rebuilt) Nīoi‘ula, a po‘okanaka [sacrificial] heiau (1,300 sq. m.) in Hālona in upper Lualualei, along the trail to Pōhākea Pass leading into ‘Ewa, circa A.D. 1640-1660" (Cordy 2002:36). There is no direct archaeological evidence available to the authors' knowledge that intensive Hawaiian settlement occurred here, but it is considered as a place of high probability, based on the above indications. John Papa ‘Ī‘ī (1959) described a journey that Liholiho took which led him and an entourage through inland Honouliuli and over Pōhākea Pass. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources.

4.1.2 ‘Ewa as a Political Center

There are many documented references to chiefs residing in ‘Ewa and to its being a political center in the past. These include oral accounts of chiefs and chiefesses recorded by noted Hawaiian historian Samuel Kamakau that date back to at least the twelfth century. He tells us that,

> The chiefs of Līhu‘e, Wahiawā, and Halemano on O‘ahu were called lō ali‘i. Because the chiefs at these places lived there continually and guarded their kapu [taboo, prohibition], they were called lō ali‘i [from whom a ‘guaranteed' chief might be obtained, loa‘a]. They were like gods, unseen, resembling men. [Kamakau 1991b:40]

By the early 1300s, ‘Ewa along with Kona and Ko‘olaupoko were the dominant political districts ruled by the sons of a chief named Māweke. It was during this time that the ‘Aha Ali‘i (council of chiefs) was also established (Cordy 2002:21). ‘Ewa at this time included the traditional districts of ‘Ewa, Wai‘anae, and Waialua (Fornander 1996:48). Around AD 1400, ‘Ewa was ruled by the *ali‘i* (chief, ruler) La‘akona of the senior Māweke-Kumuhonua genealogy and was recognized as the overall ruler of O‘ahu. Chiefs in this genealogy reigned until about AD 1520-1540, with their major royal center in Līhu‘e (Cordy 2002:24). Haka, the last chief of the Māweke-Kumuhonua line to hold this position, was deposed and slain by his men at the fortress of Waewae near Līhu‘e (Fornander 1996:88; Kamakau 1991a:54).

Then, with Haka being deposed as Ali‘i Nui (high chief), the ‘Aha Ali‘i chose Mā‘ilikūkahi, an Ali‘i Kapu (ruler of best bloodline) of the junior Māweke-Mō‘īkeha line. Mā‘ilikūkahi was born at Kūkaniloko and was to be the new Ali‘i Nui of O‘ahu. After Mā‘ilikūkahi's dedication at the *heiau* of Kapukapuākea (Site 225; McAllister 1933:140) in central Waialua, there was a shift in political centers from ‘Ewa to Kona *moku*, specifically Waikīkī. However, Mā‘ilikūkahi did keep a presence in Līhu‘e. During this time, he instituted an explicit land division and administration structure. O‘ahu was divided into six *moku*—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olauloa, and Ko‘olaupoko—that were further divided into 86 *ahupua‘a* and smaller territorial units (Kirch 2010:84-90). In reference to the productivity of the land and the population during Mā‘ilikūkahi's reign, Kamakau writes,

> In the time of Mā‘ili-kūkahi, the land was full of people. From the brow, lae, of Kulihemo to the brow of Maunauna in ‘Ewa, from the brow of Maunauna to the brow of Pu‘ukea [Pu‘u Ku‘ua] the land was full of chiefs and people. From Kānewai to Halemano in Wai‘alua, from Halemano to Paupali, from Paupali to Hālawa in ‘Ewa the land was filled with chiefs and people. [Kamakau 1991b:55]

The picture presented here is that the whole *moku* of ‘Ewa was one of prosperity and productivity in the land and its people.

According to Cordy (2002:31), the period following Mā‘ilikūkahi, specifically AD 1600-1700, was the peak of power for the O‘ahu Kingdom during the “times of these famed O‘ahu rulers: Kala‘imanuia (1600-1620), Kākuihihewa (1640-1660), Kūali‘i (1720-1740), and Peleioholani (1740-1779).” Power shifted among the chiefs of different districts until Kākuhihewa reunited the O‘ahu kingdom under one rule. He went on to become one of the famed rulers of O‘ahu and also held a residence in Kailua, Ko‘olaupoko (Cordy 2002:31-33). Generations later, his descendent Kūali‘i achieved control of all of O‘ahu by defeating the O‘ahu district chiefs and expanding his control on the windward side of Kaua‘i. Peleiōholani was called to be the regent for his nephew following the death of Kapiho‘okalani, the heir of Kūali‘i. Peleiōhōlani later assumed control of O‘ahu and later conquered parts of Moloka‘i. “By 1778, the O‘ahu Kingdom stretched across O‘ahu, to parts of Kaua‘i” (Cordy 2002:31).

‘Ewa continued to be a political center until the eighteenth century when Kahahana, the nephew of Peleiōhōlani who was raised in the court of the Maui chief Kahekili, was appointed to be chief of O‘ahu. Kahahana was defeated by Kahekili and the Maui army shortly after the *kahuna* (priest, sorcerer) Ka‘opulupulu and his son were slain at Pu‘uloa and Wai‘anae respectively, which according to Cordy occurred about 1783 (Cordy 2002:36; Thrum 1907:203–214). Kahahana’s father, ‘Elani, along with other O‘ahu chiefs, plotted to kill Kahekili and his chiefs who were residing at Kailua, O‘ahu, as well as his chiefs residing in ‘Ewa and Waialua. The plot was discovered by Kahekili and a messenger was sent to warn Hū‘eu, another O‘ahu chief, who was at Waialua. For some reason, the messenger never reached Hū‘eu and he and his retinue were killed. Kahekili avenged the death of Hū‘eu by pillaging and destroying the districts of Kona and ‘Ewa. It is said that the streams of Makaho and Niuhelewai in Kona, as well as Hō‘ae‘ae in ‘Ewa were choked with the bodies of the slain (Fornander 1996:290).

‘Ewa and Waikīkī remained political centers and favorite playgrounds for the chiefs of Kona, and ‘Ewa until Kou (old name for Honolulu, used until about 1800) was established as a center for trade of foreign goods (Pukui et al. 1974:117). With the battle of Nu‘uanu in 1895 and the subsequent unification of the Hawaiian Islands by Kamehameha I, Hawai‘i began its national history. As attention shifted to Kou which had a deep enough harbor for ships to pull in and anchor, this place became the center of activity and royalty moved away from the outer districts toward the center of commerce. Archibald Campbell writes about O‘ahu in 1809, “In consequence of this, and of the facility with which fresh provisions can be procured, almost every vessel that navigates the North Pacific puts in here to refit. This is probably the principal reason why the king has chosen it as his place of residence” (Campbell 1967:109–110).

Despite this shift in political importance, ‘Ewa is depicted as an abundant and populated land where chiefs of distinguished lineages were born and resided. The land was fertile and well fed by mountain streams that helped sustain the agricultural lifestyle needed to support the chiefs, their households, and their people. An examination of the place names reveals that water was a very important factor in this district. Six of the 12 *ahupua‘a* names begin with *wai*, the Hawaiian word for water (Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu). The fact that there were so many fishponds in the ‘Ewa District and in the Pu‘uloa area, more than any other district on

O‘ahu, indicates that agricultural and aquacultural intensification was a direct link to the political history and also to the increasing needs of the population.

4.1.3 Observations of Honouliuli from Early Explorers

The first mission station in ‘Ewa was established in 1834 at Kalua‘aha near Pearl Harbor. Charles Wilkes, of the U.S. Exploring Expedition, visited the missionary enclave at Honouliuli town in 1840:

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them . . . The natives have made some advance in the arts of civilized life; there is a sugar-mill which, in the season, makes two hundred pounds of sugar a day . . . In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop’s church. [Wilkes 1970:80–81]

Early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Honouliuli Ahupua‘a indicate that prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

The earliest detailed maps of the area show no substantial habitation closer to the project area than the western edge of West Loch, in the vicinity of Kapapapuhi Point (Hō‘ae‘ae Point on modern maps). The 1825 Malden map documents substantial settlement at the “Honouliuli Taro Lands” west of Kapapapuhi Point, and it seems clear that in early historic times, this was the population center for Honouliuli Ahupua‘a (Dicks et al. 1987). The amenities of that area, such as fishponds, taro *lo‘i*, shellfish collecting, and salt drying would have focused population there in pre-Contact times. Perhaps because of the significance of this *‘ili*, Honouliuli was also applied to the entire *ahupua‘a*.

Among the first historic accounts of Honoululi was one written by Captain Vancouver when he sailed by Kalaeloa (Barbers Point) in 1792 and recorded his impression of the small coastal village of Kūalaka‘i and the arid Honouliuli coast.

> The point is low flat land, with a reef round it . . . Not far from the S.W. point is a small grove of shabby cocoa-nut trees, and along these shores are a few struggling fishermen’s huts. [Vancouver 1798:1:167]

> . . . from the commencement of the high land to the westward of Opooroah [Pu‘uloa], was composed of one very barren rocky waste, nearly destitute of verdure, cultivation or inhabitants, with little variation all the way to the west point of the island . . . [Vancouver 1798:2:217]

> This tract of land was of some extent but did not seem to be populous, nor to possess any great degree of fertility; although we were told that at a little distance from the sea, the soil is rich, and all necessaries of life are abundantly produced. [Vancouver 1798, Vol. III:361–363]

Archibald Campbell, an English seaman who was given some land in Waimano Ahupua‘a by King Kamehameha in 1809, described his land around Pearl Harbor:

> In the month of November the king was pleased to grant me about sixty acres (ac) of land, situated upon the Wymummee [traditional Hawaiian name for Pearl River], or Pearl-water, an inlet of the sea about twelve mi to the west of Hanaroora [Honolulu] . . . We passed by footpaths, winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for the taro beds. Where there was not water, the land was under crops of yams and sweet potatoes. [Campbell 1967:103–104]
>
> Pearl and mother-of-pearl shells are found here in considerable quantity. Since the king has learned of their value, he has kept the fishing to himself, and employs divers for the purpose. [Campbell 1967:114–115]

4.2 Mid-Nineteenth Century

4.2.1 The Māhele

In the mid-nineteenth century, during the time of Kamehameha III, a series of legal and legislative changes were brought about in the name of “land reform” (Chinen 1958; Chinen 1971). Following the enactment of the Organic Acts of 1845 and 1846, the concept of private land ownership was introduced and all land in the Hawaiian Kingdom was divided into three main types: government (or Crown) land; *ali‘i* lands; and commoner lands, which *maka‘āinana* (commoner) could in principle obtain in fee simple, following passage of the Kuleana Act in 1850. This act allowed *maka‘āinana* to own land parcels at which they were currently and actively cultivating and/or residing. Of the hundreds of thousands of acres set aside as potential *kuleana* parcels (land claims by *maka‘āinana*) only about 10,000 claimants ultimately obtained some 30,000 acres, while 252 chiefs, for example, divided up about a million acres, leaving most Hawaiians disenfranchised.

In 1848, the crown and the *ali‘i* received their land titles. The common people began to receive their *kuleana* parcels in the beginning of 1850. During the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III. The 72 *kuleana* awards given to commoners were almost all made adjacent to Honouliuli Gulch, most within the “Honouliuli Taro Lands,” which contained fishponds and irrigated taro fields (Tuggle and Tomonari-Tuggle 1997:34). No *kuleana* claims were made for land within the current study area. However, there were several claims in the vicinity of the project area, specifically, near Honouliuli Stream.

In 1855, the Land Commission awarded all of unclaimed lands in Honouliuli, (43,250 acres), to Miriam Ke‘ahikuni Kekau‘ōnohi (Royal Patent 6971, LCA 11216), granddaughter of Kamehameha I and the heir of Kalanimōkū. Kalanimōkū had been given the land by Kamehameha after the conquest of O‘ahu (Kame‘eleihiwa 1992; Waihona ‘Aina 2000). Kekau‘ōnohi was one of Liholiho’s (Kamehameha II’s) wives. After his death, she lived with her half-brother, Luanu‘u Kahalai‘a, who was governor of Kaua‘i (Kelly 1985:21). Subsequently, Kekau‘ōnohi ran away with Queen Ka‘ahumanu’s stepson, Keli‘iahonui, and then became the wife of Chief Levi Ha‘alelea. Upon her death on 2 June 1851, all her property passed to her husband and his heirs. In

1863, the owners of the *kuleana* lands deeded their lands back to Ha‘alelea to pay off debts owed to him (Frierson 1972:12). In 1864, Ha‘alelea died and his second wife, Anadelia Amoe, transferred ownership of the land to her sister’s husband, John Coney.

Table 2 displays Land Commission Awards (LCA) awarded in the vicinity of the project area. Details include LCA number, claimant, *‘ili*, and a brief description of the parcels (if available). Figure 17 depicts the project area and LCA parcels found in the vicinity.

Table 2. Land Commission Awards in the vicinity of the project area

LCA Number	**Claimant**	***‘Ili***	**Notes**
831	Kaekuna	Poohilo	*‘Āpana* (parcel) 2: House lot *‘Āpana* 3: Not available *‘Āpana* 4: Not available
834	Oni	Poohilo, Kailikahi	*‘Āpana* 2: Loko Kumuulio
847	Hinaa	Poohilo	*‘Āpana* 1: *Mo‘o‘āina* (land parcel) *‘Āpana* 2: *Kahua hale* (house foundation or site) called Aihonu
848	Kapule	Poohilo	*‘Āpana* 4: *Loko* (fishpond) *‘Āpana* 5: *Kula ‘āina* (plain) of banana
911	Kauhailepa	Poohilo	*‘Āpana* 1: Four *lo‘i* (irrigated terrace) and a small strip of *kula* *‘Āpana* 2: One *lo‘i*
1570	Kekua	Poohilo	*‘Āpana* 1: One *lo‘i* and *kula* called Aihonu *‘Āpana* 2: One *lo‘i* called Haaleluunui

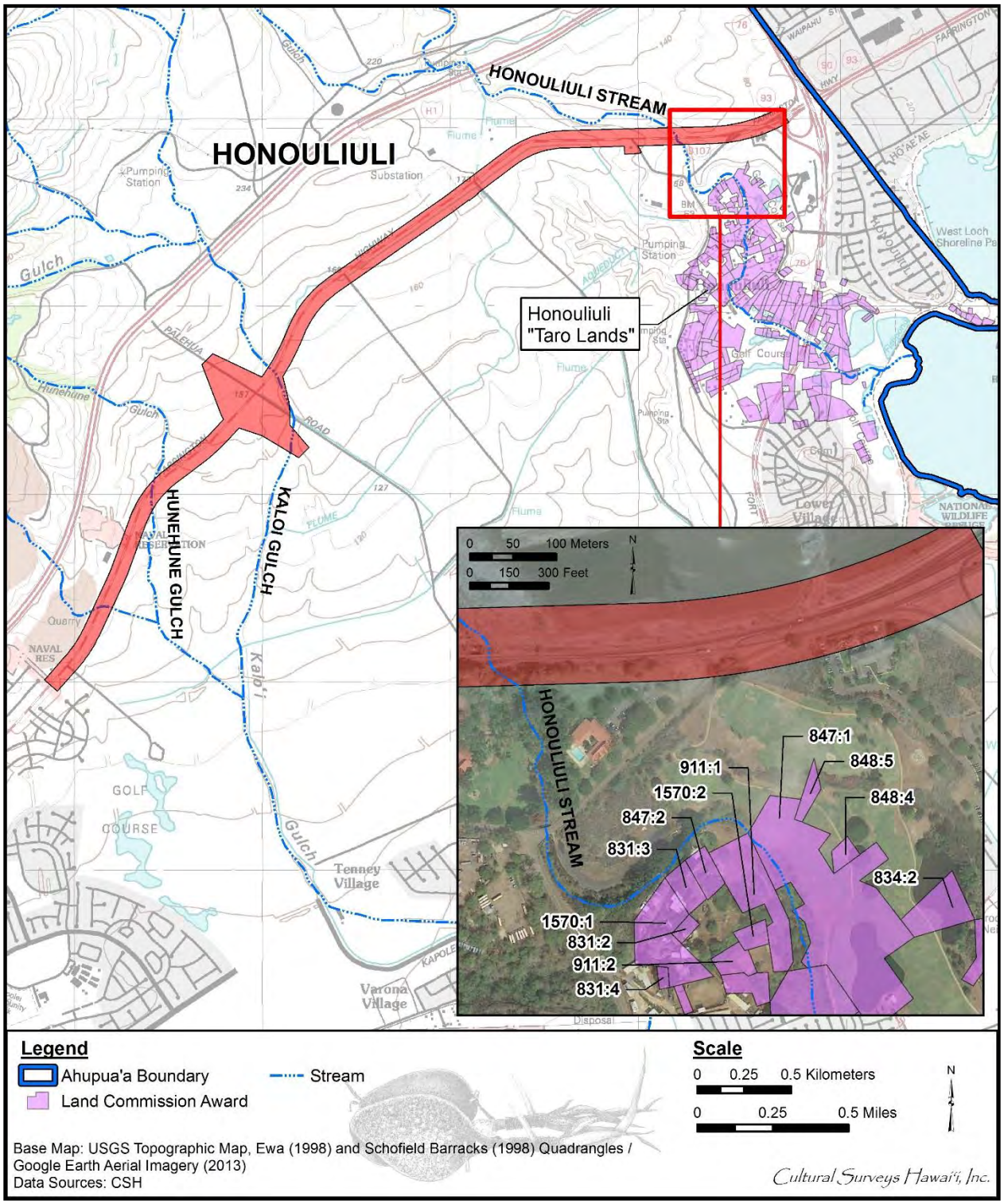

Figure 17. Portion of 1998 Ewa and Schofield Barracks USGS topographic quadrangles, depicting project area with Land Commission Awards in the vicinity

4.3 Late-Nineteenth Century to Present

Much of the *mauka* lands in western Honouliuli including ridges and deep gulches were unsuitable for commercial sugar cultivation and remained pastureland for grazing livestock. By 1920, however, many of the lands of Honouliuli were used for commercial sugarcane cultivation (Frierson 1972:18). By 1919, a reservoir had been established just south of Pālehua Road. In the late 1920s, the main residential communities were at the northeast edge of the ‘Ewa Plain. The largest community was still at Honouliuli Village. ‘Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese school. Additional settlement was in Waipahu, centered on the Waipahu Sugar Mill, operated by the Oahu Sugar Company. Historic maps of the Makakilo area indicate a lack of any other significant development in the area into the 1940s.

4.3.1 Early Ranching on the ‘Ewa Plain

John Coney rented land to James Dowsett and John Meek in 1871, who used it for cattle grazing. In 1877 this land in Honouliuli, except for the *‘ili* of Pu‘uloa, was sold to James Campbell for $95,000. Campbell then drove away 32,237 head of cattle belonging to Dowsett, Meek, and James Robinson, and constructed a fence around the outer boundary of his property (Bordner and Silva 1983: C-12). He let the land rest for one year and then began to restock the ranch, so that he had 5,500 head after a few years (Dillingham 1885 in Frierson 1972:14).

In 1880-81, the Honouliuli ranch was described as follows:

> . . . acreage, 43,250, all in pasture, but possessing fertile soils suitable for agriculture; affords grazing for such valuable stock. The length of this estate is no less than 18 mi. It extends to within less than a mi of the sea coast, to the westward of the Pearl River inlet . . . There are valuable fisheries attached to this estate . . . [Bowser 1880:489]
>
> From Mr. Campbell’s veranda, looking eastward, you have one of the most splendid sights imaginable. Below the house there are two lochs, or lagoons, covered with water fowl, and celebrated for their plentiful supply of fish, chiefly mullet . . . Besides Mr. Campbell’s residence, which is pleasantly situated and surrounded with ornamental and shade trees, there are at Honouliuli two churches and a school house, with a little village of native huts. [Bowser 1880:495]

In 1881, a medical student, touring the island to provide smallpox vaccinations to the population, viewed Campbell’s property, called the Honouliuli Ranch:

> I took a ride over the Honouliuli Ranch which is quite romantic. The soil is a deep, reddish loam, up to the highest peaks, and the country is well-grassed. Springs of water abound. The ilima, which grows in endless quantities on the plains of this ranch, is considered excellent for feeding cattle; beside it grows the indigo plant, whose young shoots are also good fodder, of which the cattle are fond. Beneath these grows the manieizie grass, and Spanish clover and native grasses grow in the open; so there is abundant pasturage of various kinds here. As I rode, to the left were towering mountains and gaping gorges; ahead, undulating

> plains, and to the right, creeks and indentations from the sea. A wide valley of fertile land extends between the Nuuanu Range and the Waianae Mountains and thence to the coast of Waialua. There are many wild goats in this valley, which are left more or less undisturbed because they kill the growth of mimosa bushes, which would otherwise overrun the country and destroy the pasturage for cattle. [Briggs 1926:62–63]

Most of Campbell's lands in Honouliuli were used exclusively for cattle ranching. At that time, one planter remarked "the country was so dry and full of bottomless cracks and fissures that water would all be lost and irrigation impracticable" (Ewa Plantation Company 1923:6–7). In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water. The well, drilled to a depth of 240 ft near Campbell's home in ‘Ewa, resulted in "a sheet of pure water flowing like a dome of glass from all sides of the well casing" (*The Legacy of James Campbell* in Pagliaro 1987:3). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource.

4.3.2 Other Enterprises on Campbell Lands

As noted above, part of Mr. Campbell's lands were also used to grow rice. These rice fields were planted in former taro fields or in undeveloped swamps (Figure 18). The rice fields in 1882 were described by Frank Damon, during a tour of the area:

> Towards evening we reached Honouliuli, where the whole valley is leased to rice planters . . . This was one of the largest rice plantations we visited. Sometimes two or three men only, have a few fields which they cultivate for themselves, and we often too came upon houses where there were eight or ten men working their own land. But the larger plantations are owned by merchants in Honolulu, who have a manager acting for them . . . [Damon 1882:37]

In 1890, Dillingham leased all land below 200 ft to William Castle, who used most of it for sugarcane, but also leased some for rice cultivation, pasture, wood lots, bee-keeping, garden crops, and quarries. Some land above 650 ft was also leased for the cultivation of canaigre, an herbal source of tannin used in leather production (Frierson 1972:15–16).

An additional agricultural trial was conducted in the Honouliuli area for the cultivation of sisal, a plant used to make fibers for rope and other material. Some sisal was planted before 1898 and production continued until the 1920s (Frierson 1972:16). This was grown mainly on the coastal plain of Honouliuli in Kānehili, just *mauka* of Kualaka‘i Beach (now Nimitz Beach).

Into the early twentieth century, some Hawaiian families continued to live in Honouliuli and preserve the traditional lifestyle, including at the fishing village of Kūalaka‘i. One resident, Mrs. Eli Williamson, recalled,

> In the Honouliuli area the train stopped among the *kiawe* (algaraboa) trees and *malina* (sisal) thickets. We disembarked with the assorted food bundles and water containers. Some of the Kualaka‘i *‘ohana* (family) met us to help carry the *‘ukana* (bundles) along a sandstone pathway through the *kiawe* and *malina*. The distance to the frame house near the shore seemed long. When we departed our *‘ukana* contained fresh lobsters, *limu* (seaweed), fish and *i‘a malo‘o* (dried fish) . . . [Williamson in Kelly 1985:160]

Figure 18. Photo of rice fields in Honouliuli Ahupua‘a (Hawai‘i State Archives n.d.)

4.3.3 Pineapple Cultivation

In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation (Figure 19). There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893. Later attempts were made in Waiawa and Honouliuli. James Dole founded the Hawaiian Pineapple Company in 1901. The previous year, Dole had purchased 61 acres of land in Wahiawa for growing pineapple. Prior to 1913, most of the upland plateau areas in Waiawa were planted in pineapple (Goodman and Nees 1991:59) and small plots along gullies, those not appropriate for sugarcane cultivation, in several ‘Ewa *ahupua‘a* were planted in pineapple. Many of these small plots were cultivated by independent farmers, who sold the crops at markets or to larger companies. In 1901, the Hawaiian Pineapple Company acquired 61 acres in Waiawa through public auction. Initially, most pineapple was shipped to California for packing. In an attempt to speed up processing, save money, and produce a fresher product, a cannery was constructed in Waiawa. This cannery was constructed by the Pearl City Fruit Company but became a part of the Hawaiian Pineapple Company operations after the Pearl City Fruit Company went bankrupt. The cannery was in operation from 1905 to 1935.

4.3.4 The Oahu Railway and Land Company (OR&L)

In 1886, Campbell and B.F. Dillingham put together the “Colonization Project,” which was an attempt to sell Honouliuli land to homesteaders (Thrum 1886:64). This homestead project failed, largely due to the lack of water and the distance from ‘Ewa to Honolulu. The water problem was solved by drilling artesian wells, and Dillingham decided the area could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was to be solved by the construction of a railroad, which B. Franklin Dillingham soon began to finance under the company name of the Oahu Railway and Land Company (OR&L).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the OR&L in 1890. To attract business to his new railroad, Dillingham subleased all land below a 200 ft elevation to William Castle who in turn sublet the area to the Ewa Plantation Company for sugarcane cultivation (Frierson 1972:15). Throughout this time, and continuing into modern times, cattle ranching continued in the area, and Honouliuli Ranch—established by Dillingham—was the “fattening” area for other ranches (Frierson 1972:15).

During the last decade of the nineteenth century, the railroad traveled from Honolulu to Pearl City in 1890, eventually making its way to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:III, 100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields.

Dillingham’s *mauka* lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892 the Ranch Department of the OR&L Company tapped plantation flumes and searched for alternative sources of water. Ida von Holt leaves this account of her husband Harry’s (Superintendent of the OR&L Ranch Department) search for water in the foothills of the Wai‘anae Range:

Figure 19. Photo of first pineapple plantation in Kunia ca. 1900 (University of Hawai‘i at Mānoa Digital Collection)

> One of those places is on the old trail to Pālehua, and had evidently been a place of which the Hawaiians had known, for its name is Kalo‘i (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. [Von Holt 1985:136]

The spring was located along the upper slopes of the southern face of Kalo‘i Gulch. A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo‘i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring. [Von Holt 1985:138]

Following the discovery, two old Hawaiians began to ask Von Holt about the spring.

> Finally he [Harry von Holt] got them to explain that the spring, called ‘Waihuna’ (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840 . . . A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. [Von Holt 1985:138–140]

Operations at the OR&L began to slow down in the 1920s, when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around, as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted that one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The Navy base at Pearl Harbor had its own rail lines that connected to the OR&L rail lines.

In August 1945 the war ended and so did the OR&L’s operation as a military transport line:

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

There was no choice but to abandon the OR&L main line, and in 1946 Walter F. Dillingham, son of B.F. Dillingham, wrote,

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and the

> shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Walter Dillingham in Chiddix and Simpson 2004:257]

After the war, most of the 150 miles of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track for their own use, to transport bombs, ammunition, and torpedoes from the ammunition magazines at Lualualei, West Loch in Pearl Harbor, and Waikele on OR&L's Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968.

In 1970, the Hawaiian Railway Society was formed to save and restore the remaining OR&L railway tracks and stock. The federal government donated the tracks and right-of-way to the State of Hawai‘i in 1974, and the Society successfully placed the Navy's Lualualei-Pearl Harbor track on the National Register of Historic Places on 1 December 1975. The Highway Railway Society has currently restored about 6.5 miles of this track, on which they run weekly tourist train rides from Ewa Station to Nānākuli, pulled by restored OR&L locomotives (Chiddix and Simpson 2004:273).

4.3.5 Ewa Plantation Company

The Ewa Plantation Company (Figure 20) was incorporated in 1890 for sugarcane cultivation. Ewa Plantation's first crop, 2,849 tons of sugar, was harvested in 1892. Ewa Plantation was the first all-artesian plantation, and it gave an impressive demonstration of the role artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:III, 69). As a means to generate soil deposition on the coral plain and increase arable land in the lowlands, the Ewa Plantation Company installed ditches running from the lower slopes of the mountain range to the lowlands. When the rainy season began, they plowed ground perpendicular to the slope so that soil would be carried down the drainage ditches into the lower coral plain. After a few years, about 373 acres of coral wasteland were reclaimed in this manner (Immisch 1964). By the 1920s, Ewa Plantation was generating large profits and was the "richest sugar plantation in the world" (*Paradise of the Pacific,* December 1902:19–22 in Kelly 1985:171).

Just north of Ewa Plantation was the equally sprawling Oahu Sugar Company, which "covered some 20 square mi . . . ranging in elevation from 10 feet at the Waipio Peninsula . . . to 700 feet at the Waiahole Ditch" (Condé and Best 1973:313). The Oahu Sugar Company lands were described as being "of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project" (Condé and Best 1973:313). The Oahu Sugar Company took control of the Ewa Plantation lands in 1970 and continued operations until 1995, when they decided to shut down sugarcane production in the combined plantation area (Dorrance and Morgan 2000:45, 50).

4.3.6 Plantation Worker Housing: ‘Ewa Villages

In 1890, housing construction began for over 500 Ewa Plantation workers (Hammatt et al. 1990:13). Eight main plantation camps, collectively known as ‘Ewa Villages, were constructed in the vicinity of Ewa Plantation sugar mill. These villages included (from northeast to southwest)

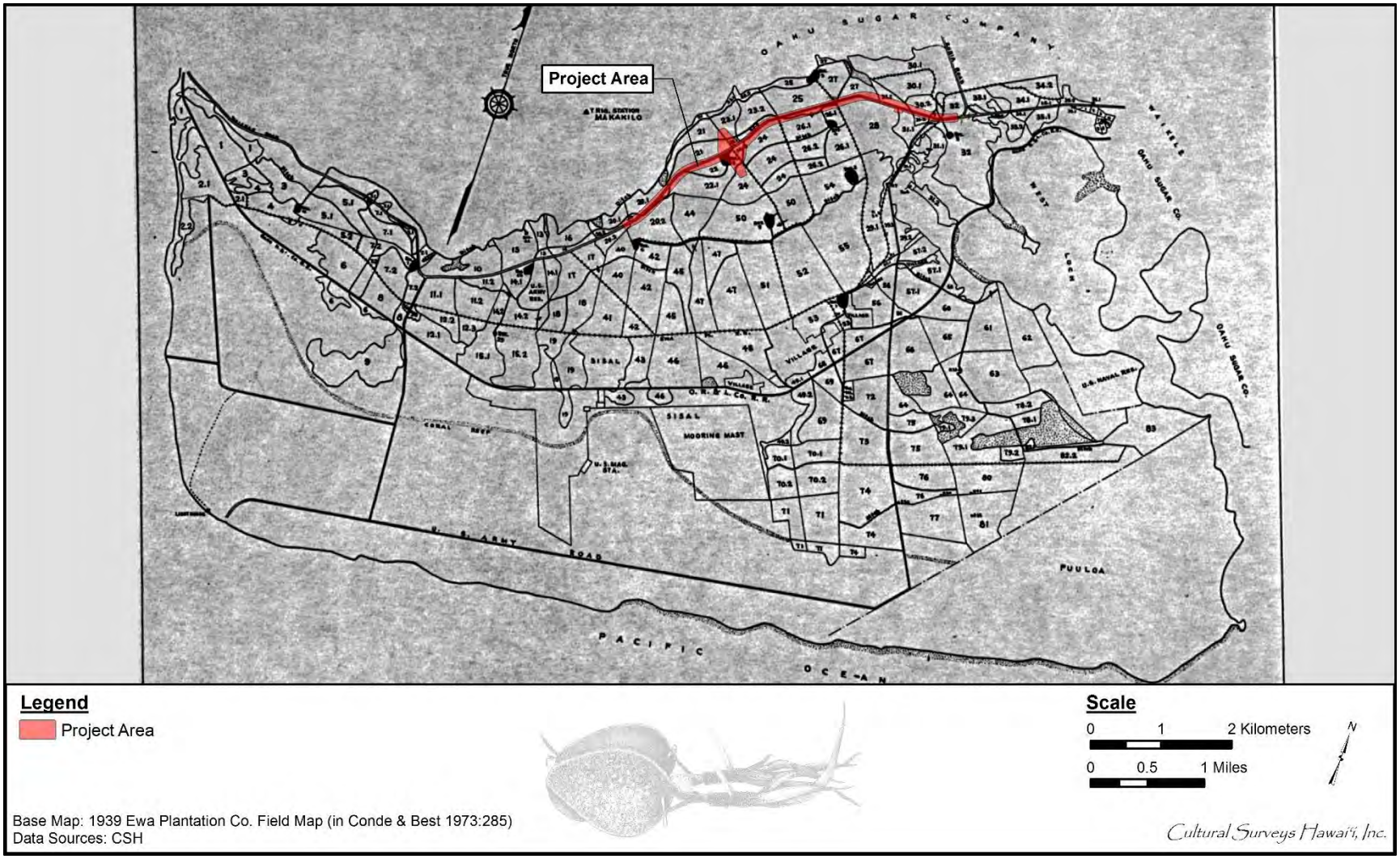

Figure 20. 1939 Ewa Planation Company map with project area location

Lower Village, Middle Village (also called Korean Village), Fernandez Village, Renton Village, Tenney Village, Mill Village, Varona Village, and “C” Village. The mill and plantation camps were located at junctions of major plantation transportation corridors, including the Ewa Plantation railway, the OR&L railway, and plantation roads (Figure 22 and Figure 22).

In 1928, probably the year with the greatest number of workers, the census bureau counted 4,967 people living on and associated with the Ewa Plantation (Hammatt et al. 1990:13). These workers were Japanese, Chinese, Okinawan, Korean, Portuguese, Spanish, Hawaiian, Filipino, and European, who usually lived in segregated camps or housing areas (Figure 23). The plantation houses were described by George F. Renton, the plantation manager from 1899 to 1920:

> Each of these dwellings is enclosed by a fence and supplied with water. It is pleasant to note the eagerness with which these homes have been taken up, and how much the premises have been improved. This is especially noticeable among the Japanese . . . At present writing there are 451 dwellings on this estate. These are actual houses exclusive of restaurants, bath houses, cook houses, work shops, schools or churches. [Pagliaro 1987:17]

With the onset of World War II in the 1940s, the U.S. military drew from the plantation workforce to support the war effort. To cope with the loss of plantation laborers, Ewa Plantation came to rely on mechanical harvesting. This led to the overall decline in the large, multi-racial plantation workforce that had characterized the early history of the plantation (Hammatt et al. 1990:13). The Ewa Plantation Mill closed in the mid-1970s, following the sale of Ewa Plantation to Oahu Sugar Company. Sugarcane cultivation continued in ‘Ewa until the mid-1990s.

4.3.7 World War II and the Military in ‘Ewa

By 1941, Pacific Naval Air Bases expenditures for new construction at Pearl Harbor were in the hundreds of millions of dollars. The Japanese attack on Pearl Harbor on 7 December 1941 damaged or destroyed much of the new construction. Reconstruction was instituted to double Pearl Harbor’s war capacity. Military planners approved a new ammunition depot in the mountainside of Waipahu, a large new hospital in ‘Aiea, and thousands of additional changes to the Navy yard to accommodate the new aircraft carrier task forces (Woodbury 1946:342–343). During World War II, the military used the sugarcane rail system to “haul large quantities of ammunition” (Condé and Best 1973:315).

Before the war, the main Pearl Harbor Naval yard was a sufficient staging and storage area for the Pacific fleet, but after the Japanese attack and the beginning of World War II, additional areas were needed for supply depots and warehouses. The government procured additional land after the beginning of World War II to expand the functionality of the military bases. The Navy took all of the coastline area in eastern ‘Ewa District from the coast inland of the OR&L railroad tracks (Ching 1996:24). Waipi‘o Point, Waiawa Gulch, Pearl City (Mānana) Peninsula, Iroquois Point in Hālawa, and small areas in Honouliuli and Hō‘ae‘ae were taken over as supply depots and storage areas. The OR&L railroad had built a spur from the coast to Wahiawa in 1905, to haul cane and pineapples down to the coast and later to haul men and supplies from Pearl Harbor to Schofield Barracks in Wahiawa through Waikakalaua Gulch in Waikele. During the war, the military built a “secret railroad” from the railroad terminus at Waikakalaua Gulch to join the OR&L railroad coming around Ka‘ena Point at Hale‘iwa, thus providing a short cut from Pearl Harbor to Army

Figure 19. Photo of first pineapple plantation in Kunia ca. 1900 (University of Hawai‘i at Mānoa Digital Collection)

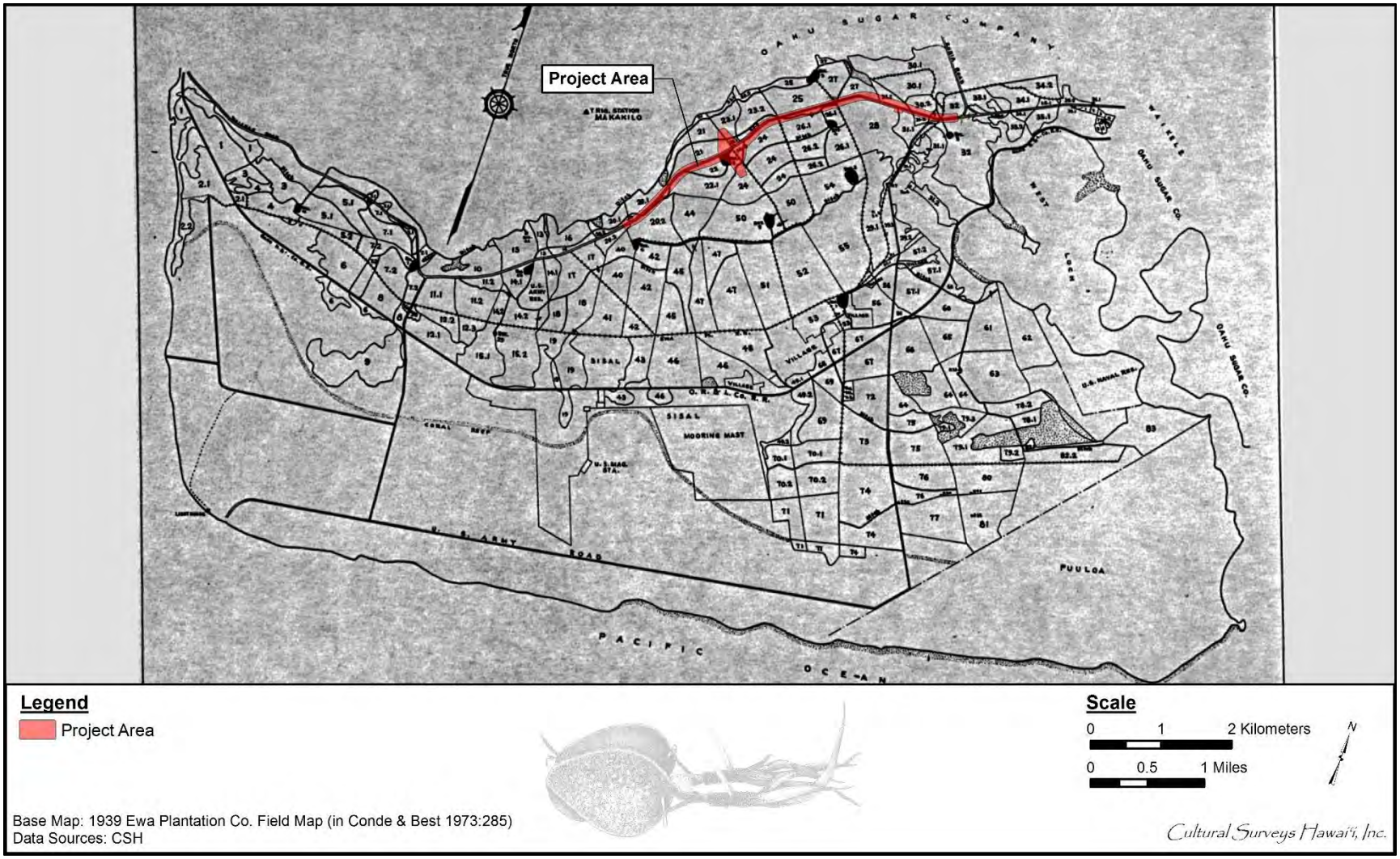

Figure 20. 1939 Ewa Planation Company map with project area location

Figure 21. Photo of the Ewa Plantation train ca. 1950s (Hawaii Aviation 1950)

Figure 21. Photo of the Ewa Plantation train ca. 1950s (Hawaii Aviation 1950)

Figure 22. Photo of the Pearl Harbor Junction ca. 1947 (Hawai‘i State Archives); in general, mills and plantation camps were located at junctions of major plantation transportation corridors

Figure 23. Photo of Ewa Plantation ca. 1925 at the Filipino Laborers Village (University of Hawai‘i at Mānoa Digital Collection)

facilities at Kahuku on the north shore of O‘ahu (Kneiss 1957:11–12). By 1944, the Navy had claimed close to 2,400 acres of land in the Pearl Harbor and Pearl City areas within Mānana, Waiawa, and Hālawa for use as military staging areas in the war effort (Allen 1999:234).

To this day, much of the Pearl City peninsula remains in the custody of the U.S. Navy; however, in the late 1990s, much of the rest of the previous Pearl City regions were released to the state for public use (Allen 1999:239).

4.3.7.1 Residential and Commercial Development in Honouliuli

A series of historic topographic maps shows the gradual residential and commercial development of Honouliuli. On the 1919 U.S. Army War Department fire control map (Figure 24), residential areas were limited to a cluster at Honouliuli near the old taro lands, adjacent to West Loch, and the Ewa Plantation Villages *makai* of Honouliuli. On the 1930s USGS map (Figure 25), both Honouliuli and the Ewa Plantation villages were expanding with new and improved roads. On the 1943 U.S. Army War Department map (Figure 26), Ewa Villages had expanded with additional “ethnic camps,” while Honouliuli had become a smaller residential area, rather than a separate “village.” On the 1953 USGS map (Figure 27), residential subdivisions were spreading to the shore of Pearl Harbor. However, the lands surrounding the current project area remained almost exclusively under commercial sugarcane cultivation until the end of the twentieth century (Figure 28).

Few irrigation ditches are indicated on maps from the 1930s and 1940s, although several reservoirs are shown near the project area (see Figure 25 and Figure 26). However, by 1953 a system of interconnected ditches and flumes are present along or near Farrington Highway and connecting to reservoirs (see Figure 27). These ditches, flumes, and reservoirs appeared extant through 1977 (Figure 28). The end of the plantation era likely saw these structures filled in or removed to accommodate subsequent development of the area.

4.3.8 History of Farrington Highway

Farrington Highway was originally constructed in the 1930s. Its predecessor was variously termed the “Government Road” or “Wai‘anae Road” and provided less than ideal travel and transport conditions. These precursor roads generally followed the path of a pre-Contact trail that crossed several *ahupua‘a* and connected Honolulu to Wai‘anae. An 1873 map by W.D. Alexander (Registered Map 405; see Figure 16) depicts the road and labels it as “Road.” A copy of Alexander’s 1873 map (Registered Map 618) has a handwritten label for the road, “Govt Road.” It is not known at what date this label was added. In 1902, the road is referred to as the Government Road (Condé and Best 1973). The 1930s USGS map (see Figure 25), as well as the 1943 U.S. Army War Department map (see Figure 26), label the road as Waianae Road. The 1953 USGS map (see Figure 27) has the road labeled as Farrington Highway.

A section of Farrington Highway’s predecessor in the Wai‘anae District was described as a “mud hole in the winter and billowed dust in the summer” (McGrath et al. 1973:51). The Wai‘anae Road was not paved. Because of the transport limitations over the Wai‘anae Road, most transport and travel between Wai‘anae and Honolulu, prior to the construction of Farrington Highway, was made using the OR&L Railroad or steamer ship (McGrath et al. 1973).

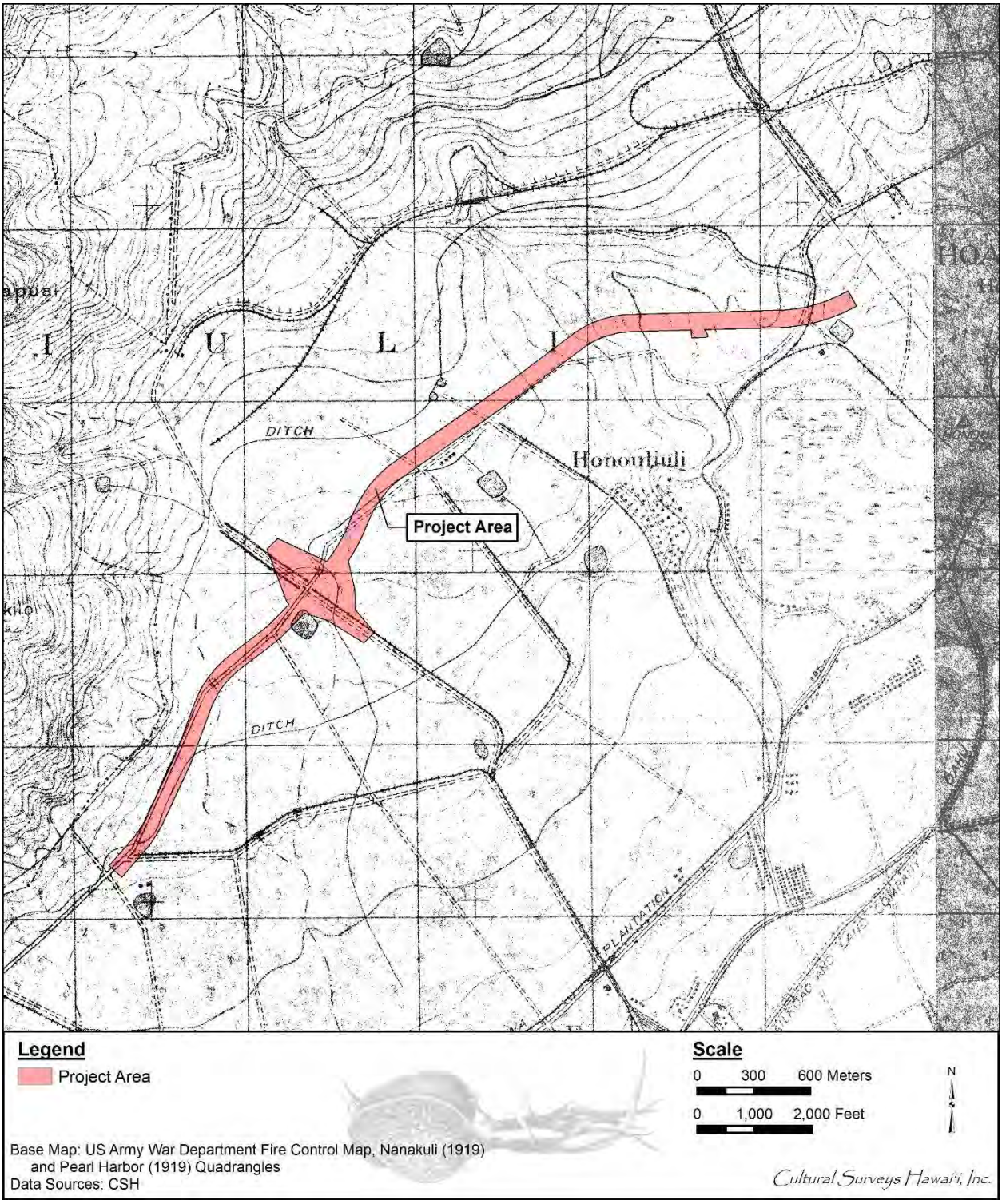

Figure 24. 1919 U.S. Army War Department fire control map, Nanakuli quadrangle showing project area

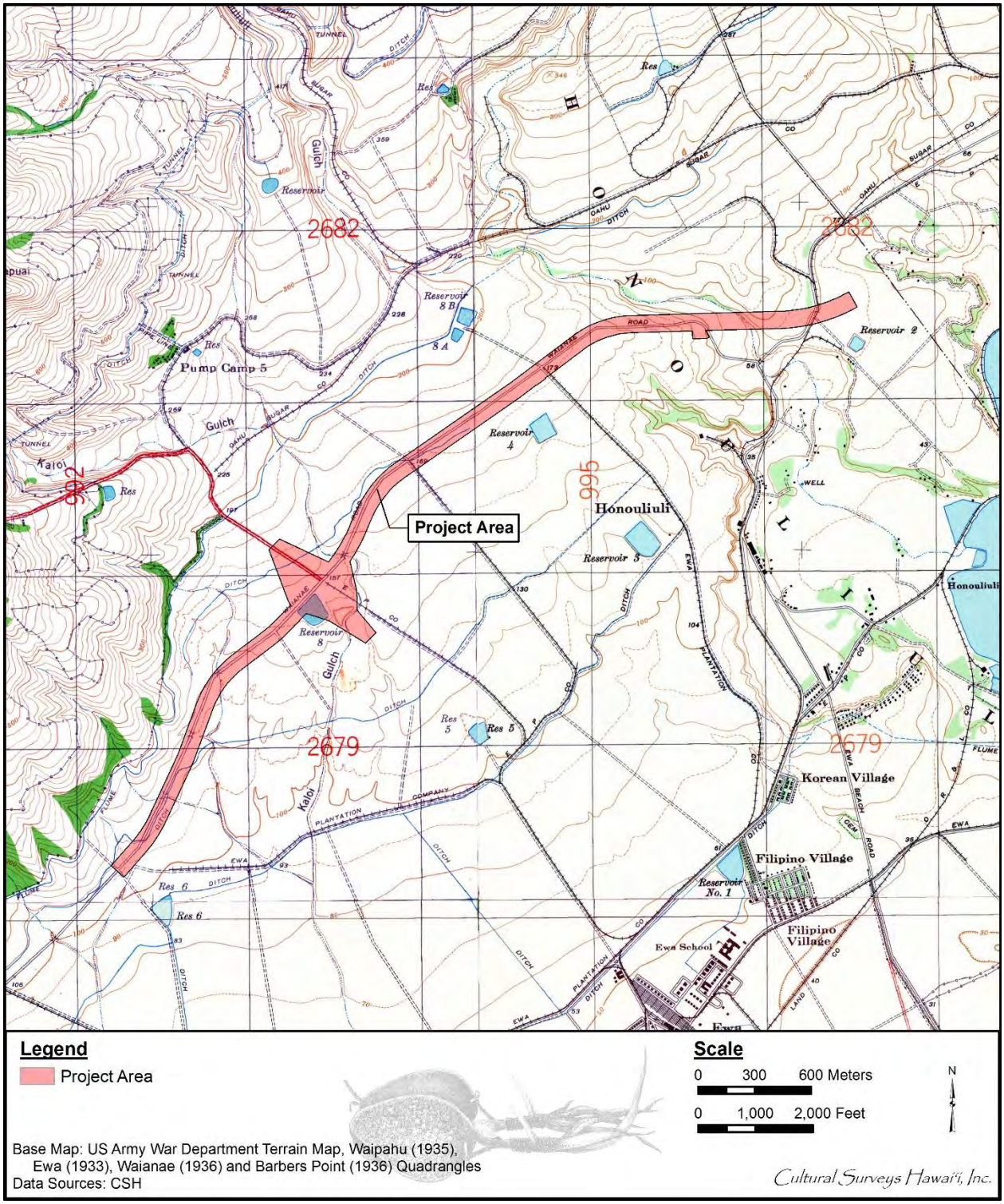

Figure 25. 1930s U.S. Army War Department fire control map showing project area; note plantation reservoir located in central project area

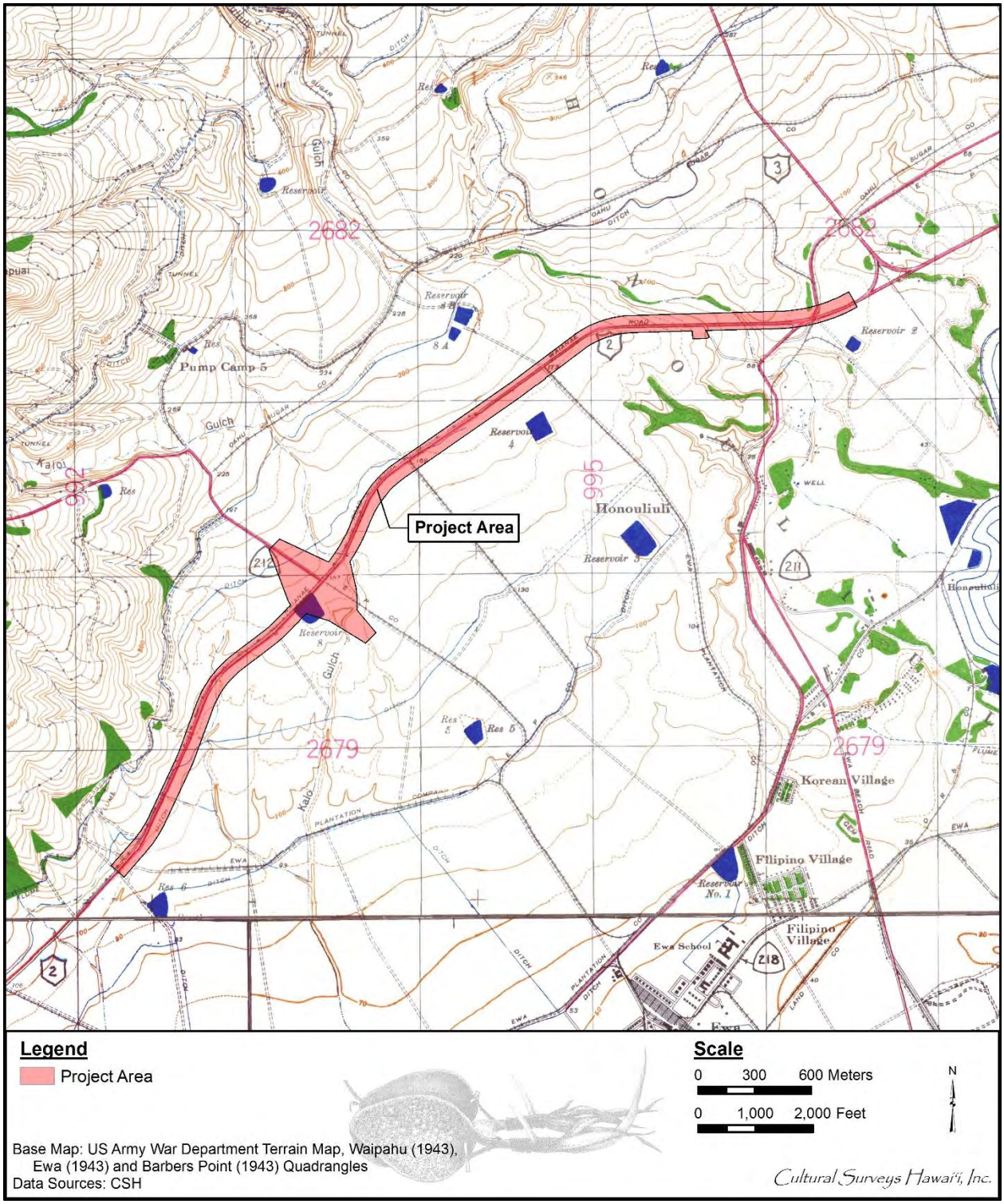

Figure 26. 1943 U.S. Army War Department terrain map showing project area

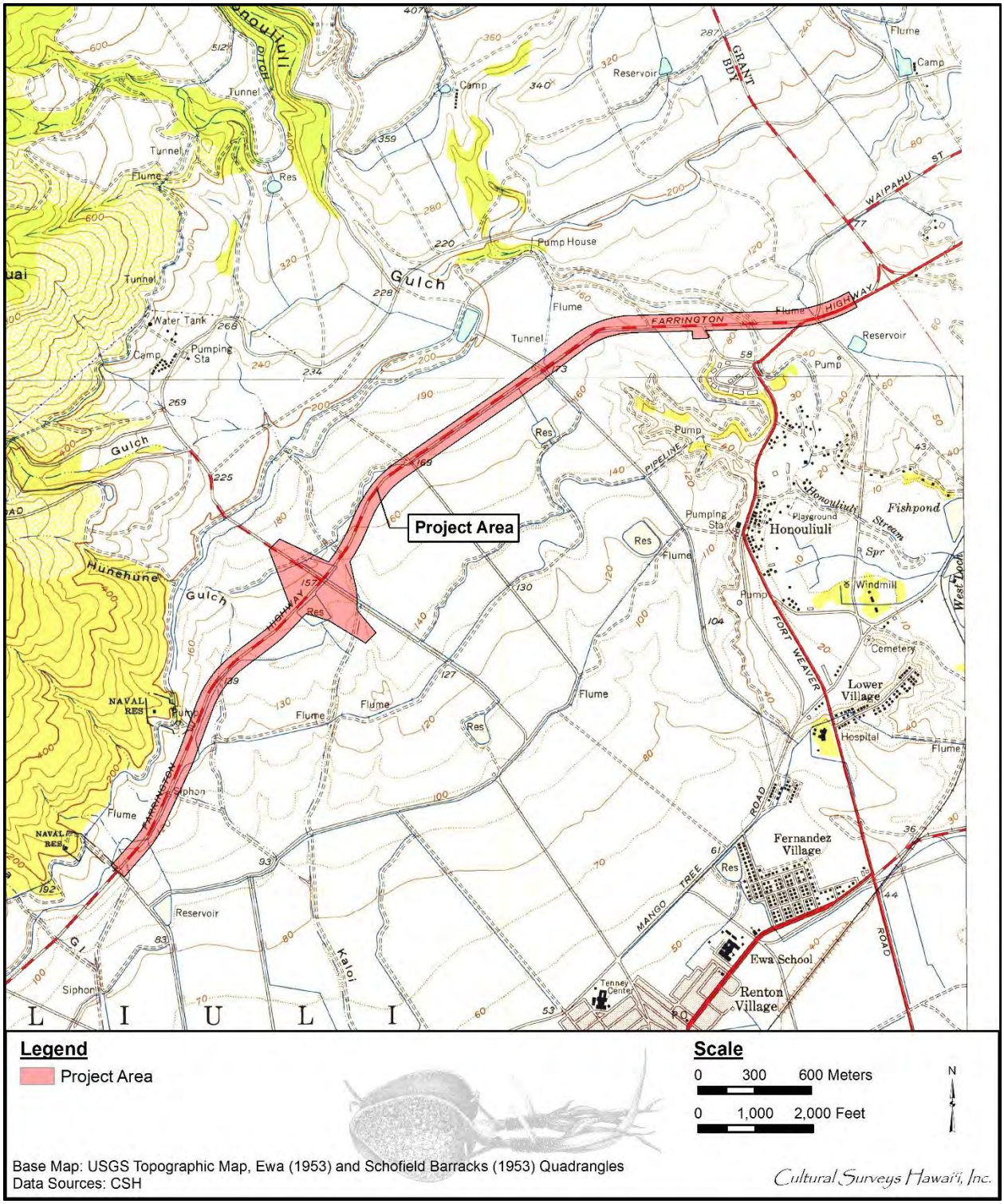

Figure 27. 1953 Ewa and Schofield Barracks USGS topographic quadrangles, showing project area; note presence of irrigation infrastructure associated with sugarcane agriculture throughout the region

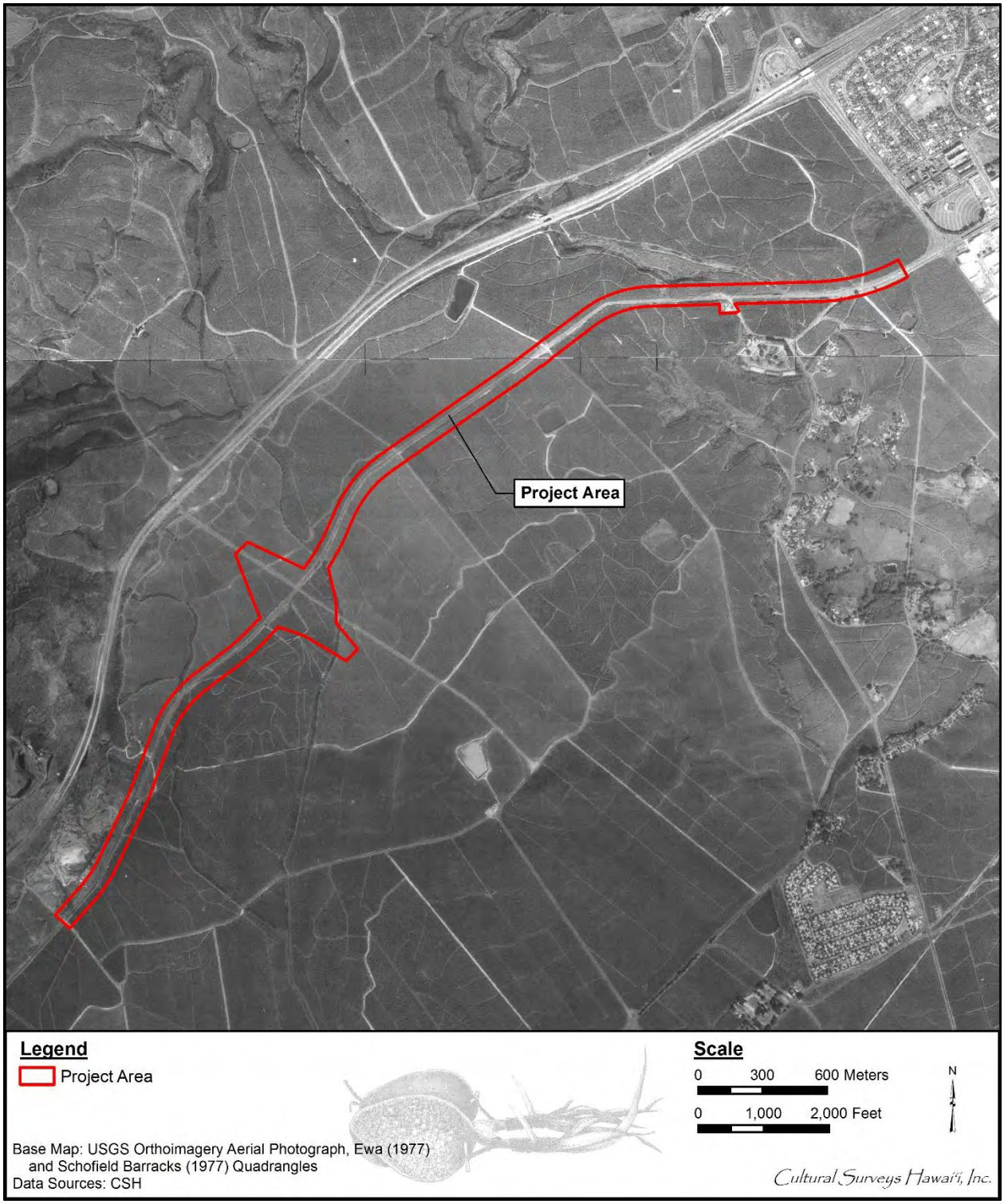

Figure 28. 1977 USGS Orthoimagery aerial photograph showing project area still under cane cultivation

The construction of Farrington Highway was a component of the overall Territorial Highway System. It was only after 1925 that Territorial officials made use of available federal funding assistance for road and bridge construction. This led to abundant bridge and road construction after 1925 in Hawai‘i. Further federal assistance became available in the 1930s as part of the Works Progress Administration and National Reclamation Association programs; this funding lead to additional standardization and improvement of the Territorial Highway System (Thompson 1983:III–15). These improvements were significant events that greatly facilitated intra-island travel, transportation, and communication. Farrington Highway was eventually named after Wallace Rider Farrington (1871–1933), a former Honolulu newspaper man, mayor of Honolulu, and Territorial Governor of Hawaii (1921–1929), who was influential in expanding Hawai‘i’s roadways.

Section 5 Previous Archaeological Research

Numerous previous archaeological studies have been conducted in the vicinity of the project area. This section discusses previous archaeological studies in the area (Figure 29 and Table 3) and identifies the types and locations of previously identified historic properties (Figure 30 and Table 3). A summary of each archaeological study follows.

5.1 McAllister 1933; Thrum 1906, 1907

The earliest attempt to record archaeological remains in Honouliuli Ahupua‘a was made by Thomas Thrum (1906). He reported the existence of a *heiau* located on Pu‘uokapolei, west of the present project area. In a second monograph on *heiau*, Thrum (1907) called this *heiau* Palole‘i (Kapolei).

During a survey of the islands in 1930, J. Gilbert McAllister recorded the specific locations of important sites and the general locations of less important sites (at least at Honouliuli). He recorded 14 specific sites in Honouliuli, Sites 133–146 (McAllister 1933:107–108), none of which are located in the immediate vicinity of the project area. Site 138, Puu Kapolei Heiau, is located approximately 2 km to the west of the project area.

5.2 Dicks et al. 1987; Wolforth et al. 1998

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted an archaeological reconnaissance survey (ARS) for the West Loch Estates Golf Course and Parks (Dicks et al 1987). The study addressed an approximately 220-acre project area bisected by Fort Weaver Road, extending from the coast of the West Loch of Pearl Harbor to Farrington Highway. The project area included only a very narrow frontage along the current project area along Farrington Highway near the intersection of old Fort Weaver Road.

The study identified seven new sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3323 (a historic fishpond), and -3324 (a pre- through post-Contact buried pondfield system).

A follow-up archaeological data recovery study (Wolforth et al. 1998) was conducted in 1988 and 1989 and included excavations of SIHP #s -3319, -3320, -3321, and backhoe trenching at SIHP #s -3322 and -3324. Radiocarbon dates from SIHP # -3321 indicated the pondfields were in use from the tenth to seventeenth centuries. SIHP # -3321 was documented approximately 160 m south of the current project area. It was described as a subsurface cultural layer that included a human burial, artifacts, midden, subsurface features, and structural remains. This site relates to a complex of LCAs that lies in the Honouliuli Stream bottomlands, approximately 80 vertical ft below Farrington Highway and the project area. Thus, although the cultural resource is only approximately 160 m south of the project area, it is ecologically distant.

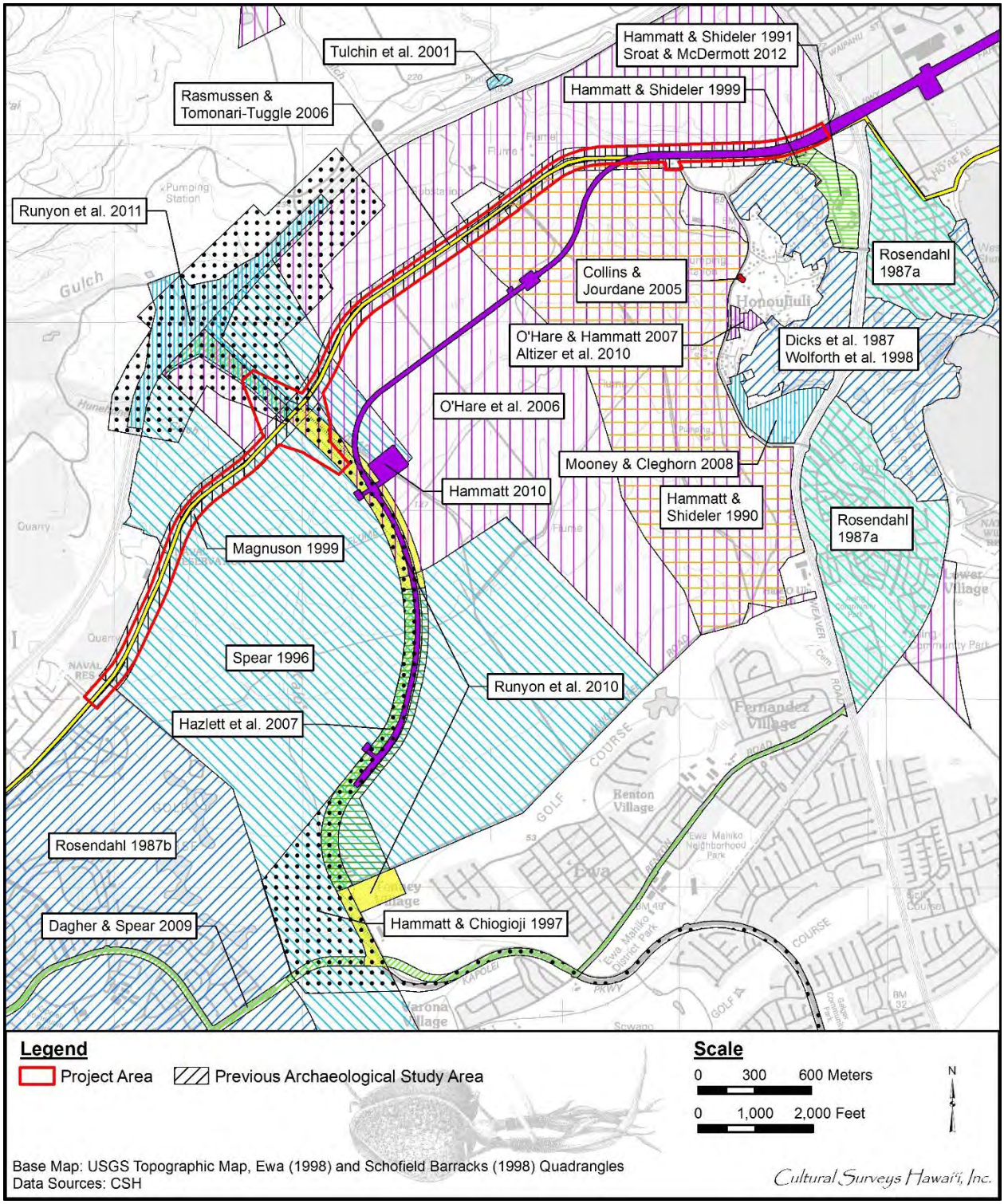

Figure 29. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previous archaeological research in the vicinity of the project area

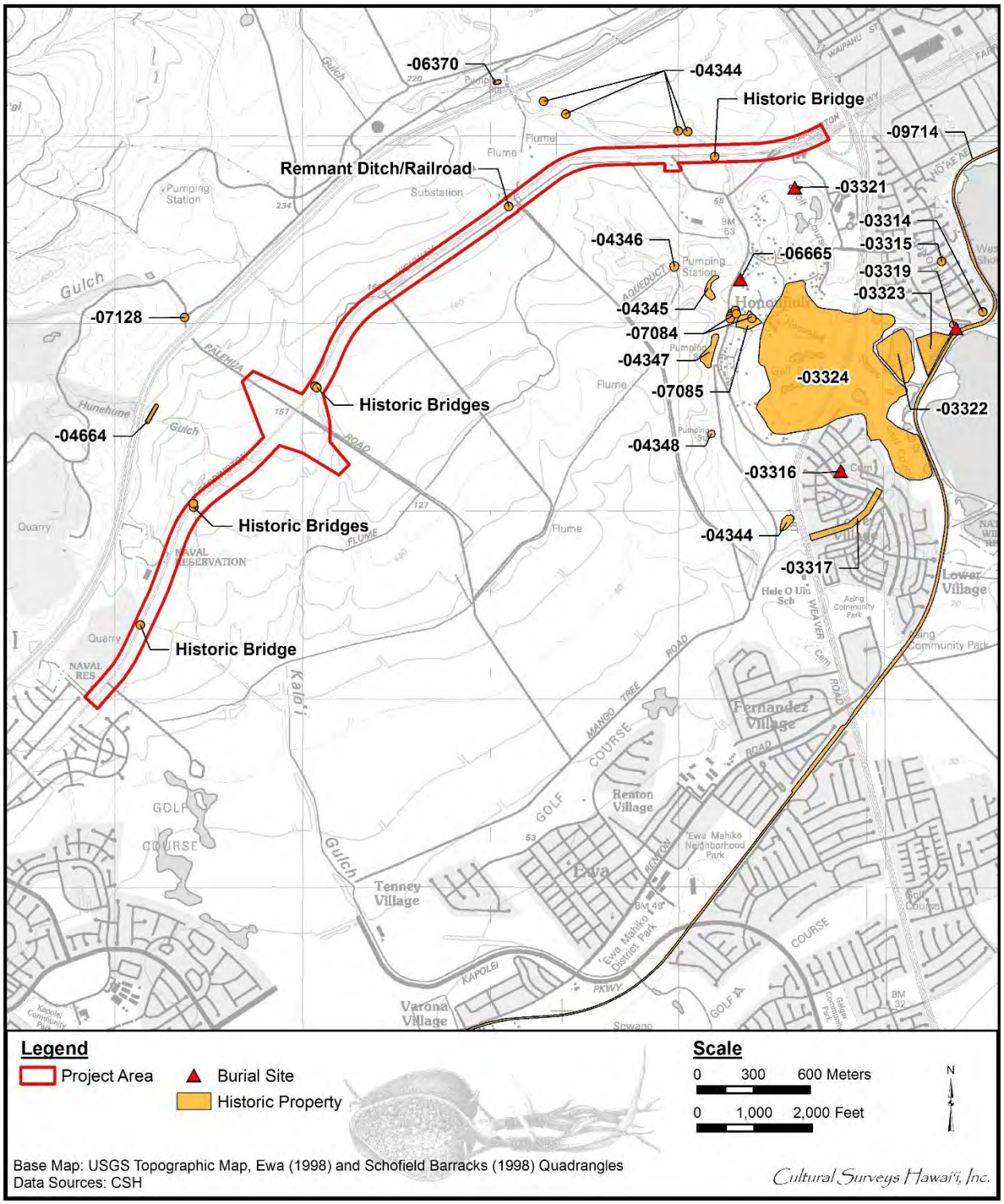

Figure 30. Portion of 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing previously identified archaeological sites in the vicinity of the project area

Table 3. Previous archaeological studies in the vicinity of the project area

Reference	Nature of Study	Project/Location	Results
Thrum 1906, 1907	Heiau studies	Island-wide	Reported existence of Pu‘uokapolei in 1906; in 1917, called the *heiau* Palole‘i (Kapolei)
McAllister 1933	Archaeological survey	Island-wide	Recorded 14 sites in Honouliuli, including Puu Kapolei Heiau (Site 138)
Dicks et al. 1987	Archaeological reconnaissance survey	West Loch Estates – Golf Course and Parks	Identified seven sites: SIHP #s 50-80-12-3318 (a surface historic artifact concentration), -3319 (a possibly historic habitation/burial complex that included one burial), -3320 (a pre-Contact and historic cultural deposit), -3321 (a pre-Contact and early post-Contact cultural deposit that included one burial), -3322 (a buried fishpond, possibly Nihola Fishpond), -3233 (a historic fishpond), and -3324 (a pre- through post-Contact buried pondfield system)
Rosendahl 1987a	Archaeological reconnaissance survey	West Loch Estates – Residential Increments I and II	Documented four sites: T-1, a midden deposit; T-2, a historic surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern surface artifact scatter related to Lower Village plantation settlement
Rosendahl 1987b	Archaeological reconnaissance survey	Kapolei Village Master Plan project	No archaeological sites identified; noted entire project area had been extensively modified by sugarcane cultivation
Hammatt and Shideler 1990	Archaeological inventory survey	West Loch Bluffs project	Recorded four surface features: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (northern pumping station), -4347 (central pumping station), and -4348 (southern pumping station)

Reference	Nature of Study	Project/Location	Results
Hammatt and Shideler 1991	Archaeological inventory survey	Saint Francis Medical Center West	Project area had been extensively disturbed and contained no surface archaeological sites
Spear 1996	Archaeological reconnaissance survey and assessment	East Kapolei Development project	No archaeological sites identified; reported Kalo‘i and Hunehune Gulches modified for sugarcane irrigation
Hammatt and Chiogioji 1997	Archaeological reconnaissance survey	North-South Rd	Documented that entire area had been extensively graded in association with sugarcane cultivation and construction of plantation infrastructure
Wolforth et al. 1998	Archaeological data recovery	West Loch Estates Residential Increment I, Golf Course and Shoreline Park project	Consisted of excavations of SIHP #s -3319, -3320, -3321, -3322, and -3324; radiocarbon dates for SIHP # -3321 indicate pondfields used from tenth to seventeenth centuries.
Hammatt and Shideler 1999	Archaeological assessment (no finds AIS)	Saint Francis Medical Center West	No cultural resources identified
Magnuson 1999	Archaeological reconnaissance survey	Farrington Hwy between Fort Weaver and Kapolei Golf Course roads	Documented eight historic sites: six bridges, a section of railroad track, and an irrigation ditch; all sites considered not significant and not designated SIHP numbers
Tulchin et al. 2001	Archaeological inventory survey	‘Ewa Shaft Renovation project	Identified one surface site, SIHP #50-80-08-6370, a historic stone wall alignment
Collins and Jourdane 2005	Burial report	Old Fort Weaver Rd	Partial remains of a possibly Native Hawaiian, adult female found eroding out of ground surface after heavy rains; burial believed to be historic in age

Reference	Nature of Study	Project/Location	Results
O’Hare et al. 2006	Archaeological inventory survey	Ho‘opili project	Documented four additional features associated with SIHP # 50-80-12-4344, plantation infrastructure; concluded sugarcane cultivation, irrigation, flood control, railroad construction, road construction, demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of archaeological cultural resources
Rasmussen and Tomonari-Tuggle 2006	Archaeological monitoring	Waiau fuel pipeline	Project area along Farrington Hwy not monitored as area determined to not be archaeologically sensitive
Hazlett et al. 2007	Archaeological monitoring	North-South Rd	No cultural materials encountered, with exception of a portion of plantation-era road and associated ditch removed during road construction
O’Hare and Hammatt 2007	Archaeological literature review and field inspection	Old Fort Weaver Rd	Observed one site, a complex of concrete curbs likely associated with Ewa Plantation Co.
Mooney and Cleghorn 2008	Archaeological assessment	Proposed development of two parcels between Fort Weaver Rd and Old Fort Weaver Rd	No cultural materials identified, no further work recommended
Dagher and Spear 2009	Literature review and field inspection	Kapolei Computerized Traffic Control System project	No cultural material identified, no further work recommended
Altizer et al. 2010	Archaeological inventory survey	Hale Kipa project, Old Fort Weaver Rd	Documented two sites: SIHP #s 50-80-12-7084 (historic features including house foundations, a cesspool, and water control features) and -7085 (a subsurface pre-Contact *lo‘i* terrace)
Hammatt 2010	Archaeological inventory survey	Construction Phase I for Honolulu High-Capacity Transit Corridor project	Identified one site in Waikele Ahupua‘a: SIHP # 50-80-09-7751, *lo‘i* sediments

Reference	Nature of Study	Project/Location	Results
Runyon et al. 2010	Archaeological monitoring	North-South Rd	No cultural materials identified
Runyon et al. 2011	Archaeological monitoring	North-South Rd	Documented two historic-era sites: SIHP #s 50-80-14-4664 (a water diversion structure) and -7128 (burnt trash fill layer used in construction of Pālehua Rd)
Sroat and McDermott 2012	Archaeological literature review and field inspection	Hawaii Medical Center West project	No historic properties identified, area extensively modified in historic and modern times

5.3 Rosendahl 1987a

In 1987, Paul H. Rosendahl, Inc. (PHRI) conducted a combined surface and subsurface survey of approximately 260 acres in two discontinuous parcels east of Fort Weaver Road for the West Loch Estates Residential Increments I and II project (Rosendahl 1987a). The northern of the two parcels extended *mauka* to the intersection of Fort Weaver Road and Farrington Highway, adjacent to the current project area. This study documented four sites: T-1, a midden deposit (possibly non-cultural); T-2, a historic (pre-1900) surface artifact scatter related to habitation; T-3, a modern cemetery; and T-4, a historic/modern (both pre- and post-1900) surface artifact scatter related to the Lower Village plantation settlement.

5.4 Rosendahl 1987b

In 1987, PHRI conducted an archaeological reconnaissance survey (ARS) for the 850-acre Kapolei Village Master Plan project, located immediately to the southwest of the current project area (Rosendahl 1987b). It was documented that the entire project area had been extensively modified by sugarcane cultivation in historic/modern times, and no archaeological sites were identified.

5.5 Hammatt and Shideler 1990

In 1990, CSH conducted an ARS of a 546-acre parcel south of Farrington Highway, then called West Loch Bluffs (Hammatt and Shideler 1990). The northern boundary of their project area extended along Farrington Highway and the current project area. During the survey, four surface features were recorded: SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Preservation of the railroad berm and the pumping stations was recommended.

5.6 Hammatt and Shideler 1991

In 1991, CSH conducted an archaeological assessment (AA; no finds archaeological inventory survey [AIS[) for a proposed expansion of Saint Francis Medical Center West on an approximately 24-acre parcel *makai* of Farrington Highway and west of Fort Weaver Road, fronting the current project area (Hammatt and Shideler 1991). A pedestrian survey and background research revealed that the entire study area, located on a bluff northeast of the flood plain of Honouliuli Stream, had been extensively disturbed, contained no surface structures or other remains, and was unlikely to contain any subsurface historic properties. The entire project area had been under sugarcane cultivation for several decades.

5.7 Spear 1996

In 1996, Scientific Consultant Services, Inc. (SCS) conducted an archaeological reconnaissance and assessment for the East Kapolei Development project, *makai* of the H-1 Freeway, in the vicinity of the North-South Road corridor (previously known as Pālehua Road, now called Kualakai Parkway) and including portions of Kalo‘i and Hunehune gulches. The project area was

located along and surrounding the western half of the current project area. The limited field inspection documented in the Spear (1996) letter report did not identify any cultural resources, but noted that Kalo‘i and Hunehune gulches appeared to have been modified for sugarcane irrigation. The study cited a 1994 SHPD letter (Doc. No. 9408TD01) that “clearly indicates that most of the present [Spear 1996] project area has been declared to have ‘no effect’ on historic sites due to the many years of commercial sugarcane production on these lands” (Spear 1996:1). The study concluded, on the basis of the SHPD letter and the field inspection, “that future development on these land parcels will have ‘no effect’ on historic sites, and that no further cultural resource work is required” (Spear 1996:1).

5.8 Hammatt and Chiogioji 1997; Hazlett et al. 2007; Runyon et al. 2010; Runyon et al. 2011

In 1997, CSH conducted an ARS of a 4.5 km-long corridor that would become the North-South Road project (Hammatt and Chiogioji 1997). An earlier version of the project area extended an additional 4.4 km from the project’s southern end at the OR&L right-of-way (SIHP # 50-80-12-9714). It is believed that the project area was revised in order to avoid two previously identified areas of archaeological and historical concern: 1) the ‘Ewa Villages Historic District (SIHP # -9786), which was nominated for National Historic Landmark status; and 2) the OR&L right-of-way (SIHP # -9714), which was placed on the National Register of Historic Places. The North-South Road corridor runs perpendicular through the current project area.

Background research and a pedestrian survey of the study area revealed that the entire area had been extensively graded by the Ewa Plantation Company in association with sugarcane cultivation and the construction of plantation infrastructure. Some remnant plantation structures—flumes, ditches, and roads—were observed in the project area, but were not considered of historic value and not classified as sites.

Archaeological monitoring for a southern portion (Phase 1A) of the North-South Road project was conducted by CSH intermittently from 2005 through 2007 (Hazlett et al. 2007). This phase of the project involved construction of a 1.40-km section of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring, with the exception of a portion of plantation-era road and associated ditch that was removed during road construction.

Archaeological monitoring for the central portion and southern end (Phase 1B) of the North-South Road project was conducted by CSH intermittently from 2007 through 2010 (Runyon et al. 2010). This phase of the project involved the construction of two sections of a four-lane divided roadway and associated development infrastructure. No cultural materials were encountered during monitoring.

CSH conducted archaeological monitoring for the northern portion (Phase 1C) of the North-South Road project intermittently from 2007 through 2009 (Runyon et al. 2011). This phase of the North-South Road project consisted of construction of a new highway interchange and roadway, including two on-ramps and two off-ramps connecting the H-1 Freeway to the North-South Road. During monitoring, two historic-era cultural resources were documented: SIHP #s 50-80-14-4664 and -7128. SIHP # -4664 was a concrete plantation-era water diversion structure containing two

sluice gates. A portion of this site located a significant distance to the west of the Runyon et al. (2011) project area was first identified by Nakamura et al. (1993). SIHP # -7128 was a burnt trash fill layer used in the construction of Pālehua Road (a precursor to the North-South Road). This site was newly identified during the Runyon et al. 2011 project. No further work was recommended for these sites.

5.9 Hammatt and Shideler 1999

In 1999, CSH conducted an AA for the proposed expansion of Saint Francis Medical Center West, located *makai* of Farrington Highway and west of Fort Weaver Road (Hammatt and Shideler 1999). This study lies adjacent to the current project area along Farrington Highway for approximately 300 ft. The study included a limited field inspection of the study area. No cultural resources were identified. Due to the presence of a subsurface cultural layer (SIHP # 50-80-13-3321) east of the study area, an archaeological inventory survey, with a focus on subsurface testing, was recommended for the southern portion of the study area prior to any development involving ground disturbance.

5.10 Magnuson 1999

In 1999, International Archaeological Research Institute, Inc. conducted an ARS along Farrington Highway between Fort Weaver Road and Kapolei Golf Course Road for the Farrington Highway Expansion project (i.e., the current project). The survey revealed eight historic sites, but none of them were considered significant, and they were not designated with SIHP numbers. The sites included six bridges (one spanning Honouliuli Stream, two spanning Kalo‘i Gulch, two spanning Hunehune Gulch, and one bridge spanning a separate section of Kalo‘i Gulch), a section of railroad track, and an irrigation ditch. Two of the bridges, the one over Honouliuli Stream and one over Kalo‘i Gulch, were inventoried by Bethany Thompson (1983) for nomination to the Register of Historic Places; both bridges were evaluated as not significant and were not recommended for preservation. The other four bridges were not inventoried by Thompson (1983) as they did not meet her criteria of possible significance. Magnuson recommended that the remaining sites—the railroad track and the irrigation ditch—lacked integrity and, therefore, were not significant and did not meet standards for inclusion on the Hawai‘i or National Registers of Historic Places.

5.11 Tulchin et al. 2001

In 2001, CSH conducted an AIS in support of the proposed ‘Ewa Shaft Renovation project, located in Honouliuli Gulch, adjacent to and *mauka* of the H-1 Freeway (Tulchin et al. 2001). One surface site was identified, SIHP # 50-80-08-6370, a historic stone wall alignment. The wall was believed to have been constructed in association with cattle ranching or a water pumping station. The study noted that all lands outside Honouliuli Gulch had been extensively and repeatedly graded over the past century by the Ewa Plantation Company in association with sugar cultivation and the construction of plantation infrastructure.

5.12 Collins and Jourdane 2005

In 2004, the SHPD conducted the disinterment of a burial that was found eroding out of the ground surface at 91-2168 Old Fort Weaver Road (Collins and Jourdane 2005). The remains had apparently been exposed by heavy rains. The remains were in a flexed/semi-flexed burial position and appeared to be those of a partial adult female. The report concluded the burial was possibly of Native Hawaiian ethnicity and was of historic age.

5.13 O’Hare et al. 2006

In 2005 and 2006, CSH conducted an AIS of some 1,630 acres for the East Kapolei project, subsequently known as the Ho‘opili project (O’Hare et al. 2006). The project area was bounded on the east by Fort Weaver Road, on the *makai* side by Mango Tree Road, on the north or *mauka* side by the H-1 Freeway, and on the west side by the Spear (1996) study (the study area was configured by owner/developer interests to dovetail with the Spear study). The O’Hare et al. study also included the area originally called West Loch Bluffs surveyed by CSH in 1990 (Hammatt and Shideler 1990). A non-contiguous portion of the O’Hare et al. (2006) study area was located *mauka* of the H-1 Freeway. The O’Hare et al. (2006) surrounds and encompasses more than half of the current project area.

Nineteen trenches were excavated in four areas of historic habitation and/or agriculture, identified by background historic work. The four areas were 1) nineteenth century (or earlier) habitation and agricultural lots in the nineteenth century Honouliuli Taro Lands and in Honouliuli Village; 2) structures or burials associated with the nineteenth century Kapalani Catholic Church near Old Fort Weaver Road; 3) structures or historic domestic artifacts associated with the early twentieth century Drivers and Stable Village of the Ewa Sugar Plantation; and 4) structures or historic domestic artifacts or pit/privy features associated with the early twentieth century Pipeline Village of the Ewa Sugar Plantation. No cultural deposits, no privy pits, no burials, and no artifacts or any type were found or recovered from the 19 trenches. It seems that sugarcane cultivation, irrigation, flood control, railroad construction, later road construction, the demolition and movement of workers camps, and other factors have obliterated all, or almost all, traces of these former traditional Hawaiian habitation and agricultural lands and the later sugarcane plantation workers camps, churches, and schools.

Four sites located within the project area had previously been identified by Hammatt and Shideler (1990): SIHP #s 50-80-12-4344 (plantation infrastructure), -4345 (a railroad berm), -4346 (the northern pumping station), -4347 (the central pumping station), and -4348 (the southern pumping station). Four additional features associated with SIHP # -4344 were documented during the O’Hare et al. (2006) survey. These additional features include Features D and E, two linear walls located along the east bank of Honouliuli Stream; Feature F, a stone-faced berm constructed perpendicular to the orientation of the stream; and Feature G, a concrete ditch and concrete masonry catchment basin on the west bank of Honouliuli Gulch.

5.14 Rasmussen and Tomonari-Tuggle 2006

In 2004, archaeological monitoring was conducted along the Waiau Fuel Pipeline corridor, extending from the Hawaiian Electric Company’s Barbers Point Tank Farm to the Waiau

Generating Station. The Waiau Fuel Pipeline corridor follows Farrington Highway to Kunia Road, angles *makai* near Kunia Road, then continues east along the OR&L right-of-way near the Pearl Harbor coast. It appears no archaeological monitoring was conducted west of Waipi‘o Peninsula (in the vicinity of the current project area), as the corridor to the west had been determined to not be archaeologically sensitive.

5.15 O’Hare and Hammatt 2007; Altizer et al. 2010

In 2007, CSH conducted an archaeological literature review and field inspection of a 4.28-acre parcel on Old Fort Weaver Road, within the “Honouliuli Taro Lands” (O’Hare and Hammatt 2007). During the field inspection, one surface structure was identified, a complex of concrete curbs. The curbs date to March 1941 and are likely associated with the Ewa Plantation Company. They may have functioned as an irrigation ditch, a flood control device, or may have been associated with a nearby pumping station. Background research indicated the area was a focus for intensive habitation and agriculture in the pre- and post-Contact periods and that related subsurface features could exist.

In 2009, CSH conducted an AIS for the proposed Hale Kipa project (Altizer et al. 2010), located on a portion of the O’Hare and Hammatt (2007) project area. During the AIS, two cultural resources were documented: SIHP # 50-80-12-7084, a series of historic features including house foundations, a cesspool, and water control features; and SIHP # -7085, a subsurface cultural layer consisting of the remains of a *lo‘i* terrace. The *lo‘i* terrace was radiocarbon dated and yielded a calibrated 2-sigma date range of AD 1270-1400.

5.16 Mooney and Cleghorn

In 2008, Pacific Legacy, Inc. conducted an AA for the proposed development of two parcels (approximately 23 acres) located between Fort Weaver Road and Old Fort Weaver Road. Fourteen backhoe assisted trenches were excavated to depths of up to 1.8mbs. Construction fills were observed extending between 0.9 and 1.5 mbs with various alluvial deposits observed beneath. No cultural material was observed, and the study recommended no further archaeological work.

5.17 Dagher and Spear 2009

In 2009, SCS conducted an archaeological literature review and field inspection for the Kapolei Computerized Traffic Control System project. The project consisted of construction of the North-South roadway corridor and installation of underground fiber optic cables, conduits, cameras, and ancillary equipment within existing right-of-ways in Kapolei and Makakilo. The field inspection was conducted along the 4.5-km North/South Roadway Corridor. No evidence of flumes, ditches, or other historic and cultural materials was observed. The study recommended no further archeological work.

5.18 Hammatt 2010

In 2009, CSH conducted an AIS for Construction Phase 1 of the Honolulu High-Capacity Transit Corridor project in Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, and Manana Ahupua‘a (Hammatt 2010). An approximately 1.3-km section of this project area extended along

Farrington Highway within the current project area. The Hammatt (2010) project area extended west for another approximately 2 km, 0.5 km *makai* of Farrington Highway and the current project area. Only one cultural resource was identified in the Hammatt project area, SIHP # 50-80-09-7751, *lo'i* sediments, but it was found in Waikele Ahupua‘a, approximately 2.5 km from the east end of the current project area. The Hammatt study identified five stratigraphic zones. Zones 1 and 2 overlap portions of the current project area. Zone 1 covered the western portion of the study area and generally consisted of a single stratum of naturally deposited alluvial sediment utilized for agriculture. Signs of previous disturbance from agricultural activities including tilling of the soil and installation of water lines, were from the surface to a depth of approximately 100 cmbs. Zone 2 covered the central portion of the study area and generally consisted of varying fill layers associated with urban development (i.e., asphalt paving and utility installation) overlying naturally deposited alluvial sediments. No subsurface cultural resources were observed within either Zone 1 or 2.

5.19 Sroat and Mc Dermott 2012

In 2011, CSH conducted an archaeological literature review and field inspection for the Hawaii Medical Center West project. Hawaii Medical Center West consists of a 24-acre campus located at the southwest side of the intersection of Fort Weaver Road and Farrington Highway. Background research and the field inspection indicate the area to have been extensively modified by historic sugarcane cultivation and modern development. No cultural materials were observed and the potential for subsurface historic properties is considered low.

5.20 Background Summary and Predictive Model

According to background research, the immediate vicinity of the project area was relatively barren and little used prior to being placed under a century of sugarcane cultivation. The area has been extensively graded and plowed repeatedly over the past century in association with sugar cultivation and the construction of plantation infrastructure. Since the cessation of cane production, the lands in the vicinity of the project corridor have been under diversified agricultural cultivation. Farrington Highway itself follows an old pre-Contact trail that traversed ‘Ewa and connected Honolulu to Wai‘anae.

There are no commoner Land Commission Awards in the vicinity of the project area, and previous archaeological studies have indicated no concerns in the immediate vicinity of the project area. The distance from the coast (and generally from fresh water) made the vicinity of the project area a little used area in pre-Contact times. The intensive land disturbance of a century of commercial sugarcane cultivation probably removed what little evidence of pre-Contact land use there was. The archaeological sensitivity of this area is generally regarded as low. As the project area crosses Honouliuli Stream and passes within approximately 150-250 m of the northernmost extent of the “Honouliuli Taro Lands,” the sensitivity is believed to increase somewhat, but is still regarded as low. Even though the distance to the former taro lands is not that far, the bottom lands that were preferred for pre-Contact agriculture and habitation near the mouth of Honouliuli Stream seem, in terms of environmental attributes, to have been a world away.

Any pre-Contact surface features and/or shallow subsurface deposits would likely have been destroyed by the continual commercial utilization of the area for crop land. Archaeological

deposits associated with pre-Contact Hawaiian habitation and burial are a remote possibility. Post-Contact archaeological deposits are not anticipated in any abundance on the basis of the historic record and the results reported in previous archaeological studies, but could include irrigation canals, plantation infrastructure remnants, sections of railroad tracks, and of course the bridges found along Farrington Highway.

Section 6 Community Consultation

6.1 Introduction

Throughout the course of this assessment, an effort was made to contact and consult with NHOs, agencies, and community members including descendants of the area, in order to identify individuals with cultural expertise and/or knowledge of the *ahupua‘a* of Honouliuli. CSH initiated its outreach effort in September 2013 through letters, email, telephone calls, and in-person contact. CSH completed the community consultation in March 2014.

Following the completion of a draft CIA, CSH was notified of a hold placed on the project as well as the EA process. In April 2018, CSH was notified that efforts related to the project and the EA process were moving forward. As part of a good faith effort, it was recommended that the individuals who participated in consultation be provided an update via letter on the status of the draft EA. The letter would also serve as a notification of the public's opportunity to comment on the draft EA (including the draft CIA) during the 30-day comment period. A letter will be mailed to the individuals who participated in consultation and will detail the following:

1) An up-to-date description of the project and project area

2) A publication date for the draft EA

3) The deadline for the comment period, as well as where to submit comments to.

A copy of the letter is contained within Appendix C.

6.2 Community Contact Letter

Letters (Figure 31 and Figure 32) along with a map and an aerial photograph were mailed with the following text:

> Cultural Surveys Hawai‘i Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the City and County of Honolulu's proposed Farrington Highway Improvements Project (Between Fort Weaver Road and Kapolei Golf Course Road*), Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu, various Tax Map Keys as depicted on a 1998 US Geological Surveys topographic map (Figure 1) and on an aerial image (Figure 2). The CIA will support an Environmental Assessment (EA) being prepared by Group 70 International, Inc.
>
> **Purpose of Environmental Assessment**
>
> The EA is being prepared pursuant to State and Federal laws. The EA will comply with Hawaii's Environmental Review Process, Hawaii Revised Statutes (HRS), Chapter 343, which requires that any project that proposes the use of State land must undergo an environmental review. Since the project may seek federal funding, the forthcoming EA will also meet the requirements of the National Environmental Policy Act (NEPA). The EA will examine the potential

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Archaeological and Cultural Impact Studies
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February 2014

SUBJECT: Farrington Highway Improvements
Cultural Impact Assessment Consultation

Aloha mai,

Cultural Surveys Hawai'i Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the City and County of Honolulu's proposed Farrington Highway Improvements Project (Between Fort Weaver Road and Kapolei Golf Course Road*), Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu, various Tax Map Keys as depicted on a 1998 US Geological Surveys topographic map (Figure 1) and on an aerial image (Figure 2). The CIA will support an Environmental Assessment (EA) being prepared by Group 70 International, Inc..

Purpose of Environmental Assessment

The EA is being prepared pursuant to State and Federal laws. The EA will comply with Hawaii's Environmental Review Process, Hawaii Revised Statutes (HRS), Chapter 343, which requires that any project that proposes the use of State land must undergo an environmental review. Since the project may seek federal funding, the forthcoming EA will also meet the requirements of the National Environmental Policy Act (NEPA). The EA will examine the potential environmental impacts of the project and seek agency and public comment on subject areas that should be addressed.

Project Description

Farrington Highway Route 93 traverses leeward O'ahu connecting 'Ewa and the Wai'anae coast (Figure 1). It is a major east-west arterial route between Waipahu and Kapolei, frequently traveled as an alternative route to H-1. The City and County of Honolulu (City) has ownership of this section of the roadway alignment, and maintenance is provided by the City.

The 'Ewa region is steadily urbanizing and slowly outgrowing existing infrastructure. The purpose of the project is to implement future transportation plans, and accommodate future transportation demands along the three mile segment of Farrington Highway in the 'Ewa region.

The proposed roadway improvements to the two-lane section of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Access Road* may include widening the highway, a new roadbed, utility relocations, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridge modifications and a landscaped median strip. Implementation of the proposed improvements is constrained by the presence of above-ground power transmission lines, an electrical substation, bridges, culverts, underground utilities, structures, the State's underground energy corridor, a Board of Water Supply pumping station and main lines near Old Fort Weaver Road.

**Official limits of the project are contingent upon results of the traffic analysis and may be adjusted.*

1

Figure 31. Community consultation letter page one

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Cultural Impact Assessment

The purpose of the CIA is to assess potential impacts to cultural practices and resources as a result of the planned Project. We are seeking your kōkua (assistance) and guidance regarding the following aspects of our study:

- **General history and present and past land use of the Project area, and Area of Potential Effect as noted in Figures 1 and 2.**
- **Knowledge of cultural sites- for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the Project area, both past and ongoing.**
- **Cultural associations of the Project area, such as legends and traditional uses.**
- **Referrals of kūpuna (elders) and kama‘āina (Native born) who might be willing to share their cultural knowledge of the Project area and the surrounding ahupua‘a (land division usually extending from the uplands to the sea).**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.**

This CIA investigation may also be used to support the National Historic Preservation Act Section 106 and the NEPA consultation, but does not, in itself, satisfy the cultural consultation requirements of either Section 106 or NEPA and a future letter will be sent for this process.

In advance, we appreciate your assistance in our research effort. Please contact me at mcorrea@culturalsurveys.com or by phone at (808) 262-9972 if you would like to participate in this study or have any information to share regarding this Project.

Mahalo nui loa,

Nicole Ishihara
CSH Cultural Researcher

2

Figure 32. Community consulation letter page two

environmental impacts of the project and seek agency and public comment on subject areas that should be addressed.

Project Description

Farrington Highway Route 93 traverses leeward O‘ahu connecting ‘Ewa and the Wai‘anae coast (Figure 1). It is a major east-west arterial route between Waipahu and Kapolei, frequently traveled as an alternative route to H-1. The City and County of Honolulu (City) has ownership of this section of the roadway alignment, and maintenance is provided by the City.

The ‘Ewa region is steadily urbanizing and slowly outgrowing existing infrastructure. The purpose of the project is to implement future transportation plans, and accommodate future transportation demands along the three-mile segment of Farrington Highway in the ‘Ewa region.

The proposed roadway improvements to the two-lane section of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Access Road* may include widening the highway, a new roadbed, utility relocations, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridge modifications and a landscaped median strip. Implementation of the proposed improvements is constrained by the presence of above-ground power transmission lines, an electrical substation, bridges, culverts, underground utilities, structures, the State’s underground energy corridor, a Board of Water Supply pumping station and main lines near Old Fort Weaver Road.

Cultural Impact Assessment

The purpose of the CIA is to assess potential impacts to cultural practices and resources as a result of the planned Project. We are seeking your kōkua (assistance) and guidance regarding the following aspects of our study:

- General history and present and past land use of the Project area, and Area of Potential Effect as noted in Figures 1 and 2.
- Knowledge of cultural sites- for example, historic sites, archaeological sites, and burials.
- Knowledge of traditional gathering practices in the Project area, both past and ongoing.
- Cultural associations of the Project area, such as legends and traditional uses.
- Referrals of kūpuna (elders) and kama‘āina (Native born) who might be willing to share their cultural knowledge of the Project area and the surrounding ahupua‘a (land division usually extending from the uplands to the sea).
- Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.

This CIA investigation may also be used to support the National Historic Preservation Act Section 106 and the NEPA consultation, but does not, in itself, satisfy the cultural consultation requirements of either Section 106 or NEPA and a future letter will be sent for this process.

**Official limits of the project are contingent upon results of the traffic analysis and may be adjusted.*

6.3 Community Contact Table

Below in Table 4 are names, affiliations, dates of contact, and comments from NHOs, individuals, organizations, and agencies contacted for this project. Results are presented below in alphabetical order.

Table 4. Results of community consultation

Name	Affiliation	Comments
Aila, William	Chairperson, Department of Land and Natural Resources (DLNR)	CSH mailed letter and figures on 21 October 2013 CSH mailed second letter and figures on 12 November 2013
Alaka‘i, Robert	Cultural practitioner	CSH emailed letter and figures on 23 September 2013 CSH mailed second letter and figures on 12 November 2013
Alegado, Dean	Former professor and chair of Ethnic Studies Department, University of Hawai‘i at Mānoa	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Amaral, Annelle	Member, ‘Ahahui Siwila Hawai‘i O Kapolei Civic Club	CSH mailed letter and figures on 23 September 2013 CSH mailed second letter and figures on 21 October 2013
Apo, Todd K.	Director of Public Affairs, Aulani Disney Resort	CSH mailed letter and figures on 23 September 2013 Letter and figures were returned to CSH on 3 October 2013
Arakawa, Lance	City and County of Honolulu	CSH mailed letter and figures on 23 September 2013

Name	Affiliation	Comments
Archer, Guy	President, Hawai‘i Trail and Mountain Club (HTMC)	CSH emailed letter and figures on 23 September 2013 Mr. Archer responded to CSH on 24 September 2013 via email: *I recommend Stuart Ball's recent book—Native Paths to Volunteer Trails—Hiking and Trail Building on Oahu, (UH Press 2012). The book is full of detail and is the best current resource for Oahu. Regarding your inquiry, where is the traditional trail located and who is doing the road widening? Is your research for academia, government agency, or private concern?* *Thank you for contacting Hawaiian Trail & Mountain Club.*
Ayau, Halealoha	Hui Mālama i Nā Kūpuna o Hawai‘i Nei	CSH emailed letter and figures on 23 September 2013
Barbieto, Pio and Lida	Raised in ‘Ewa Plantation	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Bautista, Gary	Member, ‘Ewa Neighborhood Board #23	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Beamer, Charles Richard	Member, ‘Ewa Beach Community Association	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 Second letter and figures were returned to CSH on 24 October 2013
Becket, Jan	Author, photographer, teacher	CSH hand delivered letter and figures on 12 January 2014 CSH followed up with Mr. Becket via email on 13 January 2014 Mr. Becket emailed CSH on 31 January 2014 for a possible *huaka‘i* (field trip) to the Kalaeloa Heritage Center (KHC) with Shad Kāne pending on weather; cancelled Mr. Becket emailed CSH on 7 February 2014 for a possible *huaka‘i* pending on Mr. Kāne's schedule; cancelled Mr. Becket emailed CSH on 15 February 2014 for a possible *huaka‘i* on 16 February 2014; cancelled *huaka‘i* scheduled to tour KHC for 19 February 2014

Name	Affiliation	Comments
		Site visit to KHC on 19 February 2014; authorization form signed CSH emailed interview summary to Mr. Becket for approval on 5 March 2014 Mr. Becket approved interview summary on 5 March 2014 See Section 6.7.2 for his interview with CSH
Bise, Tony	Member, ‘Aiea Community Association	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 Second letter was returned to CSH on 6 November 2013
Bond, John	Cultural practitioner, Kānehili Cultural Hui	CSH mailed letter and figures on 23 September 2013 CSH mailed second letter and figures on 21 October 2013 CSH mailed third letter and figures on 9 December 2013
Brown, Kenneth	Cultural descendent	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 Second letter and figures were returned to CSH on 26 October 2013
Cabanilla, Rida	Representative, 42nd District	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 12 November 2013
Cayan, Phyllis “Coochie”	Hui Kako‘o	CSH emailed letter and figures on 23 September 2013
Ching, Arlene	Branch Manager, ‘Aiea Library	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Clark, Melvin Kauwila	Cultural historian	CSH mailed letter and figures on 24 September 2013 Letter and figure were returned to CSH on 3 October 2013
Crabbe, Dr. Kamana‘opono	Chief Executive Officer, OHA	CSH sent letter and figures to Keola Lindsey and Momilani Lanzo on behalf of Dr. Crabbe on 23 September 2013 Mr. Lindsey responded to CSH on 24 September 2013: *I hope all is well with you and mahalo a nui for all of your hardwork on CIAs, etc to assure that our wahi*

Name	Affiliation	Comments
		and iwi kupuna across Ko Hawai‘i Pae‘āina are afforded protection. *I have recently transitioned to new kuleana within OHA and I wanted to electronically introduce you to Kai Markell and Everett Ohta of OHA. Kai and Everett are respectively the Manager and Senior Specialist in our Compliance Enforcement Program (the program I was formerly within). This is the program within OHA that has the primary kuleana for review and comment on NEPA/HEPA, NHPA, CIA, etc. documents.* *Hardcopies of your inquiries should still be sent via US Mail to OHA and addressed to our Ka Pouhana/CEO Dr. Kamana‘opono Crabbe (Kai and Everett- please correct me if this policy has changed). As always, upon receipt these hardcopies will then be routed internally to our Compliance Enforcement Program.* *In regards to your electronic inquires/follow up such as your note below however, I encourage you folks to communicate directly with Kai and Everett to determine what the most efficient process will be moving forward.* OHA responded to CSH via mail dated 7 October 2013; see Section 6.4 for an expanded response
Eaton, Arlene	*Kupuna*, Hale O Na‘auao	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
Farm, Kawika	Burials Specialist, State Historic Preservation Division	CSH emailed letter and figures on 23 September 2013 Mr. Farm responded to CSH via email on 24 September 2013: *The request was forwarded to SHPD's acting history and culture branch chief.*
Fevella, Kurt	Member, ‘Ewa Neighborhood Board	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Fujita, Mitsuko	*Kama‘āina* of ‘Aiea	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Gaballo, Dominic	Resident of ‘Ewa Beach, fisherman	CSH hand delivered letter and figures on 2 October 2013

Name	Affiliation	Comments
Golojuch, Michael	Makakilo/Kapolei Neighborhood Board	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Holden, Lance	President, ‘Ahahui Siwila Hawai‘i O Kapolei Civic Club	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 12 November 2013
Holt, Ruth	Immediate past president, King Kamehameha Hawaiian Civic Club	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 1 October 2013
Inciong, Tane	Artist and cultural practitioner	CSH emailed letter and figures on 23 September 2013
Ka‘eliwai, George	Member, ‘Ewa Hawaiian Civic Club	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Kalahiki, Mel	Member of ‘Ahahui Mālama o Kaniakapūpū	CSH mailed letter and figures on 24 September 2013 Mr. Kalahiki called CSH on 3 October 2013 and left a message CSH returned Mr. Kalahiki’s call on 3 October 2013 to set up an interview for the week of 7-11 October 2013 CSH called Mr. Kalahiki on 7 October 2013; no answer CSH called Mr. Kalahiki on 14 October 2013; interview confirmed for 17 October 2013 CSH interviewed Mr. Kalahiki and his wife Carol in Kāne‘ohe on 17 October 2013; authorization form signed by Carol Kalahiki per Mel Kalahiki on 17 October 2013 See Section 6.7.1 for his interview with CSH
Kamahele, Momi	Hawaiian Studies Department – Leeward Community College; Hālau Pua Ali‘i ‘Ilima	CSH emailed letter and figures on 23 September 2013
Kāne, Shad	Member, O‘ahu Island Burial Council (OIBC) Chairman and ‘Ewa Moku Representative, Committee on the Preservation of Historic Sites and Cultural Properties	CSH emailed letter and figures on 23 September 2013 CSH emailed second letter and figures on 6 December 2013 Mr. Jan Becket emailed CSH on 31 January 2014 saying he scheduled a possible fieldtrip to visit the KHC and Mr. Kāne pending on weather; cancelled

Name	Affiliation	Comments
	Caretaker, Kalaeloa Heritage Park ‘Ahahui Siwila O Hawai‘i O Kapolei Hawaiian Civic Club	Mr. Becket emailed CSH on 7 February 2014 for a possible fieldtrip to visit the KHC pending on Mr. Kāne’s schedule; cancelled Mr. Becket emailed CSH on 15 February 2014 for a possible fieldtrip on 16 February 2014; cancelled Fieldtrip scheduled to tour KHC for 19 February 2014 Site visit to KHC on 19 February 2014; authorization form signed CSH emailed interview summary to Mr. Kāne for approval on 3 March 2014 Mr. Kāne approved his interview summary on 4 March 2014; see Section 6.7.3 for Mr. Kāne’s interview with CSH
Kapolei Hawaiian Civic Club		CSH emailed letter and figures on 23 September 2013 CSH emailed second letter and figures on 9 December 2013
Keala, Jane	Member, ‘Ahahui Siwila Hawai‘i O Kapolei Hawaiian Civic Club	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Kupihea, Kehau	Resident of ‘Ewa Beach	CSH emailed letter and figures on 23 September 2013
Lancaster, Kaleo	Author of *Island Trails*, blogger and hiking enthusiast	CSH emailed letter and figures on 23 September 2013
Lee, Michael	Cultural practitioner, Kānehili Cultural Hui	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 CSH mailed third letter and figures on 9 December 2013
Lenchanko, Tom	Caretaker, Kūkaniloko Heiau	CSH mailed letter and figures on 24 September 2013 Mr. Lenchanko replied to CSH via email on 7 October 2013; see Section 6.6 for expanded response
Makaiwi, Martha	Member, Makakilo/Kapolei Neighborhood Board	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 12 October 2013
Malama, Tesha	Hawaii Community Development Authority (HCDA) Kaleloa; former	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 12 November 2013

Name	Affiliation	Comments
	‘Ewa Villages Association	
Matanane, Eric	Oral traditions, Wahipana ‘O ‘Ewa	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
McKeague, Kawika	Cultural practitioner; Honouliuli historian and longtime resident	CSH mailed letter and figures on 24 September 2013 Mr. McKeague sent CSH an interview transcript on 9 December 2013 CSH emailed Mr. McKeague on 3 Feburary 2014 asking permission to include a past interview summary in conjunction with his interview transcript; Mr. McKeague granted permission to use the interview summary the same day via email CSH emailed interview summary to Mr. McKeague for approval on 18 February 2014 CSH sent a follow up email to Mr. McKeague regarding edits on his interview summary on 24 February 2014 Mr. McKeague sent back interview summary with edits via email to CSH on 26 February 2014
Nahulu-Mahelona, Moani	Hawaiian Studies Department at Kapolei High School	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Nakamatsu, Charles	Raised in ‘Ewa Plantation	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Nakamura, Kojiro and Fumiko	Raised in Tenney Village	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Oamilda, Glenn	Member, ‘Ewa Beach Community Association	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 1 October 2013
Paishon, Frank	Raised in Tenney Village	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Philpotts, Douglas	Descendent of Campbell Family	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
Poirer, Dick	Chair, Mililani/Waipi‘o/Melemanu Neighborhood Board	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Quintal, Leti	Raised in ‘Ewa Plantation; Secretary for	CSH mailed letter and figure on 23 September 2013 CSH mailed second letter and figures on 12 November 2013

Name	Affiliation	Comments
	the Immaculate Conception Church	
Ramos, Rodolfo	Chair, ‘Ewa Task Force	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Rivero, Frances	Director, Boys and Girls Club of ‘Ewa	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Rodenhurst, Roda	President, ‘Ahahui Siwila Hawai‘i O Kapolei Hawaiian Civic Club	CSH emailed letter and figures on 23 September 2013
Rodrigues, Hinano R.	Interim Culture and History Branch Chief, SHPD–Maui Office	CSH emailed letter and figures on 23 September 2013
Shirai, Thomas	Kawaihapai ‘Ohana	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Silva, Adrian	Hui Huliau	CSH mailed letter and figures on 23 September 2013
Slater, Lovey	*Kama‘āina* of Pearl City; OHA	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 Ms. Slater called CSH on 7 November 2013 and left a message CSH returned call on 7 November 2013; left a message
Soma, Kenneth	Retired from ‘Ewa Plantation and resident	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
Soma, Millie	Raised in ‘Ewa Plantation and resident	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
Stagner, Dr. Ishmael	Author, cultural historian, genealogist at Alu Like	CSH mailed letter and figures on 24 September 2013 Letter was returned to CSH on 26 September 2013
Stroud, Soulee L.K.	President, Association of Hawaiian Civic Clubs	CSH mailed letter and figures on 23 September 2013
Swinney, Shirley S.	Vice President, Kapolei Community Development Corporation	CSH mailed letter and figures on 23 September 2013
Tam, Sharene	Vice President, Haseko Development Inc.	Makena White of Planning Solutions referred Ms. Sharene Tam of Haseko for access to cultural sites adjacent to the Ocean Pointe development

Name	Affiliation	Comments
		CSH called Ms. Tam on 10 February 2014; she was out of town and asked to forward a community contact letter and figures of project area via email CSH sent letter and figures on 10 February 2014 Ms. Tam replied to CSH via email on 14 February 2014 with the following: *Can you tell me which of our three preserves you'd like to visit?* CSH emailed Ms. Tam on 18 February 2014 with the following: *Aloha Sharene,* *Mahalo for getting back to me. One of the site numbers is -4278 and it is along the beach access road (Papipi Road) to One‘ula Beach Park. The other site is just mauka of One‘ula Beach Park access road, towards the park bathrooms, heading in the direction of Kalaeloa. Let me know if you need me to be more specific than that. I will be in ‘Ewa tomorrow interviewing and surveying. If we could get access tomorrow, that would be fabulous. If not, based on that it such a short notice, then we can try for another day.*
Tiffany, Nettie	*Kahu* at Lanikuhonua	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013 Letter was returned to CSH on 24 October 2013
Timson, Maeda	Makakilo/Kapolei, Honokai Hale Neighborhood Board No. 34	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Vredenburg, Keawe	Cultural practitioner, author	CSH mailed letter and figures on 24 September 2013 Mr. Vredenburg responded to CSH on 25 September 2013 via email; see Section 0 for expanded response
White, Perry	Planner, Planning Solutions	Referred to CSH by Jan Becket as a contact to access cultural sites adjacent to One‘ula Beach Park CSH called Mr. Perry White of Planning Solutions on 7 February 2014 and left a message regarding access to cultural sites adjacent to One‘ula Beach Park Makena White of Planning Solutions returned CSH's message on 10 February 2014 and referred Sharene

Name	Affiliation	Comments
		Tam of Haseko Development Inc. to gain access to cultural sites
Wong-Kalu, Hinaleimoana K.K.	Chair, OIBC; Director of Culture, Hālau Lōkahi Public Charter School	CSH mailed letter and figures on 21 October 2013
Wood, Lawrence A.	Hawaiian Civic Club of ‘Ewa-Pu‘uloa	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Yamamoto, George S.	Makakilo/Kapolei Neighborhood Board	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Yonehiro, Kathleen Kehaulani	Hula Hālau ‘O Kehaulani	CSH mailed letter and figures on 24 September 2013
Young, Helen Colburn	Archivist, Kawaiha‘o Church	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013
Young, Tin Hu	Archivist, Kawaiha‘o Church	CSH mailed letter and figures on 24 September 2013 CSH mailed second letter and figures on 21 October 2013

6.4 Office of Hawaiian Affairs

CSH contacted Keola Lindsey and Momilani Lanzi on behalf of Ka Pouhana (Chief Executive Officer), Dr. Kamana‘opono Crabbe, on 23 September 2013. Mr. Lindsey responded on 24 September 2013 stating that Kai Markell and Everett Ohta of OHA are “respectively the Manager and Senior Specialist” in the Compliance and Enforcement Program. This particular program “has the primary kuleana for review and comment on NEPA/HEPA, NHPA, CIA” documents.

CSH received a letter from OHA on 8 October 2013 (see Appendix A). OHA recommends CSH consult with (but not be limited to) the following individuals and community organizations: Shad Kāne, Mike Lee, and ‘Ahahui Siwila Hawai‘i ‘O Kapolei Hawaiian Civic Club. OHA requests “that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be identified during ground altering activities related to this project, all work will immediately cease and the appropriate agencies will be contacted pursuant to applicable law.” In addition, if any burials are found, OHA would like to be notified and consulted.

6.5 Keawe Vrendenburg

CSH contacted Keawe Vredenburg on 24 September 2013 via email. Mr. Vredenburg responded to CSH via email on 25 September 2013 with the following concerns:

Aloha.

> I have two cultural ‘issues’ for that general area.
>
> 1) The large flightless duck, Thambetochen xanion, which likely was called moa nui and served as game for travelers taking the land route to the area mauka of Pearl Harbor and on to Kou. If this project calls for deep cuts, there should be a possibility of finding moa nui bones in layers of charcoal, since they have been found in the limestone sinkholes.
>
> 2) The attached story of Mailikukahi which may produce remains at or near the Fort Weaver/Farrington intersection.

Mr. Vrendenburg attached a synopsis of the *mo‘olelo* of Mā‘ili-kūkahi:

> Mā‘ili-kūkahi was born in the early 1300’s at Kūkaniloko, just outside Wahiawā, opposite the Whitmore Village road. A chief of O‘ahu almost had to be born there to become an ali‘i kapu (sacred chief). Being ali‘i kapu, by the way, did not mean a chief was automatically a supreme governing chief (ali‘i mō‘ī), only that he was genealogically and spiritually qualified to become one. Think of this as being two parallel tracks: one of inherited title and rank (ali‘i kapu) and one of acquired knowledge and managerial skill (ali‘i mō‘ī).
>
> The chiefs asked Mā‘ili at age 20 to be the government administrator, the chief executive under the mō‘ī Haka, the ruling chief at that time, an inept executive, antagonizing chiefs and maka‘āinana (commoners) alike. There was a rebellion, Haka was killed and Mā‘ili was asked to become ruling chief. He was consecrated at the heiau of Kapukapu‘ākea (= ‘most sacred of all temples’) in Waialua.
>
> Mā‘ili-kūkahi was born with the highest kapu possible. Once given the position of ruling chief, he surveyed the entire island, redrew the six ahupua‘a (district) boundaries, and mandated the size and extent of all the smaller districts (townships, sections) within the ahupua‘a. Then he did what we all wish our State and County governments would do: he ordered government to serve the people, with heavy punishments if they failed. So many services were given to the people that taxes were paid voluntarily. Mā‘ili then declared that he would adopt the first-born sons of every family on the island.
>
> Each first-born was brought to Mā‘ili’s personal kauhale (living area) in Waialua to be educated and trained as a warrior. O‘ahu prospered under him to the extent that every island knew about and envied O‘ahu. Top quality goods made on O‘ahu were traded throughout the islands, raising the general quality of production in all of Hawai‘i. O‘ahu-made goods were seen throughout our archipelago and on down to Kahiki, Nu‘uhiva, Samoa, even Aotearoa. For nearly 25 years, Mā‘ili-kūkahi kept O‘ahu at the pinnacle of Hawaiian power and prestige and as the target of ambitious island nations.
>
> Two chiefs from Hawai‘i named Hilo and Punalu‘u joined with a chief from Maui, Luako‘a, and gathered an army for invasion of O’ahu. Rumors of this action preceded the attack by several months. When a fleet of war canoes appeared off Waikīkī, the people there left to let the invaders burn their houses and cut down their niu (coconut trees). Then the war canoes went on up the coast to ‘Ewa.

> The Hawai’i army started inland at ‘Ewa and after a few miles, the hānai children of Mā‘ili cut them off from behind and destroyed their canoes. Then the main O‘ahu army attacked from in front and the sides. The battle site was a flat plain later called Punalu‘u (after the defeated Hawai‘i chief) near Kīpapa gulch. Kīpapa, which means ‘placed prone’, was named that because that was how the bodies of the Hawai‘i warriors fell in the gulch.
>
> According to this O‘ahu history, Kīpapa was filled with the bodies. A few of the invaders made it back to Waimano and ‘Ewa. The chief Hilo and his staff were captured at a place now called Po‘ohilo (the head of Hilo) and beheaded (where Fort Weaver Rd and Farrington Hwy cross).

6.6 Tom Lenchanko

CSH contacted Tom Lenchanko on 24 September 2013 via mail. Mr. Lenchanko responded to CSH on 7 October 2013 via email with the following response to the project:

> REGARDING: VIOLATION OF HAWAIIAN NATIONAL LAW, ITS CITIZEN’S RIGHTS AND EXCLUSIVE TERRITORIAL JURISDICTION ON HAWAIIAN NATIONAL AINA; DELIBERATE HARM AND IRREPARABLE INJURY TO OUR SOVEREIGN HAWAIIAN NATIONAL STATE, ITS NATURAL RESOURCES, MONUMENTS, WORKS OF ART AND SCIENCE, TRADITIONAL CRAFTS, RELIGION, CEREMONIAL PRACTICES AND BELIEFS OF OUR LIVING DESCENDANTS; THE DESECRATION OF BURIAL SITES OF OUR KANAKA MAULI BURIED IN OUR SOVEREIGN
>
> NATIONAL SOIL WHICH CONSTITUTES ACTS OF GENOCIDE . . . EXECUTED IN VIOLATION OF UNITED STATES LAWS AND THE INTERNATIONAL LAWS OF NATIONS, E.G., THE
>
> PERPETUAL NON-ABROGATED TREATY OF FRIENDSHIP, COMMERCE, NAVIGATION OF NOVEMBER 09, 1850; EXERCISED BY THE UNITED STATES IN VIOLATION OF THE ARTICLES OF THE UNITED NATIONS CONVENTION ON GENOCIDE OF 1948; THE UNITED STATES PROXMIRE ACT (1987); AND THE NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT OF 11/16/1900 (P.L. 101-601.25 USC 3001)
>
> me oukou ka welina e kakou
>
> To avoid further conflict:
>
> 1- Please provide evidence and proof of the City & County of Honolulu’s claim of ‘exclusive territorial jurisdiction’ over our Hawaiian land and Hawaiian Nationals which claim of jurisdiction has not been revealed or proven. Jurisdiction over the land (in rem) and in personam (Private Citizen) must be proven in writing, not just assumed, not just stated and not just claimed without proof and written evidence at law. Jurisdiction when challenged, as in this international instance, must be responded to in writing and proven, as required by your own United States laws.

2- Regarding: International Humanitarian Law—Treaties and Documents

Please affirm or deny the City & County of Honolulu honors the Hague Convention (II and IV) relative to Laws and Customs of War on Land, Hague 1899 and 1907, .i.e., Article 42, 43 and 56, specifically; the Universal Declaration of Human Rights Article 18 ‘everyone has the right to freedom of thought, conscience and religion. This includes freedom to manifest his religion or belief in teaching, practice, worship and observance.’

3- Please affirm or deny the City & County of Honolulu honors our non-abrogated Hawaiian National Citizenship rights; the 1850 Treaty of Friendship with the United States; our lawful National Offices[which are superior to the STATE OF HAWAII Statute] and our non-abrogated common law, which were never removed by the United States Congress under its TERRITORIAL ACT FOR HAWAII [Territorial Act of April 30, 1900, C339, 31 Stat 141], or the STATEHOOD ACT [Admissions Act of March 18, 1959, Pub L 863, Stat4].

LAWFUL NOTICE TO CEASE AND DESIST UNLAWFUL AND GENOCIDAL ACTIONS BY THE UNITED STATES FEDERAL GOVERNMENT, ITS MILITARY, THE DE FACTO STATE OF HAWAII AND THEIR AGENTS:

The United States Federal Government, its military, the de facto STATE OF HAWAII and their agents have been unable to prove their fraudulent claim of ownership or jurisdiction over sovereign Hawaiian National Lands or even provide evidence of the existence of a lawful ‘citizenship contract’ with our ‘Hawaiian National Private Citizens’ born to and domiciled on our Hawaiian National Archipelago.

Please be noticed the foreign United States Federal Government, it military, the de facto STATE OF HAWAII and their agents, internationally, lack lawful jurisdiction to act on our Hawaiian

National land in behalf of our Hawaiian National Government, our Private Citizens, their rights, our cultural practices and our laws.

‘ike pono a me ho‘oia‘i‘o pule paulele

Thomas Joseph Lenchanko Hawaiian National 10/07/2013

kahuakai ola ko laila waha olelo Aha Kukaniloko Koa Mana mea ola kanaka mauli

6.7 Kama‘āina Interviews

The authors and researchers of this report extend our deep appreciation to everyone who took the time to speak and share their *mana‘o* and *‘ike* with CSH whether in interviews or brief consultations. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and in no way altered, and that if large excerpts from interviews are used, report preparers obtain the express written consent of the interviewee/s.

6.7.1 Mel Kalahiki

CSH interviewed Mr. Mel Kalahiki on 18 October 2013 at his home in Kāne‘ohe. Mr. Kalahiki has been previously interviewed in 2008, 2009, and 2010. Now 88 years old, Mr. Kalahiki was born on 25 June 1925 to Kamaka Kalahiki of Kahalu‘u, O‘ahu and Elisabeth Akau of Kohala, Hawai‘i. He was born and raised in the *ahupua‘a* of Kalihi on the island of O‘ahu. The Kalahiki *‘ohana* has homestead land in Kahalu‘u on the island of O‘ahu. As a child, Mr. Kalahiki recalls spending his weekends in the taro patch on the family homestead in Kahalu‘u.

Mr. Kalahiki later moved to Kawaihae on Hawai‘i Island where he resided with his maternal grandfather, William Paul Akau. Mr. Kalahiki recalled boarding the SS *Humuula*, an inter-island cattle and freight steamer. Typically, the SS *Humuula* left Honolulu at noon and arrived to Kawaihae by 4:30 a.m. the next morning. Mr. Kalahiki’s grandfather lived on the beach in Kawaihae and four homes away from the school house. Although Mr. Kalahiki was away from home on O‘ahu, he added that he had relatives who lived nearby in Kawaihae.

Mr. Kalahiki learned a great deal about his culture from his grandfather. One memory that Mr. Kalahiki has of his grandfather are the *mo‘olelo* that Mr. Akau shared with him. Mr. Kalahiki recalled one *mo‘olelo* of whales and sharks that would feed at Hale o Kapuni Heiau, the submerged ruins of a temple dedicated to shark gods. In relation to Hale o Kapuni Heiau, Mr. Kalahiki recalled a fishing trip with his grandfather. One day, Mr. Kalahiki and his grandfather paddled out their canoe off Kawaihae and dropped anchor. Mr. Kalahiki felt a tug on the canoe but ignored it. Mr. Kalahiki’s grandfather abruptly asked him to pull the anchor up and the two paddled back to shore steadily. Upon arrival back on land, Mr. Kalahiki asked his grandfather, “Why didn’t we fish?” His grandfather told him to look at the ocean. As Mr. Kalahiki turned to look at the sky and ocean, he noticed a storm was heading straight to shore. His grandfather simply said, “*Manō* [shark] is out.”

Mr. Kalahiki recalled the day his grandfather passed away. His grandfather’s doctor was located in Honolulu and he frequently came to O‘ahu for appointments. In 1941, Mr. Kalahiki was 16 years old and attending Farrington High School. Mr. Kalahiki went home that day and “saw everyone crying.” At that moment, Mr. Kalahiki knew his grandfather had passed away. Mr. Kalahiki traveled back to Kawaihae with his grandfather’s casket via the SS *Humuula*. The ship arrived in Kawaihae at approximately 4:30 a.m. He recalled the moment the ship docked. As the dock workers lowered his grandfather’s casket onto canoes, he described the sky being still dark with the only available light from kerosene lamps. Everything was quiet except for those who mourned and shouted, “*Uē* [to wail loudly]!” The captain then stated, “The *ali‘i* is coming home.”

That same year, Farrington High School stopped operating in a school capacity due to World War II. During that time, the school was used as a makeshift hospital to treat wounded soldiers. Still a teenager, Mr. Kalahiki quit school and immediately began working at Fort Shafter. He worked on various projects, which included creating a cave shelter to use for espionage work in the *ahupua‘a* of Kahauiki (today known as Fort Shafter). He was also a blacksmith’s assistant. During the “blackout” times of World War II, he made a tunnel and magazines at Diamond Head (today known as Diamond Head State Monument). The tunnel is still present today and is named the Kapahulu Tunnel. The tunnel is located before the attendant booth and parking lot of the state monument.

After working with the military, Mr. Kalahiki was employed with Hawaiian Telcom for 40 years. During his employment with Hawaiian Telcom, one project was to install a trunk cable under Farrington Highway. CSH asked if he recalled any bones or artifacts unearthed during the installation of the trunk cable for Hawaiian Telcom. Mr. Kalahiki does not recall seeing or hearing of any bones or artifacts inadvertently discovered during the installation of the trunk cable. He stated that there is a high possibility workers might encounter the cable during construction activities. He also recalled a 16-head gun mount near Fort Weaver Road. When the gun mount was used, he remembered "everything would rock." He stated that the gun mount is used as a meeting area for the O‘ahu *‘ōhua* (members) for Pu‘ukoholā Heiau, which is now headed by Mel Kalahiki, Jr. who succeeds his father, Mel Kalahiki.

Reflecting back on the landscape of Honouliuli Ahupua‘a, Mr. Kalahiki recalled Kapolei and ‘Ewa Beach being planted primarily in sugarcane. He added that ancient trails once ran through the sugarcane fields and closer *makai*. Today, the ancient trails and sugarcane are replaced by homes. During Mr. Kalahiki's childhood, he remembered a fishing village in the vicinity of the Iroquois Point area. He recalled many different types of *limu* being abundant in certain areas of ‘Ewa Beach including *limu ‘ele‘ele*, a type of *limu* used for stews. Mr. Kalahiki described the taste of *limu ‘ele‘ele* as a little salty but having a unique flavor when added to stew. Other marine life such as *‘opihi* (*Cellana talcosa*; limpet), clams, and small fish were also plentiful.

Mr. Kalahiki has suggested CSH contact Shad Kāne. As for himself, he has no objections to the highway improvements project. Mr. Kalahiki closed his interview with the *‘ōlelo no‘eau*: *‘Ike pono*, to understand what is not said.

6.7.2 Kawika McKeague

This interview summary is extracted from a telephone interview conducted by CSH on 6 June 2007 and an interview transcript titled "Oral History of Kalaeloa Harbor" in which Mr. Mark Kawika McKeague was interviewed by Mina Elison on 2 July 2013.

Mr. Mark Kawika McKeague, was born on 27 August 1970. He grew up in the *moku* of ‘Ewa, in the *ahupua‘a* of Honouliuli in what he calls, "the cascading shadows of Pu‘u Pailai," more commonly known today as Makakilo. Mr. McKeague was raised by his paternal grandparents, Alexander Laukakila McKeague and Hildegard Woelk. He grew up in a bi-cultural family, tracing his lineage to Hawai‘i and to Germany. "I'm three-quarters German, and one quarter Hawaiian," he said. Mr. McKeague shared his family history and early years:

> My mom spoke fluent—obviously, spoke fluent German, um, and then, you know, she came over during the war time. They met . . . in the ‘40s/'50s and then they relocated back home before my dad went to Vietnam in the late ‘60s, and they bought the house in Makakilo in 1965. So, our house in 1965—we're on 92-621 A‘ahuali‘i Street, that was the highest house in 1965. So, I joke now that, you know, what used to be the heights of ‘Makakilo' is now the ‘foothills of Palehua.' I tell people that, ‘I live in the foothills of Palehua.' [*laughter*] 'Cause it goes up forever, you know. [*laughs*] In 1965, only had—and I was born in 1970 . . . My grandparents on my Hawaiian-side, *hanai'd* [adopted] me first and I was legally adopted, I think, at the age of five . . . I was raised—how do you say—one generation removed—

> by my grandparents, so, to some degree, I'm a product of sort of their values, their perspective and whatevers.

Mr. McKeague considers his grandfather who raised him as his father. He talks about his Hawaiian ancestry and where they come from which illustrates life in Hawai‘i during his father's time:

> My father Alexander Lapakila, was born in Ka‘awaloa, Kona, and probably around the age of three or four thereabouts, the family moved to Keālia, Kaua‘i to be part of the Kealia Plantation, and that's where the rest of the *‘ohana* was born. Actually, I think they came back to Honolulu—from Honolulu to Keālia. So, they worked the ranch out there and then decided . . . He tells stories, like his job at a young age was to feed the horses and stuff, sugar cane plantation. Sometimes when the water would overflow, they would make *lo‘i* and stuff like that, sometimes. It became too tedious to clean the *lo‘i* so they transform the *lo‘i* into like to a watercress patch, or whatever, and then, at least for Kaua‘i, Keālia Bay, that's where they would go fishing and stuff like that, so, you know, he was born and bred of that generation, that the sea is your icebox, the ocean is your icebox. So, some of that was passed down to me, too, so, of course that, all the things you hear about taking what you need, you know, how to pick the *limu*, how to clean your nets and check your nets, you know, release stuff, and that's why my job was to sit there on the beach and just listen all the time. I didn't understand why I was stuck with that stupid job, I only say stupid now because, you know, it's like, looking back, it was like, 'How come I got to do this?' [*laughter*]

Mr. McKeague recalled fond memories of his childhood growing up as a kid in ‘Ewa. Growing up in a Seventh Day Adventist family, church played a major role in his life:

> For me, as a kid, this was Barbers Point Naval Base, right, but, as a kid growing up . . . all the way up to the age of 12, 13 . . . my standard life as a kid was . . . I was to go to school, I went to Leeward Adventist Christian School, so, I had to catch the early morning bus all the way to Wahiawa, and back, and then come home and do chores and stuff like that. You know, play around Pu‘u Palailai and stuff like that. Saturdays, because we're Seventh Day Adventist, it was all about the *hale pule* [church]. So, from early morning, go to the church service, and in the afternoon, it was either one of three things: it was either stay in Wai‘anae and we would do different community service projects, like go sing to the *kūpuna* at Jade Street Home, old folks home, go take canned goods to people that we knew were hungry, that kind of stuff; the second was go visit my birth parents who are buried at Pūowaina, Punchbowl . . . And then, the third thing, if we wasn't, you know, in Wai‘anae doing some kind of community service or Pūowaina taking care of the graves, was spent on the beaches of Kalaeloa and Kualaka‘i . . . And if you don't know, from like Friday sundown to Saturday sundown is considered like sacred time—God's time.

He spoke of his grandfather and the type of relationship that they had:

> [One time I told my father] 'I don't want to go church anymore, you know, I believe

> in God, I believe in *Ke Akua* and I pray every day,' you know, I had to explain to him, and he was—I was expecting Armageddon, but, he was totally understanding, and I think for him, my sort-of awakening was his sort-of awakening, especially as an older *kupuna* already. And that's where I started to really query him about his life experiences and learning about his early days in Keālia, 'How you guys used to do this.' Just kept pegging him, pegging him. And it was funny, 'cause then, you know, he would want to learn from me, because I'd say, 'Oh, yeah, I went to this thing and, oh, yeah, you know that Fort Barrette is actually Pu‘u o Kapolei, and Pu‘u o Kapolei gets its name from Kapaulukina‘u who is the goddess . . . ' *da da da*, you know, like this little rambling tree bird, and every now and then, he'd be like, 'Son, what was that name of that,' you know, so, he'd be asking me, so, it was kind of interesting that as we were getting older together, you know, I'm in my 20s, again, I'm not an expert, but to some degree, he was coming to me to share what I was learning and I was trying to desperately get him to talk as much as he could, even stuff outside of Kalaeloa, yeah. Or trying to remember, 'Oh, yeah, dad how did you lay the net?' Because as a kid, I just remember the net going over, I didn't remember specifically the techniques. I remember, again, the trivial jobs like I got taught basic net fixing so I knew how to tie the knots.

Growing up with his grandparents, Mr. McKeague's grandmother spoke Hawaiian and his grandfather knew some so he grew up surrounded by the Hawaiian language.

> First time I heard the *ipu heke* [gourd drum], and this might sound, whatever, drama—I don't know, *keakanui*, but, I remember the first time I really heard the *ipu heke* and that was when she was doing it and something triggered, like, I feel like I'm at home. I didn't know—I mean I had *‘ōlelo* [language] because my great-grandmother still spoke Hawaiian and she was around till I was ten, and then my father, paternal grandfather, he grew up in the era where they weren't allowed to speak, but, because it was spoken around the family, he still had some of it. So, I had the *‘ōlelo*, I had the *mele* and music and what not, and meeting her [Kumu Vicky Takamine Holt] and then being exposed to those early dances and chants and stuff, that it all sort of made sense. So, to even to this day, I'll say my conversational sucks, that I don't practice enough, but, I'm pretty, I would say, systematic in continuing to explore poetry, prose, and looking at sources like Ho‘oulumāhiehie.

As he recollects his past, Mr. McKeague believes that many of the values and who he is today stem from his upbringing:

> I think part of my sensitivity and training—even though it wasn't labeled as, 'We're going to teach you to *mālama* [to take care of] your *kūpuna*,' it was systematically, every Saturday was go to Punchbowl and take care of all the graves . . . not just my birth parents, but actually, my great-grandparents, grand-uncles, there's like three of four of them all buried there. My job as a kid, imagine from age four or five, was pull, water the graves, the flowers, go do this and that.

His love and affinity for the different kinds of *limu* comes "from those early days of gathering limu off of the beaches," said Mr. McKeague. He recalled time spent by the sea learning from his father and laying net every Saturday night by the jetty at Barbers Point base:

> When we go walk the beach . . . it wasn't about go swim, you know, even though we wanted to go swim. It was go look at the tide pools. My dad would-again, not purposely saying, 'You know, I'm going to teach you how to do this,' but, by his own—he needed stuff for things of the sea. I would learn, observe, and also absorb . . . and also . . . with him and his friends, once the sun went down on Saturday, we were back to . . . 'secular' time and that's where he would meet up with two of his friends . . . Frank Villegas and this other guy who I only remember as 'Uncle Mo'—Hawaiian man, white hair. Just Uncle Mo. And sometimes, a third person would be this guy Alex Lee and they would all *hui* [unite] up together right by the jetty. This little jetty over here, there's this jetty. On the Barbers Point base, that's where they would go lay net every Saturday night. And then, my job was to sit on the beach, listen for the bells, you know, and then sometimes we go check the net, because the thing out here, there's a lot of different kinds of sharks still, hammerhead sharks, mostly hammerhead, I've seen some black tips and what not. So, make sure that, you know, it is fish in there and not necessarily sharks.

Laying net was done by going out on a little rubber boat to just outside the reef and laying out the net. He recalled,

> They liked a lot of the reef fish . . . different kinds of mullet, *'anae* . . . lot of, well, I remember a lot of *weke*, a lot of different menpachi, and sometimes a little deeper you get *akule* [big-eyed scad; *Trachurops crumenophthalmus*]. I don't remember the things there—I like *uhu* [parrot fish; *Scarus perspicillatus*] now, I don't remember *uhu* as a kid. I remember *awa*, *āholehole* [Hawaiian flagtail; *Kuhlia sandvicensis*].

Mr. McKeague continued to share his memories of laying net:

> [We'd] lay net at night and in the morning we'd gather. And that's all I remember for a lot of my time growing up is cleaning the nets, picking the *limu*. And, at that time, there was still a lot of *limu* to gather. I remember a lot of, well, *ogo* of course—but a lot of *limu wāwae'iole*. And my dad would say, 'That's your salad, son.' [*laughter*] So, he would chop that up with tomato and onion, real simple kind, your iodine, your iron, right. Is it *manauea*, was also something I remember, not as much, but, I mean now and then. And, other people disagree with me, but, I remember on two occasions—three occasions, as a kid, it wasn't very common, but maybe it came in, but, I remember *limu kohu*. And, like I said, I remember from my dad would be the one picking it, and he knew exactly how to pick. And the *wāwae'iole*, my job, again, was sit there on the beach and clean out all the sand. You know, you learn by trial, and you learn to appreciate, so, you know I basically ate the things my dad ate. So, even if we caught—well, I call it 'rubbish fish,' but, he used to love *manini*, and that's another thing that used to be out there. He'd be like, 'Aw, yeah,' you know, 'the salad is in the guts,' right, because the *manini* eats a lot of *limu* right, so, he sliced—he would clean the fish for that one, he would just grill it and then slice the opening, and just, 'Eat it son, that's your salad.' [*laughter*] So, he had an affinity for certain kinds of things. Like, every now and then, I get *'ono* [hungry] for something, you know, and then, anyway. It makes me think of him, but, it also

> reminds me that, yeah, I was raised a little differently from most people . . . part of my life, I guess you could say, was on the beaches of Kalaeloa.

He recalled being taught by his grandfather when and how to pick the *limu* so the root is not stripped off but he remembered

> . . . the range of Asian immigrants that were less probably to *mālama* the resource . . . and just take a knife and cut and dig, or, you know, the whole—‘cause we grew up as Adventists, we had a very clear health message. So, even though as a kid I don’t remember eating too much—I remember other people gathering *hā‘uke‘uke* [edible variety of sea urchin; *Colobocentrotus atratus*] and *pāpa‘i* [general name for crabs], but, we never ate the crab or lobster. There was *he‘e* [octopus; *Polypus* sp.] holes, but, as a kid we would never used to eat, but, as I got older, and then the urchin as well.

Permits were needed to access the naval base but because Mr. McKeague’s father retired from the U.S. Army, they were able to go there freely. He lamented the changes that have occurred over time and was nostalgic of the past:

> I like to argue and contend that when Kalaeloa, a.k.a. Barbers Point, was under the naval authority, it was almost better than when it got released to the State and got opened up to everyone, ‘cause the quality of the beaches changed, the safety of going on the beach—I remember as a kid, I used to— there wasn’t too many people on the beach, but, we used to pull the van right up, make a little campfire and no one would bother us, and what not. Nowadays, I hear there’s all kinds of drug activities, homeless activities, it’s *pilau* [putrid, spoiled, foul], I go down there and actually I cry because it’s so dirty in terms of people and rubbish. And to me, it’s not tourists, the majority are our own. So, yeah, some of it is kind of hard . . . I guess, being a little bit older, seeing the landscape a little bit different, still have maybe nostalgic memories already at 42, of what I remember, of my childhood and what the place used to be, but, saying, well, maybe I can be a contributor of the next 20 years or 40 years.

In addition to *limu*, Mr. McKeague remembered utilizing other plants particularly for *lā‘au lapa‘au* or traditional medicine. He explained,

> We used to use the *kaunaoa* [native dodder; *Cuscuta sandwichiana*]. I know one thing if you don’t know about Kalaeloa, if you go over there and you, you might see *kiawe* trees or whatever, but, choke *kaunaoa*, and it’s a very thick, different—I’m more used to fine-haired *kaunaoa*, like in Mānoa, whatever, but this stuff is like real, you know, and we would—not so often, but, we would use that and then the *noni* that was from the landscape for medicine. That’s the only two I really remember. Other people might remember other things, but, I distinctly remember the *noni* because we used to put it in the mayonnaise jars and my dad would be like, ‘Take a jigger.’ He would tell stories of drinking castor oil and stuff like that. But, had the *noni*, and when we were sick and stuff, little bit of *laukahi* [broad-leafed plantain; *Plantago major*], *‘uhaloa* and *‘awa*, but, I don’t remember it growing in the landscape, somehow we’d get it and then—but, the *kaunaoa.*

Mr. McKeague also remembered sugarcane in ‘Ewa when he was growing up as a child:

> Before there was Kapolei, most of my childhood up til maybe 1990, 1989, when they put the first Safeway or Longs in Kapolei, but the rest of it, that was all sugarcane, and the sugarcane was still in active production. So I remember the days they used to burn, they used to have the black smoke. And in the summertime—I remember a lot from the summertime, so, maybe that’s when they were burning most of our cane fields, but, you know, all the rats and mice would come into our house. ‘Cause all around Makakilo was all sugarcane and wild fields, so . . . you know, those little aqueducts, is that what you call ‘em? Or flumes, where the water flowed through. So, we weren’t supposed to, but, couple times, you know, we go check ‘em out, take the boogie board jump inside.
>
> The Naval station was a naval station, but, really everything up to the naval station down from Makakilo town, that was all sugarcane all the way towards Waipahu, so basically between Makakilo and Waipahu was just one big sugarcane system. And it wouldn’t be on the *mauka* side of the H1, just *makai* of it, but all inside this, all where UH West O‘ahu, Ho‘opili and where they’re going to put the rail and stuff like that. I mean, at least from my era, that was all sugarcane.

He also recalled exploring his neighborhood and his descriptions portray a part of ‘Ewa that was undeveloped when he was a child. However, many changes have occurred over time.

> We were *nīele* [inquisitive] kids and stuff, we would go explore and get in trouble a couple times. And, I got older, my parents are kind of conservative, I think they were always worried about me, but, they allowed me to jump on my bike and ride from Makakilo down to the beaches with my boogie board. I loved reading, so, there’s the library at Barbers Point and I used to read, but, sometimes go off the beaten track and go exploring and got myself into trouble a couple times. Or go up *mauka* side, too. You got to figure, Makakilo back then only went—again, trying to put it into segments, like it’s my play years, my *kamali‘i* [small child] years, my pre-teens, was maybe not just beyond what’s *mauka* [?] today, and that wasn’t all above there where the big park is and stuff, that all came later, maybe in the early ‘90s.
>
> I’ll be 43 next month, and in my mind, I’m not young, but still younger, you know, but to the degree how much has changed in this area. So, yeah, what I remember before there was a Ko‘olina, we didn’t fish too much down there, but, I knew uncles that did and they would talk about all the hole spots and they would tell about how they used to get down through tracks or cut through all the bush. So, I mean, it was a very lively coast area . . . They did dynamite and blew out Ko‘olina bays and all that, you know, so that’s kind of *‘eha* [painful]. Though, good to know people still fish on that side.

Regarding historic and/or cultural sites in the vicinity, Mr. McKeague brought up a vivid experience with the Kapolei Hawaiian Civic Club doing an *‘aha ‘āina* ceremony for the restoration of Pu‘u o Kapolei. He explained,

> It was the first time I had ever seen it, participated in it . . . Kumu John [Ka‘imikaua] had brought Federal, State, County, neighbors, community folk and the civic club people together to talk about the long-term stewardship and restoration of Pu‘u o Kapolei as a *wahi pana*. So, you know, that was kind of profound.

As a child, he recalled being told not to go to certain places:

> Those were the beaches and the mountains. I knew, again, recognizing later, I knew burial areas, places that were secret, obviously, all the *pu‘u* themselves a lot of it [landscape] was inundated with the rubbish stuff you see around . . . You still see pockets of *‘a‘ali‘i*, or *‘ilima papa*, and stuff growing, and just knowing—and again, I wasn’t a *hula* practitioner until I was much older, but, just knowing where those resources were in the wild is important. Because even back then, they weren’t, I want to say in such high abundance as perhaps they are now because you have more stewardship in terms of conservancy programs in place and stuff like that.

The discussion turned to burials and Mr. McKeague explained, “Along Kalaeloa, One‘ula, there are a lot of sand burials, coastal burials in—I forget what they call— ‘quasi-karst,’ or, well, I guess ‘quasi-sinkholes’,” he said. He continued,

> I think ‘sinkholes’ is not the right word anymore— ‘modified karst’ I think is what they go with today. [*laughter*] We just call it the ‘*lua*’. Sinkholes are also plentiful, Along the coastal region of Kalaeloa. So, if you go on the military base side, and you walk by the runway and all that area there, choke, all the way towards Pu‘uloa.
>
> Most of the coastline here, yeah, even the soil strata is coral limestone. (There's not) a deep soil layer, so, you know, whether for coastal habitation sites or for canoe sites, whatever, they would utilize whatever they could find. I liken it to being in Kona, where there you have the lava tubes, so, they were using what they could find. And so a lot of these karst things will connect to the water systems that . . . used to flow more abundantly. There’s evidence of that, especially—if you haven’t checked it out, Uncle Shad folks’ Kalaeloa heritage site, they actually have an intact well, or spring that is still there, and then some other karst features that were evidence of habitation and burials.

When asked about *mo‘olelo* and *wahi pana* of the area, Mr. McKeague had *mana‘o* to share particularly about Hi‘iaka:

> Up to maybe about four or five years ago, we only had the Emerson version of Pele and Hi‘iaka to reference. And, if you know about when Hi‘iaka comes to this place on her return trip with Lohiau, you know, Emerson, he’s such a jackass, and I’ll say it out loud. [*laughs*] Well, he was good because he documented, but, for at least Kalaeloa, he was a jackass because, I think if you reference his document, Hi‘iaka utters so many prayers and stuff over here . . . (He states), ‘they are so numerous, I’m not going to document them, I’m not going to put them in.’ Are you friggin’ kidding me?! So, I mean, although there are chants there, ‘*Alu no Pohakea*’ and some other ones, he failed to document this, so, what was cool, for example, is when Puakea [Nogelmeier] folks worked on that project to release the Hi‘iakaikapoli epic from the Ho‘oulumāhiehie version, just for this area alone, I

> tell people, just the amount of information is like times ten. And what I mean by that is, you know, in the oratorical forms, you get the hierarchy of what Hi‘iaka was doing as she made the trek, just the practices of how you pay homage to different areas and how you should call out . . . From a practitioner's standpoint, it'd be like me going someplace and someone saying, 'Oh, you have to do an *oli kahea*.' And you're like, 'I don't know an *oli* for this place.' So, you either going to pull something from your repertoire that you know that you think is appropriate, or, you're going to take in your sensory experiences and you're going to *haku oli* right on the spot. So, I'm assuming Hi‘iaka was probably more proficient at that and *haku* [to compose] on the spot kind of action, right. So, she sees Palailai, and does '*Nani Palailai*,' or she sees Pohakea, and even the processional that she takes on the way back, there's a hierarchy in how she starts at Pohakea and works her way down to Palailai and then actually ends at Pu‘u o Kapolei before she continues her trek through. I can come back in detail, because that is what I think is one of the critical stories for this place, but, I guess, the two main thoughts that I think I've carried with me—but, again, I can't say for sure. It's just '*wahi a Kawika.'* [*laughter*] Whether that's worth any grain of salt, or you know, a time on a page, but, it's two things. One is, if you look at the different storylines and the different place names and associated practices, for example, 'Kaupe‘a' being the realm of *ao ‘auana*. If you look at the story of Kamapua‘a, and how he situates—why am I drawing a blank now, his grandmother, Kaumananiho? Forgive me Koops [*kūpuna*?], I'm drawing a blank—I want to say Kaumananiho, I'm so bad right now. But, he situates her at Pu‘u o Kapolei and he tells her, you know, 'If you smell the burning of my bristles, you know that I'm killed.' So, he basically, you know, foretells his ensuing battle with Pele in Ko‘olau and, you know, his impending death of sorts. Pele and Hi‘iaka, you know, some say it was at Pohakea, some say it was Hoakalei. I'm a believer it was at Pohakea, but, that's where, you know, she *nānā* [to look at]—from her observations, she sees the burning of her *lehua* groves at Hopoi on Hawai‘i island, near Puna, from here.

Mr. McKeague elaborated on *wahi pana* of Honouliuli and stressed the importance of development being mindful of the space it occupies.

> Even place names like 'Makakilo,' this idea of '*kilo*'—the importance of '*kilo*,' we take it to be 'observational seers' or what not, but, really, it's a specific kind of taking in of knowledge, again, that's based on sensory cues [?], so, all of these things compile to say, in my humble opinion, that similar to maybe like He‘eia Kea and He‘eia Uli, Aliapa‘akai area, and Ka‘ena, you got these three or four places, that I know of at least, where this idea of transcending between physical and ethereal happens, and it happens with reason and purpose, and it happens often. And, so, to me, that's the place we're in. And another reason I wanted to maybe take you up to the Palehua spot was because I think, you know, in the storytelling, it takes place throughout this entire *wahi kupuna* where we're talking, right. And, yes, our project area is very definitive, it's very finite and it's formal [?], it doesn't matter if it's a harbor project or whatever, an industrial project, it still has to be mindful of the space it's in. And, you know, mindful, I don't know if that translates

> into the design thing, a site orientation thing, just a convenient interpretive signage thing, or a naming—a nomenclature thing, I don’t know what that is. But, to me, stressing the importance of the space you’re in and that fact that in this entire plain—even take a step back . . . I’m always a believer that whatever presence is, whether its re-interment facility there at Kaka‘ako, what is that place, Target, no, not Target, you know the one on Ward Avenue, anyway, the re-interment right, whether it’s the physical presence like that, or calling something by its older name or stuff like that, to me, that’s a real basic thing that helps to—what’s the right word—codify behavior, because if you know you’re in a different space, or you know you’re in a space and hopefully that makes you active [?], and whether that actively means you’re not going to throw your cigarette butt on the ground and you’re not going to be loitering around with beer bottles, I mean, whatever the case may be.
>
> As much as we need to preserve and perpetuate what is in the landscape, I’m also a big—I want to advance the conversation about creating new spaces. So, just because there is no *ko‘a* now doesn’t mean we can’t create one, even if it’s just—I don’t want to say ‘token,’ but say it’s a non-functional one, but, again, there’s this idea of presence and changing it up, or giving the space for fishermen to come, or whatever, it could be part of the living legacy of our culture, too, and we cannot forget about that, not necessarily just preserve the sites, but, how do we allow places to be created and manifested for our century.

While the place name “Honouliuli” is translated by some as “deep bay” or “dark bay” with references to Pu‘uloa, Mr. McKeague had his own take on the meaning of the place:

> I’m not saying Pukui was wrong, or anyone else is wrong, in terms of ‘deep bay,’ but, in my opinion, the idea of the physical and ethereal transcendence thing, it’s like you’re diving into the realm of *pō* [night, darkness], that Pu‘u o Kapolei, as an homage to Kapaulukina‘u, who is the female *akua* [god], of not just *hula*, but also that source of ancestral knowledge that is such in that realm of *pō* that literally she comes to you in dream state, she comes in through your subconscious. So, to me, Honouliuli could take on that sense of diving into that *uliuli* [dark], that it’s deep, we’re going down deep. The other part, too, is, and this is my own little argument of sorts, that, you know the Wai‘anae mountain range, as I understand it, you know was one of two ranges, right, Ko‘olau and Wai‘anae, but, where we’re at here and how the winds and rains all sort of work on this corner of the Wai‘anae range, this is the seed bank, so Honouliuli, another definition could be this idea of it being a seed bank that germinates the rest of the island, it’s this side of the island, right here.
>
> So, that’s the first part, the other part then is, knowing the story of Pele and Hi‘iaka and also recognizing that all of our islands are formed by the power manifestation of Pele and her trekking around through here, you know, what’s unique about that landscape is that you have flat plains on coral limestone, so, you can argue that is, you know, Hina, or what have you. But, you also have very significant protrusions of *pu‘u,* which I think are very neat. And, if you look at some of the place names .

> . . Pu‘u Kapu‘ai, Pu‘u Manawaha—actually that should be Manawa Hua, Pu‘u Poulihale, Pu‘u Palehua . . . There are variations of what those names mean, but, to some degree, the quick, cut to the chase is that they are all sort of references to the female persona of that emotional, physical, spiritualness prior to and through childbirth . . . If you take the idea that these *pu‘u* are manifestations of, you know, Pele's pregnancy, right, she's giving birth to these—she's *hanau*-ing these things, as we know *pu‘u* are seed banks, as well, yeah, they protect species to some degree that all the place names from the top coming down talks about this cycle of life, or this period of life that emanated . . . yeah, so, that's my *mana‘o*, in short.

Mr. McKeague referred to his notes to remember species of bivalves mentioned in chants in the story of Hi‘iaka that spoke of their abundance in ‘Ewa at one time.

> In the Hi‘iaka story, [she mentions] I had never heard of these, so, maybe other *kūpuna* have but *mahamoe* [an edible bivalve], m-a-h-a-m-o-e, and *‘ōkupe* [a bivalve]. I looked them up, they are two bivalve species that were named in one of Hi‘iaka's chants as being abundant there, or at least abundant enough that she called them out . . . and of course, *pipi* [Hawaiian pearl oyster; *Pinctada radiata*] and then she mentions *pāpa‘i* and *limu* and some other stuff. Yeah, so, I thought that was interesting, I was like, ‘Oh, I like learn what those things were,' and if I see a picture, then maybe I can remember. But, apparently, they were abundant there.

Mr. McKeague delved into the story of Hi‘iaka and hit upon many place names on her journey throughout the west side of O‘ahu around Honouliuli. Throughout his narration, he provided his own interpretations of the story that give meaning to the landscape of specific *wahi pana*:

> Let me spend some time in this part of the story where she came from out, you know, specifically for this area, she's coming back with Lohi‘au, she's already late because he was dead, right, on Kaua‘i, bust out the whole thing, she was already worried about Pele being pissed off at her and whatever, but, with all that being said, though, there was a very distinctive purpose when she lands at **Ka‘ena**, spends a little bit of time at **Makua** and **Wai‘anae**, that, you know, as I remember the story, she tells Wahine‘ōma‘o and Lohi‘au, ‘Stay on the *wa‘a* [canoe],' and in fact, she tells them, ‘You're going to pass this cape, you know, this *lae* [cape, point], keep going.' So, basically, she identifies **Kalaeloa** and says, ‘Don't stop.' And then she identifies **Pu‘uloa** and she says, ‘Don't stop.' So, she's actually telling them keep going all the way to **Kou**.
>
> But, so what happens is, the two of them are in the boat, and as I'm reading it, you know Lohi‘au, he's just a typical boy. He got resuscitated, you know, he got killed, well, he killed himself, right, because he's all distraught, wakes up and, you know, he's just *mane‘o* [sexually titillated] as ever, so he's trying to hook up with Wahine‘ōma‘o and Wahine‘ōma‘o is like, ‘You know, brother, put it somewhere else.' In fact, if you read the Hawaiian, it's actually kind of funny because they talk about—so of relevance and pertinence, I'll bring it back to point—I think the way these waters are described around this area is *kō‘ie‘ie* [rapid current]. As I understand *kō‘ie‘ie*, you had different kinds of flowing, so *kahe* is more like the flowing, right, *kō‘ie‘ie* is the very rapid, forceful push, so, that tells you about the

currents over here, in the practical sense, but, in this poetical prose [*interviewer laughing*] I think you know where I'm going with this. 'Oh, you and me in this boat together, we got to paddle,' and he goes, 'The current is so strong that the paddle is whacking me in the head, why don't you help me and grab my paddle so we can move along together.' [*laughing*] So, I'm like, 'Really Lohi‘au, you went there?' No wonder there's not too many '*he inoa no Lohi‘au*s' 'cause you're just—I'm sure he was a wonderful chief and obviously, you know, beautiful enough that Pele took him forever . . . So, Wahine‘ōma‘o and Lohi‘au are in the boat and Hi‘iaka says, 'Keep going.' In this story, Pa‘uopala‘a, which, in the Emerson story, this reference is more like wearing a skirt, but not necessarily a companion, but, is a companion, tells Pa‘uopala‘a, 'You stay on the land, but seaward, 'cause I'm going to go mountain.' So, she distinguishes, you know, in my opinion, she's creating classification of the realms, although Wahine‘ōma‘o is her longtime companion or whatever, they're still of human form and yet the chief, he's in the *kai*, and that's where they belong, and then, you know, Pa‘uopala‘a was her guardian, is on the land, on the *kai* and then she takes the *wao akua* route, yeah, go Pohakea, and at Pohakea, she does her utterances and *kānaenae* [chant of eulogy or praise] and chants the stuff, hits this portend of her groves burning and she's feeling it, she's feeling the pain and the loss and what not, it doesn't seem like she's angry, more just deep, deep sadness of what's happened. I think the anger comes probably a little bit later.

So, it's interesting that she's at Pohakea, works her way down to **Palehua**, and, as she's on these places, she's also calling out the other important names of Honouliuli that are on the Schofield side, so, she's referencing **Līhu‘e** and **Ku‘ua**, the one on this side, yeah, so, she's standing here— she's referencing things here, and, actually in this version, after she looks towards Puna, it makes a purposeful statement to say she turns back towards Kaua‘i, who, . . . you know, they name her as her sister. Lohi‘au's sister was a healer, too. Anyway, in my opinion, that's where the transcendence to sort of *kupua* [demigod] is happening, 'cause she's getting the vision, she's able to envision and vision from end to end, and again, this is just '*wahi a Kawika*' but, it's interesting that it's so purposeful. And even, was distraught, so, you know, to me, the distraught, and all that, the sadness, that's her human form still, 'cause she's still doing *kuleana* [right, privilege] as *akua* form in that she's going from place to place and as she's traveling down, again, I could be totally wrong, I believe, and maybe the other *kūpuna* can verify, that this area, 'cause where we have several plains we're working through here, yeah, I mean, it's one big plain, but as I understand it, it has three, maybe four distinct names. I believe we're in the area of what she references as '**Keahumoa**.' I think some people say '**Ka‘ahumoa**' but, I think in this story, she says 'Keahumoa.' And whether it's 'Keahumoa' like 'the chicken *ahu*,' I don't know. I know '*moa'* as other definition, instead a plant and what not. I think it is also some kind of mollusk as well, I could be wrong. But, could be '*mo‘a*' the idea, you know . . . so, to me, the name is kind of an enigma, but, she calls out this area first and she comes onto **Palailai** where she makes reference to **Pu‘u o Palailai**, which I think is kind of cool and kind of feeds back to my earlier thing about the female persona. That she says,

‘*Nani Palailai, he ānai na no na wahine*.’ So, it’s ‘the place where the women assemble.’ Now there’s no other story of reference I know of women assembling there, ‘cause, for example, ‘Palailai’ according to Pukui—and again, I don’t say she’s wrong—is ‘the young *lai* fish.’ So, like Makakilo and all these other places, some people have said this is the *kilo i‘a* [fish observatory], I grew up right below the shadow of Pu‘u o Palailai, I’ve hiked to the top of Pu‘u o Palailai, there’s bunkers and stuff like that, yeah, you can see the ocean, but, to me, unless they got super vision—it’s close enough to see the ocean and, yeah, you can see maybe changes in the current.

Someone told me that, you know, a really skilled *kilo i‘a* can see the patterns of the ocean change or whatever, and, I don’t disagree with that, but, it’s kind of weird that through all of this yet, you have this significant *pu‘u* that is being named after the young *lai* fish. And I don’t know too much about *lai* fish being in high population in this area, too. So, it doesn’t quite make sense, too, the grown-up practitioner stuff, to me, I respect it, but, another way to look at Palailai is—well, again, I could be wrong, but, you know ‘*lailai*’ or ‘*la‘ila‘i*’ to some degree is ‘to have clean or clear sight’ I think, of the sun, or something like that. So, again, oh, that makes sense in terms of the idea of sight or sensory and, you know, what this *pa* was and again, this reference that Pele makes to say, ‘*Nani Palailai anaena no na wahine*,’ you know, who is she talking about? That’s the only thing about it[?], if that Kapolei[?] which is Kapulukina‘u, but, who else, is it Hina, is it Pele, is it other—that part is one of the mystery. So, it’s part of my own sort of, ‘what is it about’ you know. But, the fact is that it is connected to the century equation, you know, she herself says this is a place of congregation, of women, I would say maybe, ‘female *mana*.’ I mean it’s another way to take it, it’s not necessarily, literally a bunch of women, but, maybe this is an assembly of—‘*Nani Palailai*’ being the second most lowest *pu‘u* next to Kapolei, you take that whole mountain to be sort of like, you know, excuse me if I’m wrong here—but, a birth canal. And you look at some of the other place names. I’m trying—that maybe this is her way of paying respect to the fact that seedbank, place where Pele, a lot of her *mana* is still in the landscape, and the distinction between—you know and maybe that’s why, too, this is the *ao ‘auana*, but it is full of different kinds of *mana*. And again, I’m just kinda drawing straws here, trying to put the puzzle pieces together. There’s got to be reason and rhyme why these things are happening.

Kaumananiho, if I have her name correctly, again, a female presence, grandmother to Kamapua‘a, you know, so the strength there for female persona at Kapolei. Kaulukina‘u’s namesake at Kapolei, so to me, it’s not by coincidence, I don’t think it’s a *co-in-ki-dink*. Okay, here. **Pu‘umanawahu** means—and some of this is from Pukui—but ‘discomfort of the stomach, nausea, to suffer great grief, also jealousy.’

Pu‘u Kapu‘ai, ‘to cause, to flow, to bubble, gurgle, to vomit, to appear as a color,’ so, again, ‘to appear, variation of the word ‘*kapua‘i’* also means to tread.’ Pu‘u Mo‘opuna, ‘grandchild, offspring,’ you know, relatively [?]. Pu‘u Ku‘ua, ‘to release, let go or discharge.’

Pu‘u Poulihale, again the reference to *uli*, any color, riches of vegetation and seedbanks, also female *akua* of certain sorcery, so, not only do you have Kapaulukina‘u, but, you also have a reference Poulihale, ‘short for *oli*, study of omens,’ also the name for the developmental stage of a fetus as the body begins to form. *Pouli* can mean darkness, sometimes ignorance, but, a more traditional line of thinking could be that of *pō*, of knowledge beyond the sensory experience of *ao*; of being awake in the light, the knowledge that comes from the time of [?].

So, to me, again, I’m not making it up, I’m just sort of going—trying to think about each place name. **Akupu**, to sprout, germinate or be of a supernatural, you know, status. **Awanui Gulch**, could reference, you know ‘*awanui*,’ literally the large passage, indicative of a birthing passage or outburst alluding to Papahanaumoku Haumea birth of the island potentially. Pohakea, where Pele receives the cloud omens for Kawaikiu’s *kahalaupuna*, but, also been taught it could be ‘*poha a kea*’ it’s a contraction, so, the birthing forth of thunder of Kea of Wakea, so it’s like Wakea shooting his seed, so, presence of all the childbearing qualities and emotions, the ability of a woman to bring life into the world. This is my interpretation. Wakea’s presence must be the balance, yeah, for us to—if you have so much female, where’s the male balance for here, maybe it’s Pohakea, and it makes sense because that is one of the high points. Maybe Sam [Ohu Gon] can lend some guidance to that, maybe we’ll have to get his opinion. Some traditionalists cite that Papa and Lua made it to birth O‘ahu and Papa’s jealousy of Wakea and Ho‘oulukalani and Pele and Hi‘iaka—Hi‘iaka undergoes a long period of legends and *mo‘olelo*. Palehua—I disagree with Pukui [*laughter*]—what a smart ass I was. I don’t believe its only meaning is it’s a ‘*lehua* enclosure,’ that’s how she describes it. But, I see it as ‘*pale hua*,’ as in the protector of the seed of the fruit. Again, ‘*wahi a Kawika*.’

Palikea, ‘the cliff of Kea, or the cliff of Wakea.’ He is detached from the processes of childbearing activities that are evident when the form of these *pu‘u*—‘cause it’s actually wherever Hina, or Pele, is giving birth, but, to give him his space is kind of setting aside distinguishment or recognition of the male/female presence. Again, I’m making it up, or just interpreting. So, yeah, if I say Palikea, the top part, it kind of makes sense to me on the flat plain, or horizontal plain, right we were always taught that *ku*, right, is male, that Pu‘u o Kapolei, then, which has all these elements of Kaulukina‘u’s presence, Kaumananiho’s presence, *ka mea ka mea*, and that’s distinctly female, and it’s the end of that overall female passage, that plain is the female passage, yeah.

Palailai—I already showed you that—the Mauna Kapu, it says—nah, this is me drinking too much wine. I know some say this regards Kakuhihewa’s *kapu* and actually I really don’t know about it, but I just know Uncle Shad references it—well, that’s where Kakuhihewa’s *kapu* was established, or taken, and I said okay. Because I was on this line of thought, I say, it could be, but my *mana’o* at this point is that this clearly defines what belongs to Wakea, and what’s Papa, and the establishment of *kapu.* Papa giving birth, women giving birth is probably the strongest period where Haumea thrives as more powerful or omniscient than

> Wakea, yeah, so, it's like that idea of, is it defilement when women have their monthly discharge, or is it wonderful because they are that close to Haumea, it's a matter of perspective. So, maybe the same thing here, yeah, they got to set aside a place that is *kapu*—again, for boys to be boys [*laughter*] . . .
>
> Lastly, the hill front—and I'm focusing a lot on Kapolei and Palailai, and going up to Pohakea because from—again, from this vantage point, that's what you're seeing a lot of. And lastly, the *mauka*-side of Farrington Highway, opposite Honokai Hale, which is in our project area, that's what they call **Makaīwa Hills, Makaīwa Gulch** I think is also on there, too. So, lastly, Makaīwa, I believe is a contracted form of '*maka a aiwa*' as in meaning, '*maka*, the face or presence or essence, of being *aiwa*' which you hear like in Heaiwa Heiau, Kapuaīwa Lot, where '*aīwa*' is— they say of such a high unknown, that's a mystery or a surprise or incomprehensible sometimes. So, to me, that's what it is, that's what this landscape is, yeah, and that's where the project is. So, what can the project do, you know, I don't know, but, you know, today, it just needs to be mindful of the space. Granted, I know we are just talking about a fuel development pier, but, to me, again, I'm not trying to get myself documented to, you know, be an authority, or some validity, but, to me, I'll be the first to say, for what is good is beyond my own comprehension, for what is mistake or incorrect, that's just my failure as a human, not interpreting correctly what has been shared by living *kūpuna*, *kūpuna* voices in documents, and *kūpuna* voices in my life experiences in this landscape, you know, this is me kind of summarizing—at age 42, where I think I am or why I think I am in relevance to that place. I could be completely off, I could be smoking crack, but, to me, I don't think it's coincidence, some of these things.

In his narration of *wahi pana* and *mo‘olelo*, Mr. McKeague touched upon the significance of water to Honouliuli.

> This is just my interpretation, but, you take Honouliuli, it's the largest *ahupua‘a* in the area, and as I've been limitedly taught the idea that the *ahupua‘a* size was really dependent on water, water was the driver. So, I mean, you have a bigger *ahupua‘a*, it's because there is less water, so you need more physical area to sustain the same— But, we know water existed. It is interesting if you actually go back to those chants in Pele and Hi‘iaka, especially the Ho‘oulumāhiehie term, the specific line, but, she makes reference to the people—that's us, of the area, by which the clouds fed—gave them water. So, although we do have evidence of a spring system and obviously the gulch is formed by water, and you know there's evidence of water flowing in the karst, a lot of people focus on that, too. In just by that simple narration in that, you actually—the *nāulu* [sudden shower] showers used to come through, you know, came enough, or came with high intensity that it provided a water source, too.

6.7.3 Jan Becket

Jan Becket was a teacher with Kamehameha Schools who is well-recognized for his black-and-white photographic documentation of sacred sites. He has conducted extensive archival research

on sites of cultural significance, learned from *kūpuna*, and photographed many undocumented sites on O‘ahu, which resulted in a co-written book, *Pana O‘ahu* (Becket and Singer 1999). He is a member of the Committee for the Preservation of Cultural Sites and Properties under the O‘ahu Council of Hawaiian Civic Clubs, and reports back to the chair of the committee (Shad Kāne) on issues concerning cultural sites in the Kona district of O‘ahu.

CSH accompanied Mr. Becket to the Kalaeloa Heritage Center (KHC) on 19 February 2014. Shad Kāne, member of the Kapolei Hawaiian Civic Club and the ‘Ewa representative for the Committee for the Preservation of Cultural Sites and Properties under the O‘ahu Council of Hawaiian Civic Clubs, manages the KHC in Honouliuli Ahupua‘a. Mr. Becket pointed out two significant cultural sites on the KHC property, the Kūalaka‘i Trail and a religious structure. Both of these structures are a part of a larger complex known as SIHP # 50-80-12-1753, which functions as a former village with multiple cultural sites (Figure 33 and Figure 34).

The Kūalaka‘i Trail is a unique cultural site. The white coral pathway traverses the southern portion of SIHP # -1753 (Figure 35). Several white boards that read “Keep Off Trail” line the pathway that travels from *mauka* to *makai*. The *mauka* portion is cut off by the access road into the heritage park while the *makai* portion fades into the dense *kiawe* brush. The pathway is constructed of flat, rugged coral pieces. Large, flat upright stones shaped like large arrowheads line the pathway and are approximately 3 ft high, 1 ft wide at its widest part, and 8 inches thick. The upright stones are spaced out approximately 8 ft apart.

The religious structure is located on the western portion of the KHC (Figure 36). The religious structure is a large circular outcropping of white coral slabs surrounding a significantly long karst that contains burials. A large white coral upright stone stands to the west of the *ahu* (altar). The upright stands approximately 5 ft in height at its widest section. The front and back of the upright is somewhat flat. Similar to the upright stones that line the Kūalaka‘i Trail, the shape of the upright stone at the religious structure is like a large arrowhead.

In addition to our site visit, Mr. Becket knows of other cultural sites within Honouliuli Ahupua‘a. Pālehua is a *pu‘u* (peak) near the border of Nānākuli and Honouliuli. At the top of the elevation are several sites including several structures (Figure 37 through Figure 39) and a single upright stone (Figure 40) that the late scholar and activist, Marion Kelly, identified as “the Walking Stone.” In the past, Mr. Becket and Mr. Kāne escorted Ms. Kelly to Pālehua to specifically relocate the *pōhaku* (stone). Because Ms. Kelly spent a portion of her childhood in the Pālehua area, she would have been familiar with the stone, which was the reason why they took her there to identify it. In a 1959 report titled *Palehua Kuula Stone, Honouliuli, ‘Ewa, Oahu* Kelly surveys and records the stone (Kelly 1959). The single upright stone was reported to be a *kū‘ula* (a stone used to attract fish). It was originally recorded to the left of the main road going towards Pālehua, “just before the Wigg property” (Kelly 1959:1).

Mr. Becket recalled several *ko‘a* or fishing shrines located between the present Ocean Pointe development and the shoreline near One‘ula Beach Park (Figure 41). During the construction of the Ocean Pointe housing, a marina was proposed to be a part of the development. Several *ko‘a* were bulldozed to make room for the marina. However, several years later the proposed marina was dropped from the Ocean Pointe plans. Several sites are still present *makai* of the Ocean Pointe development including SIHP # 50-80-01-4278, a complex of platforms. According to Mr. Becket,

Figure 33. Photo of an enclosure at SIHP # -1753 located on the *mauka* portion of the KHC ca. 2007 (photo courtesy of Jan Becket)

Figure 34. Photo of an enclosure at SIHP # -1752 located on the *makai* portion of the KHC property ca. 2006 (photo courtesy of Jan Becket)

Figure 35. Photo of a portion of Kūalaka‘i Trail at the KHC ca. 2010 (photo courtesy of Jan Becket)

Figure 36. Photo of a religious structure at SIHP # -1753, February 2014 (photo courtesy of Jan Becket)

Figure 37. Photo of an enclosure at Pālehua ca. 2002 (photo courtesty of Jan Becket)

Figure 38. Photo of an enclosure at Pālehua ca. 2002 (photo courtesy of Jan Becket)

Figure 39. Photo of a structure at Pālehua ca. 2002 (photo courtesy of Jan Becket)

Figure 40. Photo of *kū ‘ula* at Pālehua ca. 2002 (photo courtesy of Jan Becket)

Figure 41. Photo of an enclosure at One‘ula Beach Park ca. 1994 (photo courtesy of Jan Becket)

the site is located along Pāpipi Road, the beach access road to One‘ula Beach Park. The second site was previously identified by Dr. Paul Rosendahl as a *heiau*, located just *mauka* of Pāpipi Road closer to Kalaeloa. CSH contacted the landowner, Haseko, to photograph and document the remaining sites. An answer from Haseko to visit the cultural sites is still pending.

Outside Honouliuli Ahupua‘a but still within the ‘Ewa district boundary, Mr. Becket knows of petroglyphs below the H-1 freeway between Hō‘ae‘ae and Waikele Ahupua‘a (Figure 42). The last time Mr. Becket saw the petroglyphs was during the 1990s with the late J. Mikilani Ho. The petroglyphs resemble dogs, birds, and human figures.

6.7.4 Shad Kāne

CSH interviewed Shad Kāne on 19 February 2014 at the Kalaeloa Heritage Center (KHC) in Honouliuli Ahupua‘a. CSH accompanied Mr. Kāne, spokesperson for the heritage center, and author and photographer Jan Becket on a site visit around the KHC, formerly part of the Barbers Point Naval Air Station. The KHC is a private non-profit Native Hawaiian organization comprised of members of the Kapolei Hawaiian Civic Club, which is also a 501(c)(3) non-profit organization that represents a broader community base. The Kapolei Hawaiian Civic Club is different from other civic clubs due to their involvement with federal projects such as the naming of streets and other places within Honouliuli Ahupua‘a.

The KHC received the 77-acre parcel via the Kapolei Hawaiian Civic Club two and a half years ago. Following the closure of the Barbers Point Naval Air Station in 1999, the Navy and state conveyed the property to the civic club. Mr. Kāne would like to expand the KHC, however, there is more disturbance in the surrounding areas outside the 77-acre parcel. Due to previous military occupation in the area, more effort is required for the clean-up, including removing contaminates from the soil. However, the project area did not require any cleaning of the hundreds of cultural sites found within the property as they were undisturbed by the military and only required vegetation removal. Future plans for the Kalaeloa Heritage Center include a 5,000-sq-ft visitor’s center with a recessed theater constructed like a sinkhole, an ode to the many karsts found on the ‘Ewa plain; workshops with a communal partition to open into a convention room; a gift shop; docents; an on-site archaeologist to explain the various cultural sites located within the heritage center; and security and maintenance facilities. Mr. Kāne shared that the heritage center is located in the *‘ili* of Kānehili.

Mr. Kāne led CSH on a tour of the heritage center grounds. A prominent *hale* (house structure) is the first stop on the tour (Figure 43). The walls of the *hale* are constructed of large coral boulders with smaller *pōhaku* (rock). The coral is fitted perfectly together like a puzzle. Wooden posts support the roof thatching. Sand is used as a ground cover inside the *hale* and around the perimeter. Four ti plants dot the four corners of the perimeter of the sand ground cover. Inside the *hale*, Mr. Kāne shared information about SIHP # 50-80-12-1753 or what he refers to as Site -1753, a 6-acre parcel with 51 archaeological features. David Tuggle conducted an archaeological inventory survey of the site in 1997 (Tuggle and Tomonari-Tuggle 1997). Only 11 of the 51 archaeological features of Site -1753 were cleared by the KHC staff and volunteers while the remaining 40 features were left alone as suggested by Mr. Tuggle. Site -1753 represents a cluster of a small family community with features including six house sites, agricultural sink holes, water sinkholes, burial sinkholes, a communal religious structure, temporary house sites, and a portion of an ancient

Figure 42. Photo of petroglyphs in Waikele Ahupua‘a ca. 2002 (photo courtesy of Jan Becket)

Figure 43. Photo of constructed *hale* at the Kalaeloa Heritage Center (KHC) (CSH 2014)

foot trail. Mr. Kāne feels this site can provide enough context to visitors, giving them an idea of what the rest of the park is about and represents.

While touring Site -1753, Mr. Kāne pointed out several plants such as *maiapilo* (*Capparis sandwichiana*), a native low shrub with vine-like branches. Excessive watering of the *maiapilo* destroys it. Another plant that the KHC is trying to propagate is the *‘ahinahina* (*Achyranthes splendens*), also known as an endangered plant (Figure 44). The seeds of the *‘ahinahina* originally came from the Kalaeloa Plant Sanctuary near the Honolulu Program of Waste Energy Recovery facility, more commonly known as the H-POWER facility. Blue flags dot Site -1753 marking the places where *keiki* (offspring) are planted. A wild population of the *‘akoko* (*Euphorbia* spp.) plant, an endemic shrub with jointed stems, can be found across the street, outside the Kalaeloa Heritage Center boundaries. Mr. Kāne noted that William Ailā, Director of State of Hawai‘i Department of Land and Natural Resources (DLNR), would like to bring the *‘akoko* plant inside the heritage center. Another plant they are trying to restore is the *kō* (*Saccharum officinarum*) or sugarcane which Kānehili was once known for. As we continued to walk the property, a couple of ti plants peeked out of a coral outcropping. A closer look revealed the ti plants are in a 12-15 ft deep karst (Figure 45). *Noni* (*Morinda citrifolia*) or Indian mulberry is another plant that grows abundantly in the karsts of Kānehili ‘Ili. Mr. Kāne shared that although the ‘Ewa plain is dry and there is no evidence of water on the surface, there is in fact water underground that travels through the karst system. Farming on the ‘Ewa plain in these small concentrated areas was usually done via a karst or sinkhole that contained water. Mr. Kāne recalled when the park first opened its doors, they discovered the ti plants growing in the karst. Today, the ti plants are still intact as they were found a few years ago.

Mr. Kāne continued to explain the water flow in ‘Ewa. A traditional river rushes from a higher elevation to a lower elevation at a fast pace and as the water begins to hit flat areas, the water begins to deposit nutrients and soils. The water in ‘Ewa travels in the same manner as a traditional river, but as stated earlier, it can’t be seen. The water moves over coral limestone which then dissolves the bedrock surface creating a geological formation called a karst. The cleanest water in a river or karst system is in the middle, the fastest traveling water. The most nutrient-rich water is located near the shoreline or the mouth of the river. Several sinkholes are lined with a coral outcropping and below is the karst, which was strictly used for drinking water.

Other sinkholes on the property contain no water and have a depth of about 8-10 ft with burials. *Iwi kūpuna* or ancestral bones, are scattered throughout the Kalaeloa Heritage Center property either in sinkholes, under probable burial mounds, or they have been relocated to an *ahu* on site. Some *iwi kūpuna* found in the sinkholes were left in situ and covered with sand. Other *iwi kūpuna* were relocated to an *ahu*. Approximately 26 sets of human remains were relocated to the *ahu*. Although no mounds were dismantled to verify if *iwi kūpuna* are under *pōhaku*, based on the length and width of the mound, there are most likely burials below. Mr. Kāne would like to keep most of the sites intact to keep their integrity and provenance.

Mr. Kāne continued on to a white coral pathway toward the southern portion of Site -1753. Several white boards that read “Keep Off Trail” line the pathway constructed of flat coral pieces. The rugged coral path is lined by large, flat upright stones shaped like large arrowheads approximately 3 ft high, 1 ft wide at their widest part, and 8 inches thick. The upright stones are spaced out approximately 8 ft apart. Mr. Kāne noted that the upright stones along the path are

Figure 44. Photo of native plants growing within the KHC grounds; note the blue flags marking *keiki* plants (CSH 2014)

Figure 45. Photo of a ti plant approximately 12-15 ft in karst (CSH 2014)

common in Tahitian construction and represent masculinity. The pathway travels from *mauka* to *makai*. The *mauka* portion is cut off by the access road into the Kalaeloa Heritage Center while the *makai* portion fades into the dense *kiawe* brush. This trail is called the Kūalaka‘i Trail.

According to Mr. Kāne, historically this trail traveled from the shoreline through Kapolei and to Kalo‘i Gulch. Mr. Kāne shared that during the late 1700s, Captain George Vancouver traveled and charted most of the Hawaiian Islands. During this expedition, Captain Vancouver had his surveyor, Charles R. Malden, sketch his observations offshore which included walls, homes, and trails. Malden included the Kūalaka‘i Trail on his 1825 map of the South Coast of O‘ahu. Although the brush is thick around Site -1753 today, Mr. Kāne speculated that Malden must have observed the ‘Ewa plain when it was free of flora or he visited during the hot season when nothing was in bloom to have observed the trail so well. Mr. Kāne explained that the trail was created for travel, but most importantly for *mauka* residents to barter with the *makai* residents and vice versa. *Mauka* residents had access to taro, bananas, and pigs. *Makai* residents had access to fish and *limu* (seaweed). Trading or temporary habitation at another village were solutions to a well-rounded diet.

According to Mary Pukui, the name Kūalaka‘i literally means “sea creature” (Pukui et al. 1974:119). Mr. Kāne asked Rubellite Kawena Johnson, a Hawaiian historian and Professor Emeritus of Hawaiian Language and Literature, to help him decipher the connection of the name to the land. Ms. Johnson revealed that the name Kūalaka‘i is actually a hybrid of the name, Ka-‘ulu-a-kaha‘i or “the *‘ulu* [*Acrtocarpus altilis*; breadfruit] of Kaha‘i.” Kaha‘i is the son of Ho‘okamali‘i, the grandson of Mo‘ikeha, and great-grandson of Muleiali‘i. Kaha‘i comes from a line of Tahitian navigators and he was sent out to sea to bring back an *‘ulu* tree. Kaha‘i brings back an *‘ulu* tree from Samoa, planting the first one in the Hawaiian Islands at Pu‘uloa. Mr. Kāne explained that the *mo‘olelo* of Kaha‘i is symbolic as it secures the past yet represents a new beginning. The *‘ulu* tree itself represents the connection to the past and he shared that “*‘ulu*” is not a Hawaiian word. The *‘ulu* leaf represents new life or rebirth. It’s a story of travel and migration. During Tuggle’s archaeological inventory survey in 1997, several sediment samples were carbon-dated to AD 1450, give or take 100 years. These dates suggest some kind of early habitation which complements the Kaha‘i *mo‘olelo* and Tahitian connections.

The tour continued to the Kūalaka‘i Trail passing several *wiliwili* trees (Figure 46). The *wiliwili* is a winter tree that contains flowers of orange, yellow, salmon, green, or white blooms. During the summer months, the tree usually goes dormant. The *wiliwili* tree also attracts wasps. Mr. Kāne recalled that a State of Hawai‘i entomologist came to the Kalaeloa Heritage Park and released a bug as biological control to counter the wasps that were invading the *wiliwili* trees and preventing them from propagating. Within the last few years, Mr. Kāne has seen a difference in the trees noting that the *wiliwili* now have flowers again.

L- and C-shaped structures can be found further back of Site -1753 parallel to the Kūalaka‘i Trail. Due to the smaller shape of these structures, they generally are classified as temporary housing structures in contrast to rectangular terraces reserved for permanent habitation (Figure 47). As previously mentioned, these temporary structures would support Mr. Kāne’s statement of fostering *mauka-makai* relationships. Examining one of the other structures, Mr. Kāne lifted up a flat *pōhaku* which revealed a small storage compartment. These compartments were most likely

Figure 46. Photo of a wiliwili tree with Site -1753 on the KHC property (CSH 2014)

Figure 47. Photo of a C-shaped structure on the KHC property (CSH 2014)

used to store valuables. A possible item of value that could have been stored were bird feathers, an esteemed and cherished belonging to Native Hawaiians. A *kia manu* (bird catcher) had many clever strategies for capturing birds, which included the use of sticky traps or nets. The *kia manu* of Kānehili ‘Ili used a different technique, which was to smoke birds. This method included setting a contained fire. The bird would fly through the smoke, become disoriented, and the *kia manu* of Kānehili would then gather the feathers. The *manu ‘ō‘ō* (*Moho apicalis*; black honey eater) has yellow feathers under each wing and was commonly used on O‘ahu Island for feather work. The *‘i‘iwi* (*Vestiaria coccinea*; scarlet honey creeper) and *‘apapane* (*Himatione sanguinea*; Hawaiian honey creeper) were commonly used on Hawai‘i Island for feather work.

Mr. Kāne shared an experience that brought him to the conclusion that *pueo* (owl) live in the sinkholes at the Kalaeloa Heritage Center. He recalled a time when there was a school event held at the Kalaeloa Heritage Center. Prior to the students leaving for the day, they gave Mr. Kāne a *lei*. As he began to clean up for the day at the Heritage Center, he took off the *lei* and set it down on an outcropping around a sinkhole and then went to his car. Mr. Kāne stated he was gone for one minute and by the time he returned to the sinkhole, the *lei* was gone. However, in lieu of the *lei* was a single *pueo* feather. Mr. Kāne took this as a sign that the work he has been doing in Honouliuli Ahupua‘a had not gone unnoticed by others.

Mr. Kāne is not aware of any cultural sites along the project area. He made it clear that he’s not saying there aren’t any archaeological sites, just that he is not aware of any. However, he is aware of the former cultural landscape prior to the sugar industry’s presence in Honouliuli Ahupua‘a. Two villages once existed within the project area, Keoneae and Puainako (also called Pu‘u-ainako). The village of Keoneae could be found with the natural alignment of Kalo‘i Gulch. The village of Puainako could be found with the natural alignment of Honouliuli Gulch.

6.8 Summary of *Kama‘āina* Interviews

CSH attempted to contact 74 community members, government agencies, and community organization representatives. Of the 12 respondees, four *kūpuna* and/or *kama‘āina* participated in formal interviews for more in-depth contributions to the CIA. In addition to these formal interviews, two community members and one government organization also provided written comment. Based on the written testimonies from OHA, Keawe Vredenburg, and Tom Lenchanko, in addition to the reviewed and approved interview summaries of Mel Kalahiki, Jan Becket, Shad Kāne, and Kawika McKeague, the following is a synthesis of findings within Honouliuli Ahupua‘a.

According to interviewees Mel Kalahiki and Kawika McKeague, Honouliuli Ahupua‘a was abundant in various types of *limu* including *limu ‘ele‘ele*, *ogo*, *limu wāwae‘iole*, *manauea*, and *limu kohu*. Mr. McKeague also recalled laying net and catching fish such as mullet, *weke*, *menpachi*, *akule*, *awa*, *āholehole*, and *manini*. He recalled other people gathering *hā‘uke‘uke* and *pāpa‘i* for consumption as well. In addition to natural resources, Honouliuli Ahupua‘a remains known for its cultural resources. Many of these resources are contained within the Kalaeloa Heritage Center.

The Kalaeloa Heritage Center property contains numerous sinkholes or karsts. The karsts contain water, plants, and burials. Some of the burials were left in place while others were relocated to a modern constructed *ahu*. Approximately 26 burials are within the *ahu*. In addition, probable

burial mounds (based on length and width) are located on the property. None of the probable burial mounds have been dismantled to verify if *iwi kūpuna* are under the rubble. Mr. Kāne would like to keep most of the site intact to retain the integrity and provenance of the cultural landscape.

A portion of the Kūalaka‘i Trail is located on the grounds of the Kalaeloa Heritage Center. According to Mr. Kāne, the Kūalaka‘i Trail was meant for travel and also to exchange goods. The trail fostered relationships between *mauka* and *makai* residents by establishing a trading system or providing temporary habitation while away from their permanent home. Mr. Kāne also shared that the *kia manu* of Kānehili ‘Ili favored the method of smoking birds to capture them for their feathers. This method included setting a contained fire where the bird would fly through the smoke, become disoriented, and thus enabling the *kia manu* to gather the feathers. The *manu ‘ō‘ō* was the most commonly used bird on O‘ahu for feather work.

Through his photographic work, Mr. Jan Becket has also assisted with the documentation of *wahi pana* throughout both the Kalaeloa Heritage Center and ‘Ewa Moku. Mr. Jan Becket knows of several structures and a *kū‘ula* near the summit of Pālehua, a peak near the border of Nānākuli and Honouliuli Ahupua‘a. Mr. Becket conducted a site visit with the late Marion Kelly who identified the *kū‘ula* as “the Walking Stone.”

Mr. Becket recalled several *ko‘a* between the present Ocean Pointe development and the shoreline near One‘ula Beach Park. During the construction of the development, several *ko‘a* were bulldozed for a proposed marina. Several years later the marina was dropped from the plans. Several sites are still present in the area including SIHP # 50-80-01-4278, a complex of platforms, and a *heiau* that was identified by Paul Rosendahl. The *heiau* is located *mauka* of Pāpipi Road towards Kalaeloa.

Outside Honouliuli Ahupua‘a, but still within ‘Ewa *moku*, Mr. Becket and Mr. Kāne have seen petroglyphs below the H-1 freeway between Hō‘ae‘ae and Waikele Ahupua‘a.

Indeed, many of the *wahi pana* throughout Honouliuli Ahupua‘a maintain connections to traditional *mo‘olelo*. Through *mo‘olelo*, the historical, religious, and/or cosmological significance of a place can be better understood. Keawe Vredenburg shared the *mo‘olelo* of Mā‘ili-kūkahi and the naming of several places. Mā‘ili-kūkahi was asked to become *mō‘ī* (paramount ruler, chief) of O‘ahu after the death of the former *mō‘ī*, Haka. For the next 25 years, O‘ahu Island prospered with Mā‘ili-kūkahi as *mō‘ī*. Two chiefs from Hawai‘i Island and one from Maui Island plotted against Mā‘ili-kūkahi. Rumors of the invasion preceded and Mā‘ili-kūkahi was aware of the possible attack. When a war fleet of canoes landed, Mā‘ili-kūkahi led his warriors to attack the Hawai‘i and Maui army. A full battle broke out on the plain known as Punalu‘u, named after the chief Mā‘ili-kūkahi defeated. Punalu‘u is located near Kīpapa Gulch. Kīpapa translates to “placed prone,” which is how the bodies of the defeated warriors were placed. The other Hawai‘i chief, Hilo, was captured with his staff at a place called Po‘ohilo (“the head of Hilo”). Hilo and his staff were beheaded at Po‘ohilo, which is located within the project area at the intersection of Fort Weaver Road and Farrington Highway.

Mr. Vredenburg is concerned with finding *iwi kūpuna* at the location of Po‘ohilo, the location where Mā‘ili-kūkahi beheaded the Hawai‘i chief, Hilo, and his staff in the *mo‘olelo* of Mā‘ili-kūkahi. The location of Po‘ohilo is in close proximity to the project area, where Fort Weaver Road and Farrington Highway intersect. The area may produce remains at or near the intersection.

Section 7 Traditional Cultural Practices

Timothy R. Pauketat succinctly describes the importance of traditions, especially in regards to the active manifestation of one's culture or aspects thereof. According to Pauketat,

> People have always had traditions, practiced traditions, resisted traditions, or created traditions . . . Power, plurality, and human agency are all a part of how traditions come about. Traditions do not simply exist without people and their struggles involved every step of the way. [Pauketat 2001:1]

It is understood that traditional practices are developed within the group, in this case, within the Hawaiian culture. These traditions are meant to mark or represent aspects of Hawaiian culture that have been practiced since ancient times. As with most human constructs, traditions are evolving and prone to change resulting from multiple influences, including modernization as well as other cultures. It is well known that within Hawai‘i, a "broader 'local' multicultural perspective exists" (Kawelu 2015:3) While this "local" multicultural culture is deservedly celebrated, it must be noted that it has often come into contact with "traditional Hawaiian culture." This contact between cultures and traditions has undoubtedly resulted in numerous cultural entanglements. These cultural entanglements have prompted questions regarding the legitimacy of newly evolved traditional practices. The influences of "local" culture are well noted throughout this section, and understood to represent survivance or "the active sense of presence, the continuance of native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry" (Vizenor 1999:vii). Acknowledgement of these "local" influences help to inform nuanced understandings of entanglement and of a "living [Hawaiian] contemporary culture" (Kawelu 2015:3). This section strives to articulate traditional Hawaiian cultural practices that were practiced within the *ahupua‘a* in ancient times, and the aspects of these traditional practices that continue to be practiced today; however, this section also challenges "tropes of authenticity" (Cipolla 2013) and acknowledges the multicultural influences and entanglements that may "change" or "create" a tradition.

This section integrates information from Sections 3–6 in examining cultural resources and practices identified within or in proximity of the project area in the broader context of the encompassing Honouliuli landscape. Excerpts from interviews are incorporated throughout this section where applicable.

7.1 Settlement and Habitation

Honouliuli Ahupua‘a had a tremendous amount of various resources including 12 miles of coastline with a continuous shallow fringing reef offering extensive fisheries including mullet and *awa*. According to community participants Mel Kalahiki and Kawika McKeague, Honouliuli Ahupua‘a was abundant in various types of *limu*. Honouliuli also consisted of a broad limestone plain with many sinkholes known as karsts, which offered a nesting home for a large population of avifauna. Community participant Shad Kāne has restored a portion of a former village known as Site -1753 within the Kalaeloa Heritage Center (KHC). The KHC contains a series of burial karsts, agricultural karsts, and water karsts. The lower portions of Honouliuli and Kalo‘i Gulch offered rich, alluvial soils with irrigation from springs and streams to create excellent taro lands. Approximately 12 miles inland from the shoreline was an extensive upland forest zone containing

kukui, *‘ōhi‘a lehua*, *‘iliahi*, *hau*, tī, banana, etc. The various resources of Honouliuli Ahupua‘a from *mauka* to *makai* may have been one of the early attractions for human settlement.

John Papa ‘Ī‘ī described a network of trails throughout leeward O‘ahu. The main trail leading from Kou (Honolulu) toward the ‘Ewa district traveled from east to west and generally followed the route of the project area. At a place called Pueohulunui the trail branched off either to Waialua, down to Honouliuli, or to Wai‘anae. The trail to Honouliuli eventually branched into two directions and traversed the plain north to south. Both trails traveled toward the shoreline, however, one trail led to the approximate area of One‘ula Beach Park and the other trail led to ‘Ewa Beach Park. Three different trails allowed passage to Wai‘anae from the Honouliuli plain, one by way of Pu‘uokapolei, another by way of Pohakea, and a third by way of Kolekole Pass.

A portion of the Kūalaka‘i Trail is located on the KHC and travels *mauka* to *makai*. The rugged coral pathway is lined by large, flat upright stones shaped like large arrowheads approximately 3 ft high, 1 ft wide at its widest part, and 8 inches thick. The upright stones are spaced out approximately 8 ft apart. According to Mr. Kāne, the trail traveled from the shoreline to Kalo‘i Gulch. Although the trail was created for travel, its utmost importance was to establish *mauka* and *makai* relationships. *Mauka* residents had access to food items that *makai* residents did not have access to and vice versa. Trading or temporary habitation at another village provided a well-rounded diet. Several L- and C-shaped structures, which are generally classified as temporary housing in contrast to rectangular terraces reserved for permanent habitation, can be found to the west of the Kūalaka‘i Trail. The close proximity of these structures to the Kūalaka‘i Trail supported the fostering of these *mauka-makai* relationships.

Two villages once existed within the project area, Keoneae and Puainako (also called Pu‘u-ainako). The village of Keoneae could be found in the natural alignment of Kalo‘i Gulch. The village of Puainako could be found in the natural alignment of Honouliuli Gulch.

7.2 Cultivation, Fishing, and Gathering

The Honouliuli Taro Lands were irrigated by Honouliuli Stream and eventually drained into West Loch. According to historian Carol Silva, the western portion of Honouliuli that borders West Loch was clearly a major population center and a logical response to the abundance of marine life and taro cultivation. The earliest documentation of these well-irrigated bottomlands is a map created by Charles R. Malden in 1825. Malden was the surveyor for Captain George Vancouver who traveled and charted the majority of the Hawaiian Islands. Honouliuli was also known for a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marsh locations and was a prized variety.

Cultivated yams and bananas could be found on the lower portion of the valley walls. Further inland grew *‘awa* for which the ‘Ewa district was also known. In addition, *‘ulu*, coconuts, *wauke*, *olonā*, and other plants were grown in the interior. ‘Ewa was one of the best areas to cultivate gourds and was famous for its *māmaki*. Mr. Kāne of the KHC is restoring and propagating plants that grew on the Honouliuli plain. This includes the *kō* or sugarcane, which the *‘ili* of Kānehili was once known for. Other plants such as *maiapilo*, *‘ahinahina*, *‘akoko*, *noni*, ti, and the *wiliwili* tree are being restored on the KHC property.

Community participant Kawika McKeague recalls utilizing some plants for *lā‘au lapa‘au* including the *kaunaoa* and *noni*. He remembers storing the *noni* fruit in mayonnaise jars and his father telling him to, “Take a jigger.” When he was ill, he recalls ingesting *noni*, *laukahi*, *‘uhaloa*, and *‘awa*.

Mr. Kāne has shared that the *kia manu* or bird catchers of Kānehili ‘Ili used the technique of smoking birds to capture them for their feathers. This method included setting a contained fire so the bird would fly through the smoke, become disoriented, and the *kia manu* could easily gather the feathers. The *manu ‘ō‘ō* was the bird commonly used on O‘ahu Island for feather work. Community participant Keawe Vredenburg shared a concern for the *moa nui* or large flightless duck. The duck served as game for travelers between the *mauka* areas of Pearl Harbor en route to Kou. The *moa nui* also lived in the limestone sinkholes on the Honouliuli plain.

Community participant Mel Kalahiki recalled a fishing village in the vicinity of Iroquois Point. Mr. Kalahiki also remembered many different types of *limu* being abundant in certain areas of ‘Ewa Beach including *limu ‘ele‘ele*, a type of *limu* used for stews. *‘Opihi*, clams, and other small fish were plentiful. Mr. McKeague stated that he grew up with the mantra, “The ocean is your icebox.” Mr. McKeague was taught to take what you needed from nature, how to properly pick items such as *limu*, how to clean nets, how to regularly check your nets, and how to catch and release. He recalled catching mullet, *weke*, *menpachi*, *akule*, *awa*, and *āholehole*. He regularly gathered various types of *limu* including *ogo*, *limu wāwae‘iole*, *manauea*, and *limu kohu*. He recalled other people gathering *hā‘uke‘uk*e and *papa‘i*, but he stated that growing up he never ate crab or lobster. He recalled seeing *he‘e* holes, but would never eat *he‘e*. As Mr. McKeague got older he began to incorporate *he‘e* and *hā‘uke‘uke* into his diet.

In historic times, the landscape of Honouliuli dramatically shifted. In 1877, the lands of Honouliuli were sold to James Campbell who used the land to graze cattle. Most of the land was used for ranching. One planter remarked that the area was so dry and full of bottomless cracks that irrigation would be impracticable. In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water. A well was drilled to a depth of 240 ft near Campbell’s home in ‘Ewa where it resulted in a continuous water flow. Other plantation developers and ranchers drilled numerous wells to tap into the resource. Other enterprises include the redevelopment of former taro fields into rice fields during the late 1800s; pineapple cultivation in 1901 by James Dole; and sugarcane cultivation in the late 1800s.

7.3 *Mo‘olelo*

The hill, Pu‘uokapolei, was a prominent landmark for travelers on the trail who traversed the ‘Ewa plain from Pearl Harbor to Wai‘anae. The word *pu‘u* means “hill” and Kapolei means “beloved Kapo,” a reference to the sister of the Hawaiian volcano goddess, Pele. The hill is also associated with the pig god, Kamapua‘a, who conquered the majority of the island of O‘ahu and made his grandmother, Kamaunuaniho, queen and established her court there. According to historian Emma Nakuina, the foundations of Kamaunuaniho’s home can still be seen at Pu‘uokapolei (Nakuina 1904:50).

Mr. Vrendenburg shared the *mo‘olelo* of Mā‘ili-kūkahi. Mā‘ili-kūkahi was born at Kūkaniloko, one of the most significant cultural sites on O‘ahu where chiefs were born. At the age of 20, Mā‘ili-kūkahi was asked to be the government administrator, the chief executive under the *mō‘ī* Haka,

the ruling chief at the time. Haka was killed during a rebellion and Mā‘ili-kūkahi was asked to become the *mō‘ī* to replace Haka’s seat. As *mō‘ī*, Mā‘ili-kūkahi surveyed the entire island of O‘ahu, redrew the *ahupua‘a* boundaries, and ordered the government to serve the people. He then asked for each first-born son to be brought to his personal living area where they were educated and trained as a warrior. Top quality goods were produced and traded throughout the archipelago. For 25 years the island of O‘ahu prospered with Mā‘ili-kūkahi in control. Two chiefs from Hawai‘i Island named Hilo and Punalu‘u joined with Maui chief Luako‘a to gather an army and invade O‘ahu. Rumors of the invasion preceded the attack for months. When a fleet of war canoes appeared off Waikīkī, the residents fled the area letting the invaders burn their homes and cut down their *niu* grove. The war canoes then traveled to ‘Ewa and attempted to attack inland. The *hānai* children of Mā‘ili-kūkahi attacked the Hawai‘i and Maui army from behind and destroyed their canoes. A full battle broke out on the plain known as Punalu‘u. Bodies filled Kīpapa Gulch and the chief Hilo and his staff were captured at a place called Po‘ohilo and beheaded.

Mr. Shad Kāne shared the naming of the Kūalaka‘i Trail and its connection to the *mo‘olelo* of Kaha‘i. Kūalaka‘i literally means “sea creature” (Pukui et al. 1974:119). Mr. Kāne asked Rubellite Kawena Johnson, a Hawaiian historian and Professor Emeritus of Hawaiian Language and Literature, to help him decipher the connection of the name to the land. Ms. Johnson revealed that the name Kūalaka‘i is actually a hybrid of the name Ka-‘ulu-a-kaha‘i or “the ‘ulu of Kaha‘i.” Kaha‘i comes from a line of Tahitian navigators and was sent to sea to bring back an *‘ulu* tree. Kaha‘i brought back an *‘ulu* tree from Samoa, planting the first one in the Hawaiian Islands at Pu‘uloa. Mr. Kāne explained that the *mo‘olelo* of Kaha‘i is symbolic as it secures the past yet represents a new beginning. The *‘ulu* tree itself represents the connection to the past; the word *‘ulu* is not a Hawaiian word. The *‘ulu* leaf represents new life or rebirth. The story of Kaha‘i is about travel and migration.

Mr. McKeague shared the epic of Hi‘iakaikapoliopele traveling, paying homage to the different areas, and calling out to these areas she encounters on her trek around the Hawaiian Islands. Mr. McKeague noted one of the most critical stories for Honouliuli is when Hi‘iaka sees Pohakea and works her way to Palailai and ends at Pu‘uokapolei before continuing her trek.

7.4 *Wahi Pana*

There are 41 documented *wahi pana* and cultural sites in Honouliuli Ahupua‘a. These include gulches, streams, peaks, *heiau*, *‘ili*, and some structures. During a field visit to KHC, Mr. Jan Becket pointed out two important cultural sites on the property, the Kūalaka‘i Trail and a religious structure. Both of these structures are part of a large complex previously mentioned, Site -1753. The site functions as a former village with multiple cultural sites. The Kūalaka‘i Trail is a unique cultural site in the Hawaiian Islands as there is no other known pathway that is intact and constructed with coral. The religious structure is also unique, constructed with coral; a large outcropping surrounds a significantly long karst that contains human burials. A large white coral upright stone stands to the west of the outcropping.

Mr. Becket also shared his knowledge of other cultural sites in Honouliuli Ahupua‘a including several structures and a *kū‘ula* at Pālehua, a peak near the border of Nānākuli and Honouliuli Ahupua‘a. In the past, Mr. Becket and Mr. Kāne had escorted the late Marion Kelly to verify the *kū‘ula*, which she identified as “the Walking Stone.” Mr. Becket recalled several *ko‘a* or fishing

shrines located between the present Ocean Pointe development and the shoreline near One‘ula Beach Park. During the construction of the Ocean Pointe housing, a marina was proposed as part of the development. Several *ko‘a* were bulldozed to make room for the marina. However, several years later the proposed marina was dropped from the Ocean Pointe plans. Mr. Becket noted that several sites are still present including SIHP # 50-80-01-4278, a complex of platforms, and a *heiau* identified by Dr. Paul Rosendahl. The *heiau* is located *mauka* of Pāpipi Road toward Kalaeloa. Outside Honouliuli Ahupua‘a, but still within ‘Ewa *moku*, Mr. Becket knows of petroglyphs below the H-1 freeway between Ho‘ae‘ae and Waikele Ahupua‘a.

Mr. Vredenburg shared the *mo‘olelo* of Mā‘ili-kūkahi and several place names. One place is the flat plain known as Punalu‘u, named after the defeated Hawai‘i chief. Punalu‘u is located near Kīpapa Gulch. Kīpapa translates to “placed prone,” which is how the bodies of the Hawai‘i warriors fell into the gulch. The other Hawai‘i chief, Hilo, was captured with his staff at a place now called Po‘ohilo (“the head of Hilo”). Hilo and his staff were beheaded at this location. Po‘ohilo is located within the project area at the intersection of Fort Weaver Road and Farrington Highway.

7.5 Religious Practice and Burials

While touring the KHC, Mr. Kāne indicated some of the sinkholes on the property contain *iwi kūpuna.* Some of the *iwi kūpuna* were left in place while others were relocated to a modern constructed *ahu*. Approximately 26 burials are within the *ahu*. In addition, probable burial mounds are on the KHC property (based on length and width). None of the probable burial mounds have been dismantled to verify if *iwi kūpuna* are under the rocks. Mr. Kāne would like to keep most of the site intact to keep the integrity and provenance.

As previously mentioned, Mr. Vredenburg shared the *mo‘olelo* of Mā‘ili-kūkahi. At the location of Po‘ohilo, within the project area where Fort Weaver Road and Farrington Highway meet, the area may produce remains at or near the intersection.

Section 8 Summary and Recommendations

CSH undertook this CIA at the request of Group 70 International, Inc. for the proposed Farrington Highway Improvements project. The cultural survey broadly included the entire *ahupua‘a* of Honouliuli.

8.1 Results of the Background Research

Background research for this project yielded the following results (presented in approximate chronological order):

1. Honouliuli Ahupua‘a had a tremendous and varied amount of resources that were attractive and readily available for early habitation. Honouliuli consists of 12 miles of coastline with a continuous shallow fringing reef, which offers rich marine resources. The West Loch of Pu‘uloa (commonly known as Pearl Harbor) offered another 4 miles of waterfront that boasted extensive fisheries, fishponds, and salt pans.
2. The ‘Ewa plain consists of a flat, karstic raised limestone reef forming a level, nearly featureless “desert” marked in pre-Contact times by a thin or non-existent soil mantle. Many sinkholes dot the plain, offering a nesting home for a large population of avifauna.
3. The lower portion of Honouliuli Stream fed the Honouliuli Taro Lands and eventually drained into West Loch. The earliest documentation of the Honouliuli Taro Lands can be seen in Charles R. Malden’s map of 1825. The area around the Honouliuli Taro Lands and near West Loch would be ideal for habitation and a logical response to the abundance of fish and other aquaculture as well as its close proximity to the well-irrigated bottomlands.
4. John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails, which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘uokapolei and Waimānalo Gulch to the Wai‘anae coast and onward circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96–98).
5. Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain and was the primary landmark for travelers on the trail that ran from Pearl Harbor to Wai‘anae. A *heiau* was once on the summit of the hill, however, by the time of McAllister’s survey of O‘ahu it had been destroyed (McAllister 1933:108). The hill was also used as a point of solar reference or as a place for celestial observations that mark the winter and summer solstice. A ceremony at a *heiau* on Pu‘uokapolei provides a vantage point to capture the sun setting directly behind Pu‘ulailai, a peak farther west in the Wai‘anae range. A coinciding ceremony at Kūpalaha Heiau in Waikīkī captures the same essence as the sun sets behind Pu‘uokapolei.

8.2 Results of Community Consultation

From September 2013 to March 2014, CSH attempted to contact 74 NHOs, agencies, and community members in order to identify individuals with cultural expertise and/or knowledge of the project area and its vicinity. Of the 12 individuals and/or organizations that responded, three *kama‘āina* and/or *kūpuna* provided written testimony and four participated in formal interviews for more in-depth contributions to the CIA. Below is a list of individuals who shared their *mana‘o* and *‘ike* about the project area:

1. Keola Lindsey and Momilani Lanzi on behalf of Ka Pouhana (Chief Executive Officer), Dr. Kamana‘opono Crabbe of the Office of Hawaiian Affairs (OHA)
2. Keawe Vredenburg, cultural practitioner and author
3. Tom Lenchanko, caretaker of Kūkaniloko Heiau
4. Mel Kalahiki, member of ‘Ahahui Mālama o Kaniakapūpū
5. Jan Becket, author, photographer, and retired teacher from Kamehameha Schools; former Kona Moku Representative, Council of Hawaiian Civic Club’s Committee on the Preservation of Historic Sites and Cultural Properties
6. Shad Kāne, member of the Kapolei Hawaiian Civic Club, Chair of the O‘ahu Council of Hawaiian Civic Clubs Committee on the Preservation of Historic Sites and Cultural Properties, Ali‘i Ai Moku of the Kapuāiwa Chapter of the Royal Order of Kamehameha Ekahi, and ‘Ewa Moku Representative on the State Aha Moku Advisory Committee
7. Kawika McKeague, cultural practitioner; Honouliuli historian and longtime resident

8.3 Impacts and Recommendations

During community consultation, participants identified potential impacts, articulating their concerns within a cultural context. Based on information gathered from the cultural and historical background, and the community consultation, potential impacts were identified, and the following preliminary recommendations were made.

1. CSH recommends that should historic, cultural, or burial sites or artifacts be identified during ground disturbance, the personnel involved with project construction activities should immediately cease all work and the appropriate agencies be notified pursuant to applicable law. In the event of discoveries of burials during project construction activities, recognized cultural and lineal descendants should be notified and consulted on matters of burial treatment.

2. Additionally, CSH recommends that cultural and lineal descendants be granted access rights to *iwi kūpuna* to conduct traditional and customary burial practices on-site.

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Appendix A Response Letter from OHA

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD13/6897

October 7, 2013

Nicole Ishihara
CSH Cultural Researcher
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, HI 96734

Re: Cultural Impact Assessment Consultation
Proposed Farrington Highway Improvements Project
Honouliuli Ahupua'a, 'Ewa District, O'ahu Island

Aloha e Nicole Ishihara,

The Office of Hawaiian Affairs (OHA) is in receipt of your September 23, 2013 letter seeking assistance and comments ahead of a cultural impact assessment (CIA) as part of the environmental assessment (EA) for the proposed Farrington Highway Improvements Project. Based on the information contained within your letter, the area for the assessment is located in the ahupua'a of Honouliuli, moku of 'Ewa, mokupuni of O'ahu. The project is situated on a three mile stretch of Farrington Highway between Fort Weaver Road and Kapolei Golf Course Access Road.

As mentioned in your letter, the project may involve "widening the highway, a new roadbed, utility relocations, drainage infrastructure, curbs, gutters, sidewalks, bridge modifications landscaping and a landscaped median strip." Because this project may utilize funding from the Federal Highways Administration, the CIA may be used to guide compliance with provisions of the National Historic Preservation Act and National Environmental Policy Act, if applicable.

OHA recommends that consultation be initiated with the following individuals and community organizations who may be willing to share their mana'o regarding this assessment: Shad Kane, Mike Lee, and Ahahui Siwila o Kapolei Hawaiian Civic Club. Please know that this list is not all encompassing and we are sure additional individuals will be identified as you move forward with your consultation process

We applaud your efforts to perform a CIA. OHA does request assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be identified during ground altering activities related to this project, all work will immediately cease and the appropriate agencies will be contacted pursuant to applicable law. OHA would like to be notified and consulted if burials are found.

Nicole Ishihara
October 7, 2013
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Thank you for initiating consultation and providing an opportunity to provide comments. We look forward to the opportunity to review the completed CIA as well as the draft EA. Should you have any questions, please contact Kathryn Keala at 594-0272 or kathyk@oha.org.

'O wau iho nō me ka 'oia'i'o,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer
Office of Hawaiian Affairs

KMC:kk

Appendix B Authorization Form

Cultural Surveys Hawai'i, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawai'i 96734 Ph: (808) 262-9972 Fax: (808) 262-4950

Job code: HONOULIULI 71 nishihara@culturalsurveys.com www.culturalsurveys.com

AUTHORIZATION AND RELEASE FORM

Cultural Surveys Hawai'i (CSH) appreciates the generosity of the *kūpuna* and *kama'āina* who are sharing their knowledge of cultural and historic places, experiences of past and present cultural practices. Cultural Surveys Hawai'i Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the City and County of Honolulu's proposed Farrington Highway Improvements Project (Between Fort Weaver Road and Kapolei Golf Course Road), Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu, various Tax Map Keys. The CIA will support an Environmental Assessment (EA) being prepared by Group 70 International, Inc.

We understand our responsibility in respecting the wishes and concerns of the interviewees participating in our study. Here are the procedures we promise to follow:

1. The interview will not be tape-recorded without your knowledge and explicit permission.
2. You will have the opportunity to review the written transcript or notes of our interview with you. At that time you may make any additions, deletions or corrections you wish.
3. You will be given a copy of the interview transcript or notes for your records.
4. You will be given a copy of this release form for your records.

For your protection, we need your written confirmation that:

1. You consent to the use of the complete transcript and/or interview quotes for reports on cultural sites and practices, historic documentation, and/or academic purposes.
2. You agree that the interview shall be made available to the public.

I, _____, agree to the procedures outlined above and, by my
(Please print your name here)
signature, give my consent and release for this interview and/or photograph to be used as specified.

_____
(Signature)

_____
(Date)

Appendix C Courtesy Letter to Community Consultation Participants

Cultural Surveys Hawai'i, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawai'i 96734 Ph: (808) 262-9972 Fax: (808) 262-4950
Job code: HONOULIULI 71/154 bbeauchan@culturalsurveys.com www.culturalsurveys.com

March 2019

Aloha,

In September 2013, Cultural Surveys Hawai'i (CSH) at the request of Group 70 International, Inc., and on behalf of the City and County of Honolulu's Department of Design and Construction (DDC) reached out to you regarding a cultural impact assessment (CIA) for the proposed Farrington Highway Improvements project (between Fort Weaver Road and Kapolei Golf Course Road; official limits of the project were to be contingent upon results of the traffic analysis), Honouliuli Ahupua'a, 'Ewa District, O'ahu, TMKs: [1] 9-1-016, 017, and 018. We would once again like to thank you for all your assistance and your valuable *mana'o* (thoughts, comments) on this project.

Following the completion of a draft CIA, CSH was notified of a hold placed on the project as well as the Environmental Assessment (EA) process. In April 2018, CSH was notified that efforts related to the project and the EA process were moving forward. Due to the lapse in time from when you were originally consulted for this project, we would like to provide you with a courtesy letter on the status of the draft EA. Currently, the draft EA is expected to be published on MM/DD/YYYY. Per Hawai'i Revised Statutes (HRS) §343-5, "a draft environmental assessment shall be made available for public review and comment for a period of thirty days." If in any way your *mana'o* has changed or been affected by the passage of time, please submit comments to (contact for G70 and address).

The project area remains located at Farrington Highway (Route 93) between Fort Weaver Road and Kapolei Golf Course Road, and still consists of the 3.1-mile (approximately 149.7 acres) linear roadway alignment (Figure 1 and Figure 2). The purpose of the project is to provide additional vehicular capacity through improvements to the transportation and utility infrastructure, designed to current standards, to serve the anticipated growth from planned projects in the area such as the University of Hawai'i West O'ahu, the Ho'opili master planned community, and a section of the Honolulu Rail Transit project. The project may also include widening the highway as well as installation of a new roadbed, drainage infrastructure, curbs, gutters, sidewalks, bike lanes, bridges, and a landscaped median strip.

Once again, if these changes have in any way changed your *mana'o*, please do not hesitate to submit comments to (contact for G70 and address) during the 30-day comment period.

Mahalo nui loa,

Cultural Surveys Hawai'i Inc.
Archaeological and Cultural Impact Studies
P.O. Box 1114
Kailua, Hawai'i 96734 Ph.: (808) 262-9972

CIA and EA for the Proposed Farrington Highway Improvements Project

Page 2

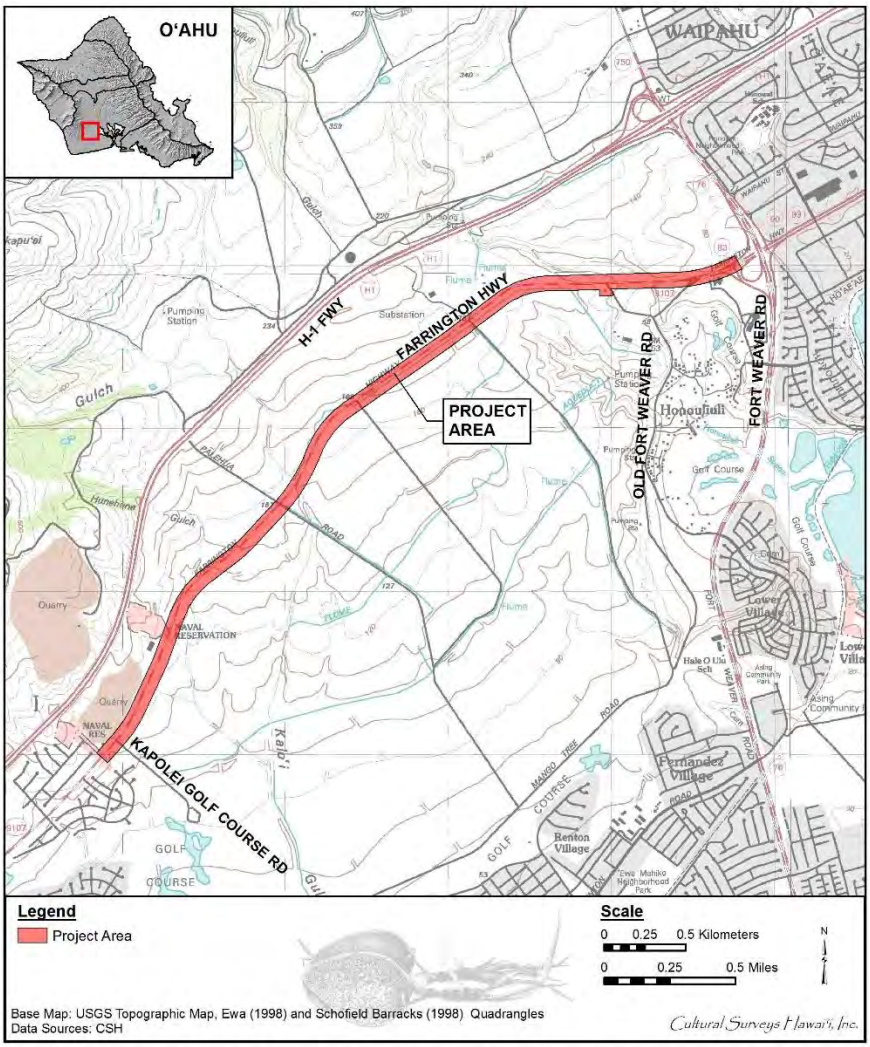

Figure 1. Portion of the 1998 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing the location of the project area

CIA and EA for the Proposed Farrington Highway Improvements Project

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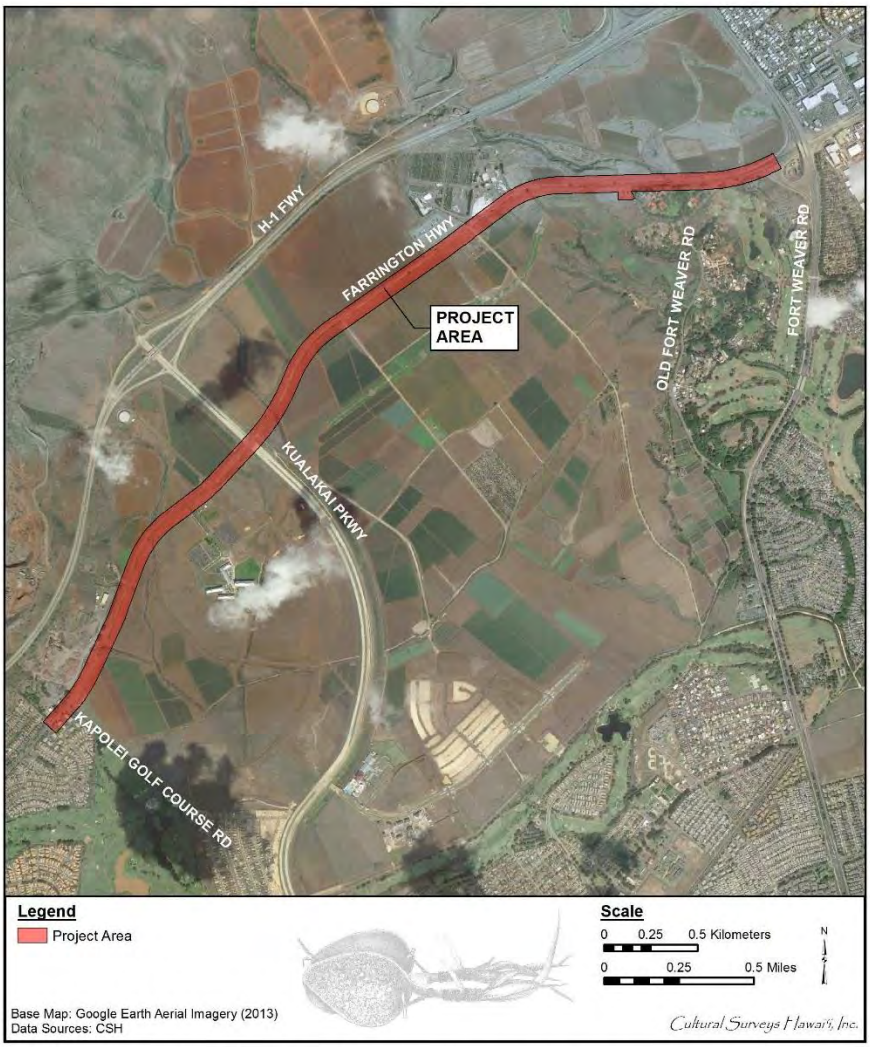

Figure 2. Google Earth Aerial Image (2013), showing the location of the project area