JOSH GREEN, M.D.
GOVERNOR

EDWIN H. SNIFFEN
DIRECTOR

Deputy Directors
FORD N. FUCHIGAMI
DREANALEE K. KALILI
TAMMY L. LEE
ROBIN K. SHISHIDO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-PA 2.1976

May 26, 2023

TO: MARY ALICE EVANS, ACTING DIRECTOR
ENVIRONMENTAL REVIEW PROGRAM
OFFICE OF PLANNING AND SUSTAINABLE DEVELOPMENT

FROM: EDWIN H. SNIFFEN
DIRECTOR OF TRANSPORTATION

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT
WAIMEA ROADWAY IMPROVEMENTS PROJECT
WAIMEA, HAWAII

With this letter, the State of Hawaii Department of Transportation, Highways, hereby transmits the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the proposed Waimea Roadway Improvements Project on the island of Hawaii. The FEA-FONSI has been prepared pursuant to Chapter 343, Hawaii Revised Statutes, and Title 11, Chapter 200.1, Hawaii Administrative Rules.

We request that the Office of Planning and Sustainable Development, Environmental Review Program publish notice of the FEA-FONSI publication in the next available periodic bulletin, The Environmental Notice.

Should you have any questions, please contact Ken Tatsuguchi, Engineering Program Manager, Highways Planning Branch at (808) 587-1830 or by email at ken.tatsuguchi@hawaii.gov.

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Friday, May 26, 2023 11:04:07 AM

Action Name

Waimea Roadway Improvements Project

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

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

South Kohala, Hawaiʻi

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

(3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; 6-5-007:001

Action type

Agency

Other required permits and approvals

HRS Chapter 6E-8, Community Noise Permit/Variance, County Grading Permit

Proposing/determining agency

Hawaii Department of Transportation, Highways Division

Agency contact name

Ken Tatsuguchi

Agency contact email (for info about the action)

ken.tatsuguchi@hawaii.gov

Agency contact phone

(808) 587-1830

Agency address

869 Punchbowl Street
Honolulu, Hawaii 96813
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

SSFM International, Inc.

Consultant contact name

Jennifer Scheffel

Consultant contact email

jscheffel@ssfm.com

Consultant contact phone

(808) 375-6038

Consultant address

99 Aupuni Street
Suite 202
Hilo, HI 96720
United States
Map It

Action summary

The State of Hawaii Department of Transportation (HDOT), Highways Division, has identified projects that would improve safety and relieve congestion within Waimea Town. The proposed project would include multimodal safety and operations improvements to existing roadways within the town of Waimea, including the following:
• Installation of a roundabout at the Kawaihae Road and Lindsey Road intersection,
• Roadway improvements along Kawaihae Road between Lindsey Road and Opelo Road, including bicycle and pedestrian treatments along both sides of the Kawaihae Road to Opelo Road
• Intersection improvements at Mamalahoa Highway and Lindsey Road
• Bicycle and pedestrian treatments along Mamalahoa Highway between Waimea School and Pukalani Road

Depending on funding availability, project components may be constructed in phases.

Reasons supporting determination

See Section 5.1 in the Final EA for a discussion of the significance criteria and their relationship to the Proposed Action.

Attached documents (signed agency letter & EA/EIS)

- 230509-WaimeaMultimodal_FinalEA-v2.pdf
- HWY-PA-2.1976-Final-Environmental-Assessment-and-Finding-of-No-Significant-Impact-Waima-Roadway-part-1-signed.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

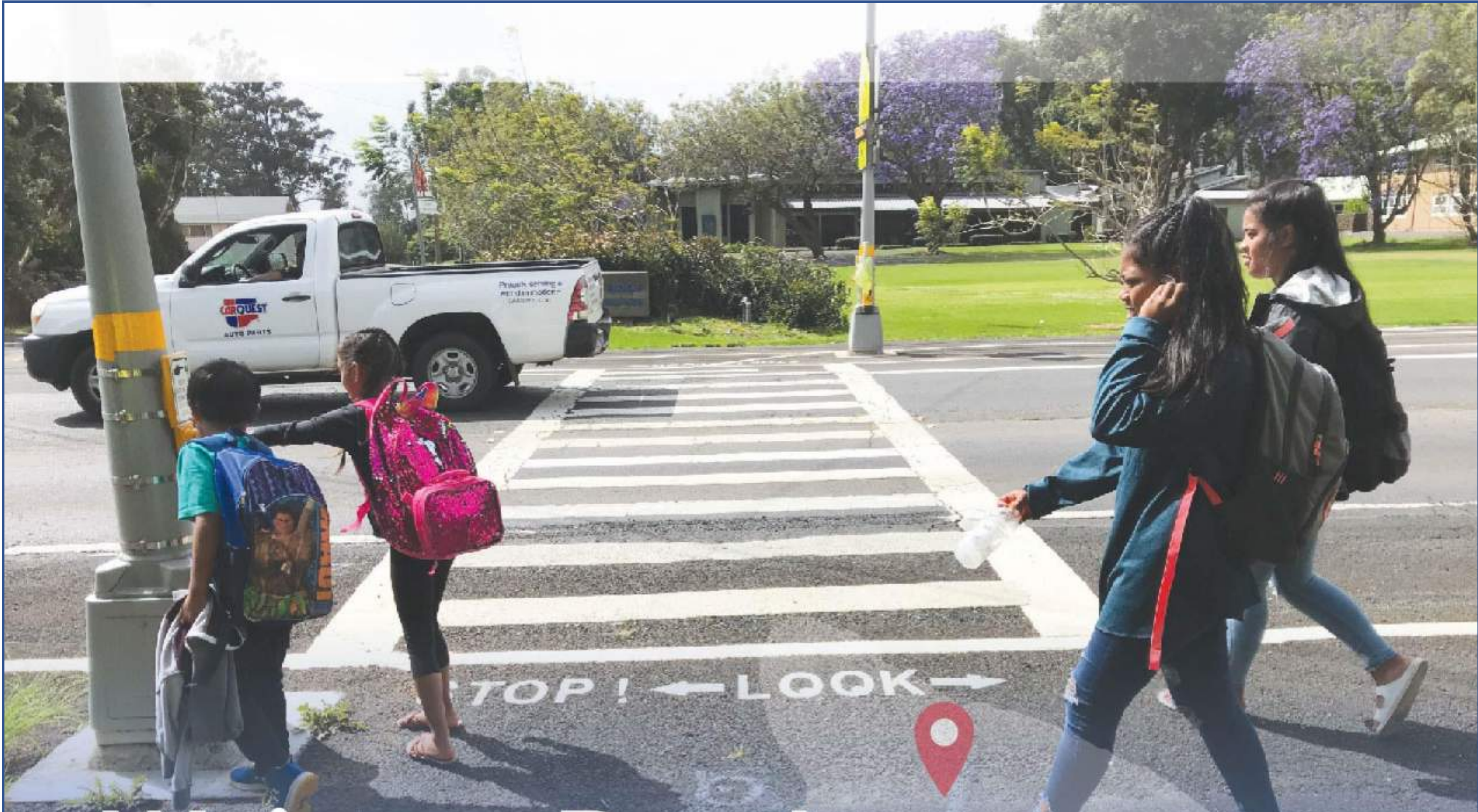
- Waimea_ProjectBoundary.zip

Authorized individual

Jennifer M Scheffel

Authorization

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



Waimea Roadway Improvements Project

Final Environmental Assessment and Finding of No Significant Impact

Prepared for: State of Hawaii, Department of Transportation

Prepared by: SSFM International

May 2023

DEPARTMENT OF TRANSPORTATION STATE OF HAWAII

SSFM International

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Final Environmental Assessment
And
Finding of No Significant Impact

Waimea Roadway Improvements Project

Waimea, Island of Hawaii, Hawaii

Prepared for:

State of Hawaii Department of Transportation, Highways Division

Prepared By:

SSFM International, Inc.

May 2023

Project Summary

Project Name	Waimea Roadway Improvements Project
Location	Waimea, Hawaii
District	South Kohala
Project Site Tax Map Keys	(3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; 6-5-007:001
Landowners	County of Hawaii State of Hawaii Parker School Parker Land Trust Annunciation Catholic Church Kanilehua LLC
Project Site Existing Uses	The majority of the Proposed Action would be within existing road right-of-way. Adjacent land uses include commercial, schools, and parkland.
State Land Uses	Urban
Hawaii County Zoning	CV 7.5, Village Commercial District RS 7.5, Single-Family Residential District Open, Open District
Proposed Action	The State of Hawaii Department of Transportation (HDOT), Highways Division, has identified projects that would improve safety and relieve congestion within Waimea Town. The proposed project would include multimodal safety and operations improvements to existing roadways within the town of Waimea, including the following: • Installation of a roundabout at the Kawaihae Road and Lindsey Road intersection, • Roadway improvements along Kawaihae Road between Lindsey Road and Opelo Road, including bicycle and pedestrian treatments along both sides of the Kawaihae Road to Opelo Road • Intersection improvements at Mamalahoa Highway and Lindsey Road • Bicycle and pedestrian treatments along Mamalahoa Highway between Waimea School and Pukalani Road Depending on funding availability, project components may be constructed in phases.

Anticipated Impacts	The Proposed Action would result in short-term and temporary impacts during construction to air quality, noise, soils, water resources, biological resources, and traffic. These impacts would be minimized through the implementation of Avoidance and Minimization Measures, as well as Best Management Practices (BMPs). The Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park, which are historic features. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style. In addition, there would be a reduction in the size of the park. HDOT is consulting with State Historic Preservation Division (SHPD) under Hawaii Revised Statutes (HRS) Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required. The Proposed Action could have a beneficial impact to air quality, socioeconomic characteristics (e.g., quality of life), and public facilities and services through the reduction of congestion in Waimea Town. In addition, the Proposed Action would increase the multimodal network in the heart of Waimea Town.
Proposing Agency	Hawaii Department of Transportation, Highway Division 869 Punchbowl Street, Room 301 Honolulu, Hawaii 96813
Determination	Finding of No Significant Impact (FONSI)
Project Site Permits/ Approvals Required	HRS, Chapter 343 HRS, Chapter 6E Community Noise Permit/Variance County Grading Permit
EA Preparer	SSFM International 99 Aupuni Street, Suite 202 Hilo, Hawaii 96720 Contact: Jennifer Scheffel (808) 356-1273

Agencies, Elected Officials, and Non-Governmental Organizations Consulted

State of Hawaii Agencies
Department of Accounting and General Services
Department of Business, Economic Development & Tourism
Department of Business, Economic Development & Tourism, Office of Planning
Department of Education
Department of Hawaiian Home Lands
Department of Health, Clean Water Branch
Department of Health, Clean Air Branch
Department of Health, Indoor and Radiological Health Branch
Department of Health, Office of Environmental Quality Control
Department of Land and Natural Resources, Land Division
Department of Land and Natural Resources, State Historic Preservation Division
Office of Hawaiian Affairs

County of Hawaii Agencies
Department of Environmental Management
Department of Parks and Recreation
Department of Research and Development
Department of Water Supply
Planning Department
Civil Defense Agency
Department of Public Works
Mass Transit Agency
Police Department
Fire Department

Elected Officials
Mayor Harry Kim, Office of the Mayor
Senator Lorraine R. Inouye, State Senate District 4
Representative David A. Tarnas, State House District 7
Council Member Valerie T. Poindexter, Hawaii County Council District 1
Council Member Tim Richards III, Hawaii County Council District 9

Non-Governmental Organizations
South Kohala Traffic Safety Committee
Waimea Hawaiian Homesteaders' Association
PATH Hawaii
Blue Zones Project
Waimea Community Association
Waimea Preservation Association
Parker Ranch
Parker School

Individuals Consulted

Nell Achtmeyer
Julia Alos
Sally Ancheta
Dana Asis
Nani Barretto
Dr. Billy Bergin
Carol Buck
John Buck
Andrew Choy
Tina Clothier
Patti Cook
Steve Cotton
Don Cox
Annette Cromwell
Lisa DeSantis
Debbie Diehl
Mike Donoho
Jim Dupont
Leningrad Elarionoff
Janice English
Barbara Feliciano
G.T. Foulkes
Anika Glass
David and Dallas Gomes
David and Terri Greenwell
David Gross
Robyn Hafner
Judy Halford
Howard Hall
Pat Hall
Betty Hannah
Roger Harris
Susan Harris
Whitney Harvey
Pete Hendricks
Wayne Higaki
David Higgins
Roger Hirako
James Hustace
Carol Ignacio
Gens Johnson
Maxine Kahaulelio
Susan Kim
David Kirk
Steve Kittell
James Kong
Llewellyn Kumulae
Clemson Lam
Janet Lam
Betty Lau
Leonard Librizzi
Randy Luck
Jan Marrack
Tim McCullough
Gunner Mench
Melvin Miranda
Sonny Miranda
Jonathan Mitchell
Colin Miura
Bill Moore
Keith Neal
Dodie Neves
Joyce O'Connor
Avi Oki
Val Overlan
Frankie Pang
Diane Paulson
Eliza Pond
Juanita Ritz
Ric Rocker
Chris Romeo
Liliu Ross
Susy Ruddle
Jada Rufo
William Sanborn
Barbara Schaefer
Meilan Sharpe
Julia Simmons
Bill Simonsa
Ruth Smith
Gary and Dorothy Souza
Aaron Stene
Paul Strauss
Fran Tabor
Jojo Tanimoto
Jen Valera
Michael Vasquez
Franz Weber
Roger Wehrsig
Kerry Wells
Lunn White
Chad Wiggins
Margaret Wilie

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Appendices

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Acronyms

$\mu g/m^3$	micrograms per cubic meter
AAQS	Ambient Air Quality Standards
BMPs	Best Management Practices
CAA	Clean Air Act
CDP	census designated place
CIA	Cultural Impact Assessment
CO	carbon monoxide
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DLNR	Department of Land and Natural Resources
DOH	Department of Health
EA	Environmental Assessment
FEMA	Federal Emergency Management Agency
FHWA	Federal Highways Administration
FIRM	Flood Insurance Rate Maps
HAR	Hawaii Administrative Rules
HDOT	Hawaii Department of Transportation
HRS	Hawaii Revised Statutes
LOS	level of service
LRFI	Literature Review and Field Investigation
LRLTP	Hawaii Regional Long-Range Land Transportation Plan
MOT	maintenance of traffic
MP	milepost
mph	miles per hour
MSAT	mobile source air toxics
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NAC	noise abatement criteria
NOx	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
PCS	Public Conversion Charter School
PEL	Planning and Environment Linkages
ppm	parts per million
ROW	right-of-way
RRFB	rectangular rapid flash beacon
SDC	Seismic Design Category
SHPD	State Historic Preservation Division
USEPA	U.S. Environmental Protection Agency
VHT	vehicle hours traveled
VMT	vehicle miles traveled
VOCs	volatile organic compounds

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1.0 PROJECT DESCRIPTION

1.1 Introduction

The State of Hawaii Department of Transportation (HDOT), Highways Division, has identified multiple treatments along existing roadways that would improve safety and operations and relieve congestion within Waimea Town. The proposed project would include multimodal safety and operations improvements to existing roadways within the town of Waimea, including the following:

- Installation of a roundabout at the Kawaihae Road and Lindsey Road intersection,
- Roadway improvements along Kawaihae Road between Lindsey Road and Opelo Road, including bicycle and pedestrian treatments along both sides of the Kawaihae Road to Opelo Road
- Intersection improvements at Mamalahoa Highway and Lindsey Road
- Bicycle and pedestrian treatments along Mamalahoa Highway between Waimea School and Lindsey Road
- Restriping to include a shared shoulder and bike lane between Waimea School and Kaomoloa Road
- Restricted left turns along Mamalahoa Highway between Lindsey Road and Pukalani Road

Depending on funding availability, project components may be constructed in phases.

This project is subject to the state environmental review process prescribed under Chapter 343 (Environmental Impact Statements), Hawaii Revised Statutes (HRS), as amended, also known as the Hawaii Environmental Policy Act, and Title 11, Chapter 200.1 (Environmental Impact Statement Rules), Hawaii Administrative Rules (HAR). Under these regulations, nine specific types of actions are identified that "trigger" environmental review. This project triggers the state environmental review process under these regulations because it proposes the use of state or county lands and the use of state or county funds (HRS §343-5(1)).

1.2 Project Background

1.2.1 Planning and Environment Linkages Process

In 2018, HDOT informed the Federal Highway Administration (FHWA) that it intended to pursue a Planning and Environment Linkages (PEL) process to study the needs of the greater Waimea region on the island of Hawaii. PEL is a method for linking planning and environmental review and is an approach to transportation decision-making that fosters collaboration and integration. The PEL process was completed in August 2019. The PEL Report was finalized in June and is available on the project website (http://www.waimearegionalsafetystudy.com/).

According to the public notice published on September 6 and September 9, 2018, notifying the public that a PEL process would be undertaken and information during that process would be used in subsequent environmental review, the following items are intended to carry over from the PEL process to this EA:

- Identify the problems that "Need" to be addressed.
- Document those "Needs" with data.
- Identify the Affected Environment
- Community input (from PEL Meetings)

- Consultation with stakeholders and agencies
- Preparation of the "Purpose and Need" statement
- Identification of "Alternatives" that meet the Purpose and Need.
- Narrowing of Alternatives to a reasonable number

This Environmental Assessment (EA) will explain when the material presented was developed under the PEL process and brought forward into the EA.

1.2.2 Previous Plans and Studies

There have been several planning studies that have documented longstanding transportation issues in Waimea Town but whose projects were not advanced due to lack of support and/or inadequate financial resources. These past efforts included studies to improve in-town circulation.

In 2005, the County of Hawaii adopted an updated General Plan that supported the completion of Lalamilo connector road and Parker Ranch connector road projects as an alternate way around the Waimea Town Center. The two connector roads would create a mini bypass around Waimea's choke point. In 2005, funding to construct Lalamilo Connector Road was available using a $10 million County bond secured for this purpose. However, there was community resistance by Lalamilo Farm Lot residents. The road project was no longer a County priority and was cancelled.

The Waimea Circulation Study sponsored by the County of Hawaii Planning Department was completed in December 2007. This study was conducted to identify how traffic circulation within Waimea Town could be improved and how the local roadway network interfaces with proposed regional roadway improvements. The Waimea Circulation Study identified short-range actions to address the current traffic issues in Waimea Town, as well as mid- to long-range issues that need to be considered when implementing regional transportation improvements. Projects identified in the Waimea Circulation Study and their status are provided in **Table 1**.

Table 1. Waimea Circulation Study Project Status

Project	Status
Mamalahoa Highway Widening from Hospital to East of Kamamalu Street	Project Completed
Parker Ranch Connector Road	EA in progress (see **Section 1.2.3**)
Waimea School Improvements (i.e., connector between Lindsey Road and the Waimea Schools internal road)	Project Completed
Prohibit Eastbound and Westbound Left Turns at Lindsey Road/Mamalahoa Highway Intersection	Intersection improvements are part of the Proposed Action in this EA
Traffic Signal Optimization	Intersection improvements are part of the Proposed Action in this EA
Mamalahoa Highway-Kawaihae Road Connector	Alignment included as part of the proposed bypass alternative identified during the PEL process

1.2.3 Other Transportation Projects Within the Project Area

Other roadway projects that are part of the state or local roadway system proposed within the project area include:

- **Waiaka Bridge Project/Kawaihae Road (State Route [SR] 19) and Kohala Mountain Road (SR 150)**
  Purpose: The HDOT is studying the redesign or renovation of the Waiaka Bridge to alleviate the narrow lane widths and intersection issues in Waimea and to address the substandard bridge rating. The project would involve realigning the approaches to the bridge to increase sight distances and improve hydrology of Keanuiomano Stream.

  Status: The Final EA published in 2012 was withdrawn in 2015 as a result of "new circumstances and information that require additional studies." Lawmakers approved a two-year state budget in May 2017 that includes $6 million for planning and land acquisition. The HRS Chapter 343 Final EA and Finding of No Significant Impact (FONSI) were published in July 2022. Clearances for compliance with the National Environmental Policy Act are ongoing and expected to be complete in mid-2023.

- **Parker Ranch Connector Road**
  Purpose: Parker Ranch Connector Road is part of the Waimea Town Center Project being developed by Parker Ranch.

  Status: A Hawaii County Planning Department Board of Appeals settlement was reached with Parker Ranch, as landowner developer, agreeing to pay for completion by May 2010 of a connector road between the Mauna Kea side of the Lualai subdivision and Mamalahoa Highway near the Parker Ranch entrance. A portion of the Parker Ranch Connector Road has been constructed and is now called Ala Ohia Road. An EA is in progress that includes the Lindsey Road Extension and the Ala Ohia Road Completion, discussed below.

- **Lindsey Road Extension**
  Purpose: This project extends Lindsey Road from its intersection with Mamalahoa Highway to Ala Ohia Road. Parker Ranch is required to construct this section of the project.

  Status: The Draft EA for the Waimea Town Center Infrastructure Improvements, which includes the Lindsey Road Extension, was published on August 8, 2017. It is expected that land exchanges and development permits will be obtained by 2020, and infrastructure improvements will be completed by 2035.

- **Ala Ohia Road Extension**
  Purpose: The project extends Ala Ohia Road from Pukalani Road to Mamalahoa Highway in the vicinity of the Waimea Civic Center.

  Status: The Draft EA for the Waimea Town Center Infrastructure Improvements, which includes the Ala Ohia Road Extension, was published on August 8, 2017. It is expected that all land exchanges and development permits will be obtained by 2020 and all infrastructure improvements will be completed by 2035.

- **Waimea Trails and Greenway (*Ke Ala Kahawai o'Waimea*)**
  Purpose: The County of Hawaii Department of Parks and Recreation proposes to construct a four- to five-mile-long multi-use path following Waikoloa Stream in Waimea to provide an alternative facility for pedestrian and bicycle use connecting residences, businesses, and schools, and enhancing opportunities to exercise and enjoy nature.

  Status: The Project is currently in Increment 1, and in early stages of planning and development.

1.3 Project Location

1.3.1 Project Location

The Proposed Action is located in the heart of the town of Waimea on the island of Hawaii. The primary roadways in the study area are Mamalahoa Highway, Kawaihae Road, and Lindsey Road, as shown in **Figure 1**.

1.3.2 Description of Roadways Involved in the Proposed Action

Roadways within the project area for the Proposed Action include Mamalahoa Highway (Route 190), Kawaihae Road (Route 19), and Lindsey Road (Route 19). The existing Kawaihae Road was constructed in 1934 and serves the town of Waimea and the South Kohala District on the Island of Hawaii. Along with Mamalahoa Highway, Kawaihae Road provides the main thoroughfare within and through Waimea Town. Project limits and intersections for each roadway are as follows:

- **Mamalahoa Highway (Route 19/190)** from Kaomoloa Road (milepost [MP] 0.3) to Pukalani Road (MP 56.4).
  - This section of roadway has two lanes and an average daily traffic (ADT) volume of 7,044 vehicles on a typical weekday.
  - The 85th percentile speed is 56 miles per hour as measured between Lalamilo Road and the airport access road.
  - The northern portion of Mamalahoa Highway from the eastern boundary of the project area to the intersection with Lindsey Road is part of the National Highway System (NHS) and is designated as "Other Principal Arterial".
- **Kawaihae Road (Route 19)** from Lindsey Road to Opelo Road (MP 56.9 to 57.3).
  - This roadway segment has two lanes and an ADT of 9,077 vehicles.
  - The section of Kawaihae Road within the study area is not part of the NHS but is a state highway.
- **Lindsey Road (Route 19)** in the heart of downtown Waimea (MP 56.75 to 56.9).
  - The average speed of travelers along Lindsey Road drops approximately 50% from when vehicles are on the balance of the regional system.
  - Lindsey Road has four lanes, two in each direction.
  - The average daily volumes in this short segment are 20,426 vehicles, which is the heaviest segment involved.
  - The intersection of Lindsey Road and Mamalahoa Highway is striped with channelized lanes for each movement.

- The signalized intersection of Mamalahoa Highway and Lindsey Road has a level of service (LOS) of D during both AM and PM peak periods.
- Driveways to adjacent businesses contribute to this area being a major conflict point.
- Lindsey Road is not part of the NHS. The portion of Lindsey Road between Mamalahoa Highway and Kawaihae Road is part of the state highway system.

The roadway functional classification, number of lanes, shoulder width, access control, and surrounding environment for each roadway is provided in **Table 2**. Bicycle and Pedestrian facilities are provided in **Table 3**.

Table 2. Existing Transportation Facilities within the Study Area

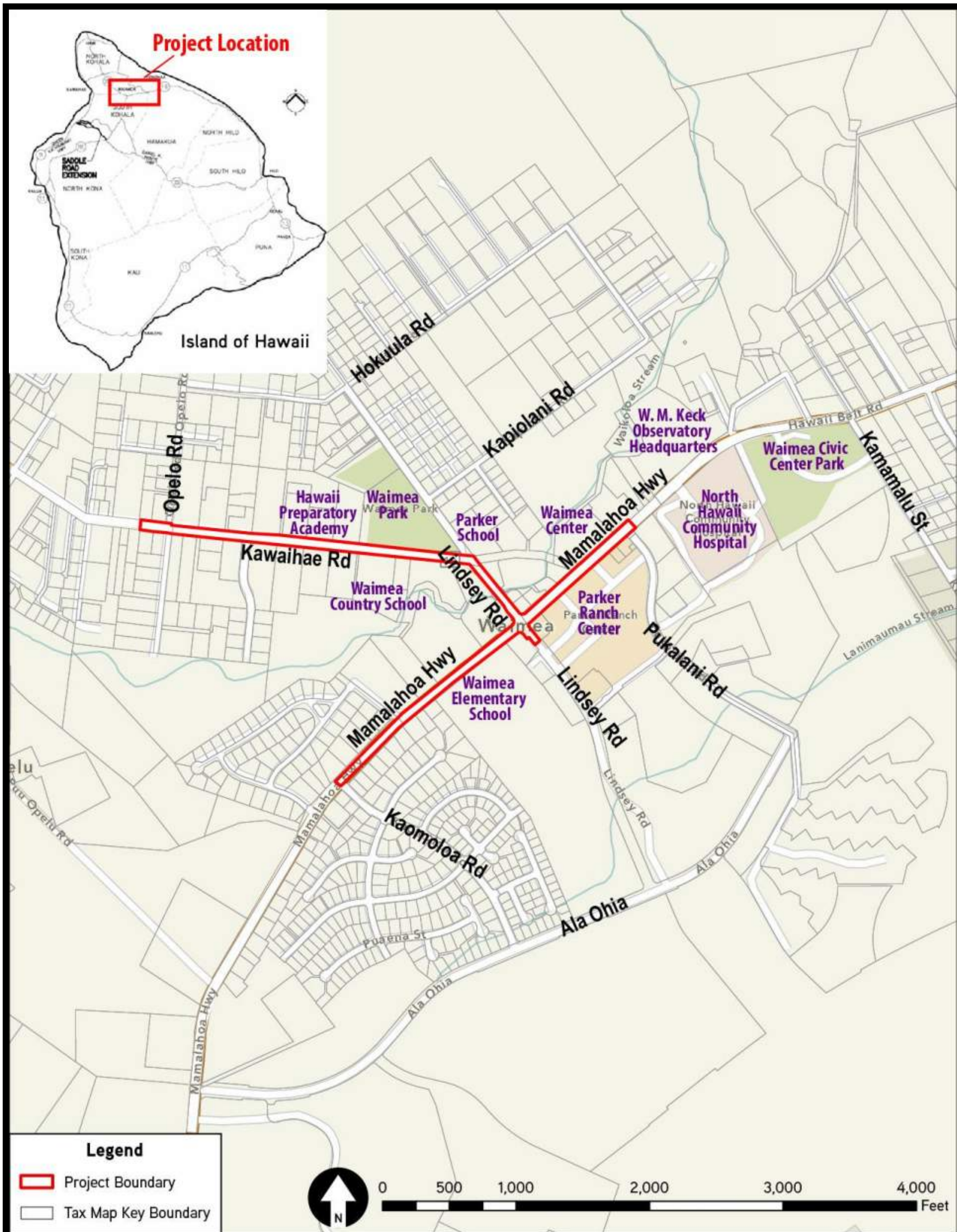
Roadway	Functional Classification	Number of Lanes	Shoulder Width	Access Control	Urban/ Rural	Federal Aid/NHS	Freight Route	Surrounding Environment
Mamalahoa Highway	Minor Arterial	2	4 feet	None	Small Urban	Yes[1]	Yes	• Agricultural • Village Commercial District • Single-Family Residential
Kawaihae Road	Principal Arterial	2	6 feet	None	Small Urban	No[2]	Yes	• Village Commercial District
Lindsey Road	Principal Arterial	4	None	None	Small Urban	No	Yes	• Village Commercial District

[1] Only the northern portion of Mamalahoa Highway is Federal Aid/NHS
[2] Kawaihae Road is Federal Aid/NHS only between Queen Kaahumanu Highway and Maluokalani Street

Table 3. Existing Bicycle and Pedestrian Facilities within the Study Area

Roadway	Bicycle Facilities	Pedestrian Facilities
Mamalahoa Highway	Partial bike lanes between Lindsey Road and Kaomoloa Road	• Sidewalks in places between Lindsey Road and Waimea Elementary School driveway. • Sidewalks on both sides of the roadway between Lindsey Road and Pukalani Road
Kawaihae Road	Unsigned bikeable shoulders on both sides	Shoulder on both sides of the roadway between Lindsey Road and Opelo Road
Lindsey Road	None	Sidewalks on both sides between Mamalahoa Highway and Kawaihae Road

Figure 1. Project Location Map



1.3.3 Land Ownership

The majority of the Proposed Action would be constructed within the existing roadway right-of-way (ROW) under HDOT's jurisdiction. The proposed roundabout at the Lindsey Road/Kawaihae Road intersection would require land acquisition and/or construction easements from adjacent landowners, as provided in **Table 4** and shown in **Figure 2**. These include the State of Hawaii, Parker School, Parker Land Trust, Annunciation Catholic Church, and Kanilehua Traders, LLC. Based on comments received at PEL Meeting #4, these adjacent landowners support the construction of a roundabout. HDOT will coordinate with the landowners regarding land acquisition. There would be no relocations required.

A construction easement would be required from adjacent landowners along Kawaihae Road, as shown in **Table 4**. The construction easement would be required to provide connections to existing sidewalks/paths, relocated existing driveways and parking stalls, relocate utilities, and install drainage improvements. Construction easements along Mamalahoa Highway and Lindsey Road are not expected to be required except at Waimea School to accommodate minor striping work along Māmalahoa Highway. These easements are still being defined.

Roadway plans showing the proposed temporary construction easements and permanent ROW are provided in **Appendix A**.

Table 4. Land Requirements Along Kawaihae Road

Tax Map Key (TMK)	Landowner	Construction Easement Acreage	Permanent Land Required
Kawaihae Road and Lindsey Road Intersection			
(3) 6-5-007:001	State of Hawaii	0.18	0.0 (175 sf)
(3) 6-5-005:025	Parker School	0.08	0.0
(3) 6-5-003:005	Parker Land Trust	0.14	0.21
(3) 6-5-005:021	Kanilehua Traders, LLC	0.05	0.0
(3) 6-5-003:029	Annunciation Catholic Church	0.11	0.0 (115 sf)
(3) 6-5-004:027	Parker School	0.05	0.0
Kawaihae Road			
(3) 6-5-007:002	County of Hawaii	0.04	0.0
(3) 6-5-003:006	Episcopal Church in Hawaii	0.05	0.0
(3) 6-5-003:046	Episcopal Church in Hawaii	0.09	0.0
(3) 6-5-003:032	Episcopal Church in Hawaii	0.01	0.0
(3) 6-5-003:032	Chock Properties Habitat for Humanity Hawaii	0.07	0.0
(3) 6-5-007:003	Hawaii Preparatory Academy	0.05	0.0
(3) 6-5-007:053	Hawaii Preparatory Academy	0.05	0.0
(3) 6-5-007:049	Hawaii Preparatory Academy	0.01	0.0
(3) 6-5-007:005	Hawaii Preparatory Academy	0.05	0.0
(3) 6-5-003:008	LPSR Properties, LLC	0.06	0.0
(3) 6-5-003:009	Long Drug Stores California, LLC	0.02	0.0
(3) 6-5-003:010	Long Drug Stores California, LLC	0.02	0.0
(3) 6-5-003:033	Niu Pia Land Company, Ltd.	0.08	0.0

Tax Map Key (TMK)	Landowner	Construction Easement Acreage	Permanent Land Required
(3) 6-5-007:047	R&T Properties (Waimea), Inc. Kenichi Hayashi Ent., LLC	0.08	0.0
(3) 6-5-007:006	65-1292 Kawaihae Road, LLC	0.02	0.0
(3) 6-5-007:007	Sameshima Muneo & Yuriko	0.06	0.0
(3) 6-5-007:008	State of Hawaii	0.04	0.0
(3) 6-5-003:011	Niu Pia Land Company, Ltd.	0.04	0.0
(3) 6-5-003:042	Red Ohia, LLC	0.05	0.0
(3) 6-5-003:043	Ryusaki Natsuko Trust Hawaii Gourmet Society, LLC	0.07	0.0
(3) 6-5-003:020	Kauila, LLC	0.02	0.0
(3) 6-5-003:026	Tamarack Pines	0.02	0.0
(3) 6-5-002:177	Opelo Plaza II, LLC Comtemporary Restaurant Corp.	0.02	0.0
(3) 6-5-002:042	Niu Pia Land Company, Ltd.	0.02	0.0
(3) 6-5-002:043	Okuno, Dale, Loren, Marcelle Franchoise Trust	0.01	0.0
(3) 6-5-003:028	Y Hamada Ohana, LLC	0.03	0.0
(3) 6-5-009:032	Waimea Apartments	0.04	0.0
(3) 6-5-009:033	Gladys M. Nekoba TR	0.06	0.0

1.4 Purpose and Need for the Proposed Action

HDOT, Highways Division is seeking to improve safety and operations and relieve congestion in the Waimea region. This includes constructing in-town multimodal treatments that would improve safety and reduce congestion. The Purpose and Need for the Proposed Action were developed during the PEL process and are discussed below in **Section 1.4.1** and **Section 1.4.2**, respectively.

1.4.1 Purposes of the Proposed Action

The Purposes for the Proposed Action were developed during the PEL process and had extensive community input before the final purposes were agreed upon. The purposes of the Proposed Action are to improve safety and to reduce congestion in Waimea, as detailed below.

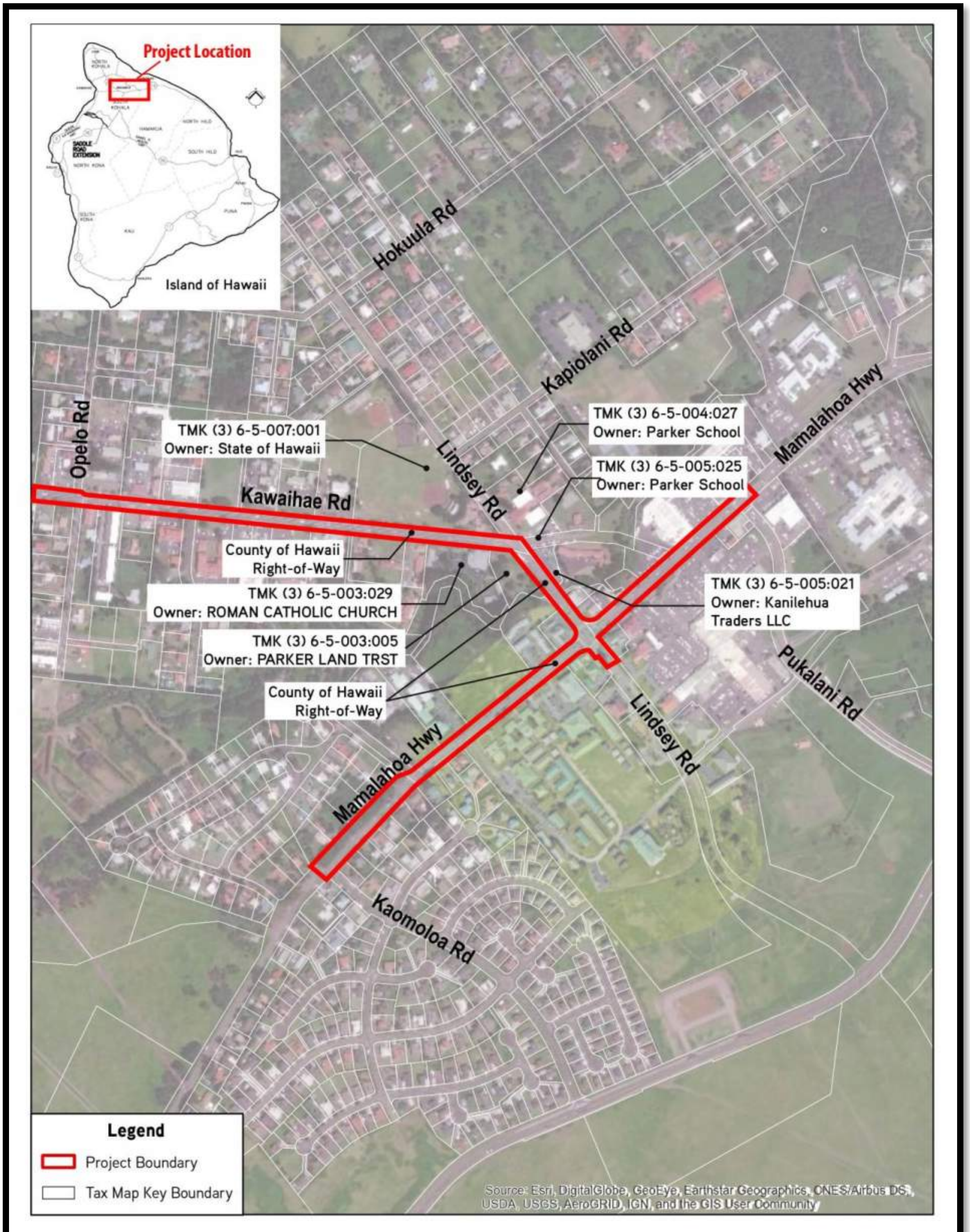
Improve Safety

- Safety will be addressed as a reduction in conflict points, which inherently reduces the number of fatalities and serious injuries for all modes of transportation and improves response times for emergency vehicles.

Reduce Congestion

- Congestion will be addressed by improving the Level of Service (LOS) and/or travel times for vehicles and freight movement locally on roadways within the Waimea community.

Figure 2. Land Ownership of Parcels Requiring Partial Acquisition or Construction Easements



1.4.2 Need for the Proposed Action

The material that documents needs for the project was developed during the PEL process using several sub-consultant studies. **Section 2.3** presents additional information that assesses how well the Proposed Action addresses existing and future needs.

Improve Safety Need

The Improve Safety Need for the Proposed Action is supported by examining conflict points, accident history, and emergency vehicle use, as well as multimodal safety. It improves safety for pedestrians and bicyclists by improving existing and creating new facilities such as sidewalks and paths for these modes.

The Proposed Action would increase safety by modifying existing intersections, installation of a roundabout, and reducing the number of conflict points. The installation of dedicated bicycle and pedestrian facilities would increase safety on existing roadways and encourage greater use of those modes which are now under-represented due to real and perceived safety problems. In summary, the Proposed Action would improve safety by changing how two intersections operate and by adding dedicated facilities for pedestrians and bicyclists.

Conflict Points

There are 69 conflict points, such as driveways and side streets, along Mamalahoa Highway between Kaomoloa Road and Kamamalu Street, Lindsey Road between Mamalahoa Highway and Kawaihae Road, and Kawaihae Road between Lindsey Road and Opelo Road, as shown in **Table 5**. Most of these conflict points have multiple movements occurring each day because they involve driveways to schools, churches, shops, restaurants, and businesses. These conflict points impact all modes of transportation, including vehicular, bicycle, and pedestrian. The Proposed Action would limit left-turn movements along Mamalahoa Highway between Lindsey Road and Pukalani Road. A roundabout would reduce the number of conflicts in the Lindsey Road/Kawaihae Road intersection and control each conflicting movement through the channelized movements into and through the roundabout.

Table 5. Conflict Points on Existing Roadway Sections

Roadway Segment	Number of Driveways and Minor Roadways
Mamalahoa Highway between Lindsey Road and Kamamalu Street	23
Mamalahoa Highway between Lindsey Road and Kaomoloa Street	18
Lindsey Road between Mamalahoa Highway and Kawaihae Road	5
Kawaihae Road between Lindsey Road and Opelo Road	23

Source: Google Maps

Accident History

There were 60 accidents within the study area in the five-year period from 2012 through 2016, which is the latest data available from HDOT. One crash involved a pedestrian, and three crashes involved other types of vehicles. There were 34 injuries and no fatalities. The Lindsey Road and Kawaihae Road intersection is a high collision “hot spot” with seven collisions. The Proposed Action would reduce the potential for accidents by providing a roundabout at Lindsey Road and Kawaihae Road. In addition, the Proposed Action would create dedicated sidewalks/bikeways and shared use paths so these modes do not have to share the road with passenger and freight vehicles, thereby reducing the likelihood of vehicle collisions with pedestrians and bicyclists. **Table 6** provides the number of accidents within the study area by year.

Table 6. Motor Vehicle Accidents within the Study Area by Year (2012-2016)

Year	# Crashes involving Cars	# Crashes involving Trucks	# Crashes Involving Motorcycles	# Crashes involving Other Types of Vehicles	# Crashes Involving Pedestrians	# Injuries	# Fatalities	Total # Crashes
2012	24	0	0	1	0	9	0	**25**
2013	6	0	0	0	0	0	0	**6**
2014	2	1	0	0	0	0	0	**3**
2015	7	1	0	0	0	11	0	**8**
2016	16	0	0	2	1	14	0	**18**
TOTAL	**55**	**2**	**0**	**3**	**1**	**34**	**0**	**60**

Source: HDOT Crash Data, 2012-2016

Emergency Vehicles

From 2016 to 2018, there were an average of 468 emergency (i.e., 911) calls made each year in which first responder vehicles utilized Kawaihae Road between Queen Kaahumanu Highway and Lindsey Road. The number of calls per year that required fire or ambulance response are shown in **Table 7**. The Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations.

Table 7. Emergency Assistance Calls requiring Kawaihae Road from Lindsey Road to Queen Kaahumanu Highway (2016-2018)

Year	Number of Calls
2016	501
2017	455
2018	449

Source: County of Hawaii Fire Department, 2019

Dedicated Facilities for Pedestrians and Bicycles

Currently there are partial bike lanes between Lindsey Road and Kaomoloa Road on Mamalahoa Highway and unsigned bikeable shoulders on both sides of Kawaihae Road within the study area. There are no bicycle facilities along Lindsey Road. Sidewalks are provided sporadically and are only located in the following locations within the study area for the Proposed Action:

- Mamalahoa Highway
  - South side of Mamalahoa Highway in places between Lindsey Road and Waimea Elementary School
  - Both sides of Mamalahoa Highway between Lindsey Road and Pukalani Road
- Lindsey Road
  - Both sides of Lindsey Road between Mamalahoa Highway and Kawaihae Road
  - East side of Lindsey Road between Mamalahoa Highway and the southern terminus of the proposed improvements

There are no sidewalks along Kawaihae Road. Pedestrians and bicyclists must compete on the road with vehicles and heavy trucks, and crossing the roadways has little by way of respites or safety zones. This discourages use of either walking or bicycling, even for short distances within town. The bike share program operated by PATH and supported by the County is now in Kailua-Kona and Hilo but has deferred going into Waimea Town until safer facilities are in place.

Bicycle comfort score definitions for roadway segments are shown in **Table 8**. Bicycle comfort score definitions for intersections are shown in **Table 9**. The existing bicycle and pedestrian comfort scores for roadway segments and intersections in the project area are provided in **Table 10**.

Reduce Congestion Need

The Reduce Congestion Need for the Proposed Action is supported by examining traffic volumes and multimodal travel. The Proposed Action would reduce congestion by improving access, optimizing operations at intersections, and by adding sidewalks and bicycle facilities where they do not exist on Mamalahoa Highway, Lindsey Road, and Kawaihae Road.

Vehicle Level of Service

An analysis of roadway operations was conducted based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6). The operations of roadway facilities are described as LOS, which is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six (6) levels are defined: from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents “at-capacity” operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. LOS definitions are dependent on roadway classifications. The roadways within the study area include Urban Street Segments and Class III Two-Lane Highways. The existing roadway segment LOS for study area roadways is provided in **Table 11**.

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Table 8. Bicycle Comfort Score Definitions for Roadway Segments

			High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
Facility Type	**Bike Path**		All Bike Paths are Score 1			
	Protected Bike Lanes	Buffer Type	Solid/Raised	Painted with Vertical Elements[1]	Painted with Vertical Elements[1]	Painted with Vertical Elements[1]
		Speed Limit	30 MPH or less	35 MPH	40 MPH or more	40 MPH or more
	Bike Lanes *Includes standard or buffered bike lanes*	Speed Limit	25 MPH or less	30 MPH	35 MPH	40 MPH or more
		Bike lane blockage	Rare	Rare	Frequent	Frequent
		Total # of travel lanes	3 or less	3 or less	4 or more	4 or more
		ADT	5,000 or less	5,001 – 9,000	9,001 – 15,000	15,001 or more
Facility Type	**Bike Route** OR **No Bike Facility**	Speed Limit	25 MPH or less	30 MPH	35 MPH or more	35 MPH or more
		Total # of travel lanes	3 or less	3 or less	4-5	6 or more
		ADT	3,000 or less	3,000 or less	3,001 – 6,000	6,001 or more

Source: Fehr & Peers, 2020. Adapted from *Mekuria, Furth, and Nixon, 2012* and project experience
Notes:
[1] Such as soft-hit posts, landscape planters, and other vertical elements that provide additional protection but do not provide a continuous raised barrier

Table 9. Bicycle Comfort Score Definitions for Intersections

			High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
Facility Type	**Protected Bike Lanes at Signalized Intersections**	Separation	Separate phasing[1] with barrier[2]	Barrier[2] and good sightlines but permitted turns (RT<150 vph) during bicycle phase	Barrier[2] and good sightlines but permitted turns (RT>150 vph) during bicycle phase OR No barrier[3] (RT<150 vph)	No barrier[3] (RT>150 vph)
		Bicycle Left-Turn	Protected Intersection	Painted Treatment[4]	Break in barrier for bikes to	Break in barrier for bikes to

			High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
					merge into mixed traffic	merge into mixed traffic
		Conflicting Left-Turn Treatments	Protected	Protected	Permitted	Permitted
	Protected Bike Lanes at Stop or Un-Controlled Intersections	Approach Geometry	(no effect)	Barrier with permitted turns (RT<150 vph)	Through bike lane and right-turn lane OR mixing zone with <150 vph	Through bike lane and right-turn lane OR mixing zone with >150 vph
Facility Type	**Pocket Bike Lane** *Separate bike lane provided to the left of one or more exclusive right turn-lanes*	Number of right-turn lanes	0	1	1	2 or more
		Length of right turn lane	150' or less	150' or less	151' or more	151' or more
		Turning speed	Less than 15 MPH	Less than 15 MPH	20 MPH	25 MPH or more
		Characteristics	Turn lane has a steep taper and bike lane continues straight	Turn lane has a steep taper and bike lane continues straight	Turn lane does not have a steep taper and/or bike lane shifts left to accommodate turn lane	Turn lane does not have a steep taper and/or bike lane shifts left to accommodate turn lane
	Bicycles in Mixed Traffic *Either street has no bike lanes or bike lane is dropped*	Number of right-turn lanes	0 - 1	0-1	0-1	2 or more
		Length of right turn lane	75' or less	75' or less	76' - 150'	151' or more
		Turning speed	Less than 15 MPH	Less than 15 MPH	Less than 15 MPH	20 MPH or more

Source: Fehr & Peers, 2020. Adapted from *Mekuria, Furth, and Nixon, 2012* and project experience

Notes:

[1] Either with protected right-turn phase or dedicated bicycle only phase that does not overlap with permitted turning autos or opposing auto movements.

[2] Barrier would be a solid, raised element (such as curb or landscape-buffer) or a protected intersection that remains up until the intersection

[3] For example, mixing zone or striped bike lane with right-turn pocket

[4] For example, two-stage turn box or bike box

Table 10. Pedestrian and Bicycle Comfort Scores on Segments and Intersections

Segment / Intersection	Existing No Project Pedestrian Comfort Score	Existing No Project Bicycle Comfort Score
SEGMENTS		
Segment 1: Kawaihae Rd West of Opelo Rd	4	3
Segment 2: Kawaihae Rd Between Opelo Rd and Lindsey Rd	4	1
Segment 3: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy	3	4
Segment 4: Mamalahoa Hwy Between Lindsey Rd and Kamamalu St	4	4
Segment 5: Mamalahoa Hwy East of Lindsey Rd	4	3
INTERSECTIONS		
Intersection 1: Opelo Rd / Kawaihae Rd	4	4
Intersection 2: Kawaihae Rd / Lindsey Rd	4	3
Intersection 3: Lindsey Rd / Mamalahoa Hwy	4	4

Source: Fehr & Peers, 2020

Table 11. Existing Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Affected Environment LOS
EASTBOUND/NORTHBOUND			
Kawaihae Rd EB: Between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy: Between Kaomoloa Rd and Lindsey Rd	Urban Street Segment	AM	D
		PM	D
Mamalahoa Hwy: Between Lindsey Rd and Pukalani Rd	Urban Street Segment	AM	C
		PM	D
Mamalahoa Hwy: Between Pukalani Rd and Lindsey Rd	Urban Street Segment	AM	A
		PM	B
WESTBOUND/SOUTHBOUND			
Kawaihae Rd: Between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	D
		PM	D
Mamalahoa Hwy: Between Lindsey Rd and Kaomoloa Rd	Urban Street Segment	AM	A
		PM	A
Mamalahoa Hwy: Between Pukalani Rd and Lindsey Rd	Urban Street Segment	AM	D
		PM	**E**
Mamalahoa Hwy: Between Kamamalu St and Pukalani Rd	Urban Street Segment	AM	C
		PM	C

Source: Fehr & Peers, 2020

Intersection counts were collected for vehicles, bicycles, and pedestrians in 15-minute intervals at nine locations during the weekday morning (6:00 AM to 9:00 AM) and weekday afternoon (2:00 PM to 6:00 PM) periods. Analysis of the data was based on procedures presented in the HCM 6 published by the Transportation Research Board in 2016. The resulting LOS at each intersection is provided in **Table 12**.

Table 12. Existing (2018) Level of Service (LOS) at Study Area Intersections

Intersection	Traffic Control	Peak Period	Delay (sec/veh)[1]	LOS[2]
Mamalahoa Hwy/Lindsey Rd	Signal	AM	33.0	C
		PM	34.6	C
Lindsey Rd/Kawaihae Rd	SSSC	AM	17.6	C
		PM	27.8	D

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

The travel times through the corridor are summarized in **Table 13**.

Table 13. Travel Times in the Project Area

Intersection	Peak Hour	Travel Time (min:sec)
Kawaihae Road to Mamalahoa Highway Eastbound	AM	2:50
	PM	3:24
Mamalahoa Highway to Kawaihae Road Westbound	AM	2:19
	PM	2:43

Source: Fehr & Peers, 2020

Multimodal Travel

Pedestrians and bicyclists are most common along Mamalahoa Highway around the Parker Ranch Center, which is a primary destination in Waimea Town. The busiest intersection for bicyclists and pedestrians is Mamalahoa Highway and Lindsey Road, which provides access to the Parker Ranch Center and Parker School. Bicycle and pedestrian 15-minute counts during the AM and PM peak hours are provided in **Table 14**. The Proposed Action provides facilities for pedestrians and bicyclists, which may reduce the number of people using vehicles in the heart of Waimea Town to make short trips.

Table 14. Bicycle and Pedestrian Peak 15-Minute Flowrates during AM and PM Peak Hour

Intersection	AM Peak Hour		PM Peak Hour	
	Bicycle	Pedestrian	Bicycle	Pedestrian
Mamalahoa Highway and Kamamalu Street	4	0	0	0
Mamalahoa Highway and Pukalani Road	4	0	12	2
Mamalahoa Highway and Lindsey Road	16	2	80	4
Mamalahoa Highway and Ala Ohia Road	0	0	0	0

Source: Quality Counts, LLC (November 14, 2018)

2.0 ALTERNATIVES AND PROPOSED ACTION

2.1 Alternatives Identified During the PEL Process

During the PEL Study, two types of alternatives to address the Purpose and Need were identified: (1) Bypass Alternative and (2) Multimodal Improvements to Existing Roadways. These alternatives are complementary and have independent utility. This EA analyzes the Multimodal Improvements to Existing Roadways alternative. The Bypass Alternative will be documented in a subsequent environmental document.

2.1.1 Screening Criteria for Multimodal Improvements to Existing Roadways

The study team developed a list of concepts for bicycle and pedestrian treatments following best practices for Complete Streets. Preliminary concepts were prepared and used in a Walk Audit with community members, as described in **Section 6.1.2**. Key criteria in developing the conceptual alternatives for multimodal safety and operations improvements to existing roadways were:

- Identify improvements that would improve safety and congestion for all modes (i.e., vehicle, bicycle, pedestrian)
- Identify improvements that would promote multimodal access for all users
- Identify improvements that would provide linkages to other projects
- Identify improvements that have community support
- Minimize the need to acquire land that is protected or designated for other purposes such as:
  - Hawaiian Home Lands
  - Section 4(f) properties
  - Known archaeological or cultural sites
  - Existing subdivisions
- Be shovel-ready or available under design-build within two years

Based on the comments received during and after the Walk Audit and during the associated presentation given between the two walk audits, four multimodal alternatives were developed:

- Kawaihae Road between Opelo Road and Lindsey Road
- Kawaihae Road at Lindsey Road
- Mamalahoa Highway at Lindsey Road
- Multimodal network

2.1.2 Identification of Recommended Alternative

Improvements to Kawaihae Road and Mamalahoa Highway were combined into one alternative recommended to move forward for further analysis and are analyzed in this EA. This alternative is described as follows:

- Multimodal safety and operations improvements to existing roadways, including the following:
  - Installation of a roundabout at the Kawaihae Road and Lindsey Road intersection and bicycle and pedestrian treatments along both sides of Kawaihae Road to Opelo Road, to be funded with state resources; and

- Intersection improvements and bicycle and pedestrian treatments at Mamalahoa Highway and Lindsey Road, to be funded with state resources.
- Installation of bicycle and pedestrian treatments along both sides of Mamalahoa Highway from Waimea School to Lindsey Road, to be funded with state resources.
- Restriping to include a shared shoulder and bike lane between Waimea School and Kaomoloa Road, to be funded with state resources.
- Restricted left turns along Mamalahoa Highway between Lindsey Road and Pukalani Road, to be funded with state resources.

The creation of a multimodal network was not recommended due to cost and financial constraints. However, it is expected that improvements to the multimodal network throughout Waimea would be completed by others.

2.2 Alternatives Considered in This EA

2.2.1 No-Action Alternative

Under the No-Action Alternative, roadway improvements within Waimea Town would not be undertaken. Therefore, the Waimea Roadway Improvements Project would not be built, and the project area would remain in its current state. There would be no improvements to safety and no reduction of congestion. Conditions at the Proposed Action intersections and adjacent roadways would remain the same and continue to deteriorate with future growth of Waimea.

2.2.2 Proposed Action

The project is a single action, but presented as having three parts:

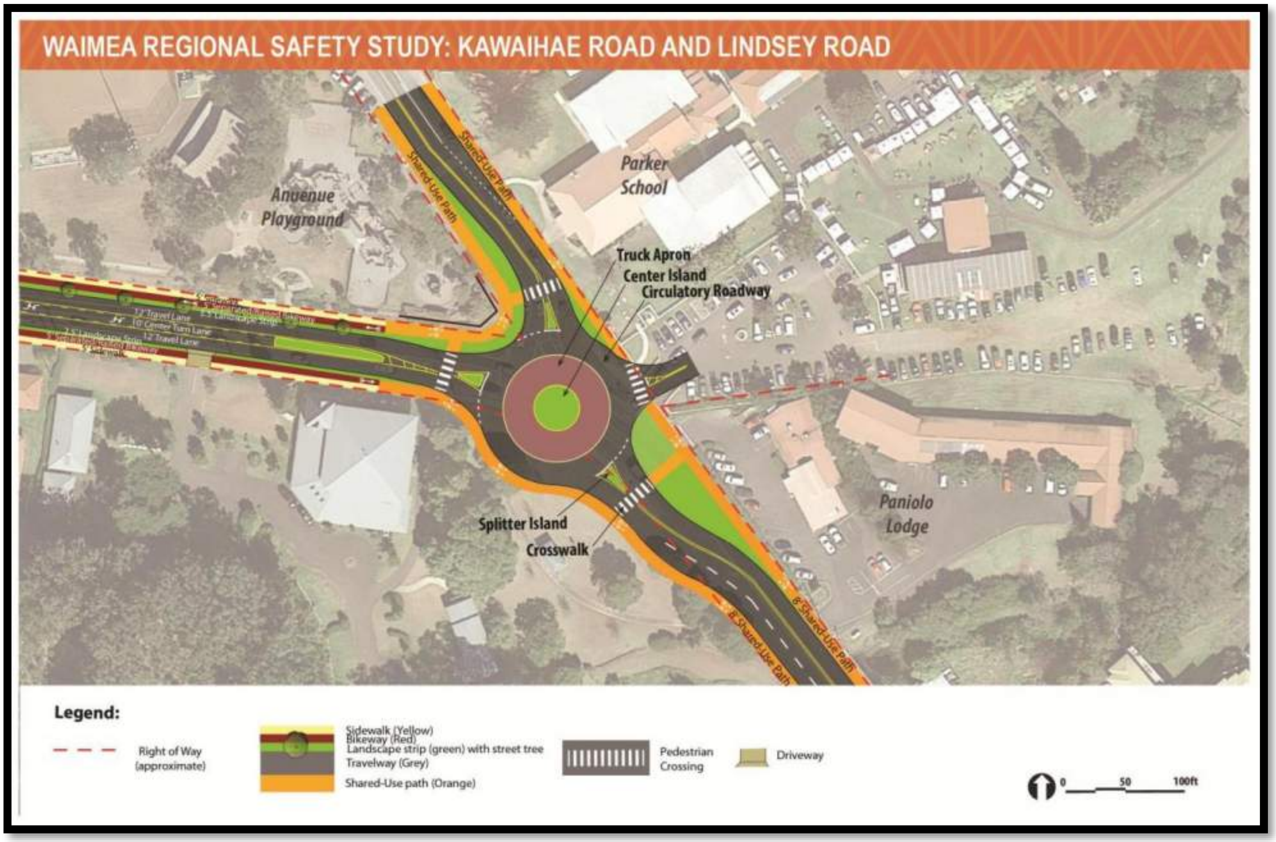
- Kawaihae Road and Lindsey Road Intersection and Roadway Multimodal Improvements
- Mamalahoa Highway and Lindsey Road Intersection Improvements
- Mamalahoa Highway Multimodal Improvements

The Proposed Action could be completed in phases if funding is unavailable for the entire action.

Kawaihae Road and Lindsey Road Intersection and Roadway Multimodal Improvements

A roundabout would be installed at the Kawaihae Road/Lindsey Road intersection. The roundabout would have a 125-foot inscribed circle and would include sidewalks, bikeways, and crosswalks. The sidewalk and bikeway would be combined into a single raised sidewalk in addition to differentiating between existing and proposed sidewalks. The north leg of Lindsey Road would handle the transition into the existing travelway with Parker School’s drop-off lane. The roundabout would include marked crosswalks across all legs with splitter island refuges across the west and southern legs. The conceptual plan for the roundabout is shown in **Figure 3**.

Figure 3. Conceptual Design for Roundabout at Kawaihae Road and Lindsey Road Intersection



This alternative also includes modifications to Kawaihae Road between Opelo Road and Lindsey Road, which were developed during the PEL Process, as discussed in **Section 6.1**. These modifications include the installation of the following:

- Center two-way left turn lane
- Raised/separated protected sidewalks and bikeways on both sides of the road
- Landscaping with street trees
- Marked crosswalks located west of Parker Square, east of Long's Drugs (relocated from existing location), and east of Habitat for Humanity (relocated from existing location)
- Marked crosswalk with a rectangular rapid flash beacon (RRFB) at Opelo Road
- Gateway feature west of Opelo Road.

The conceptual plan for the improvements to Kawaihae Road is shown in **Figure 4**.

Improvements to Kawaihae Road including the roundabout cost estimate are approximately $9.5M (not including land acquisition). The roundabout project would be pursued using state revenue sources.

Figure 4. Conceptual Design for Multimodal Improvements to Kawaihae Road

Mamalahoa Highway and Lindsey Road Intersection Improvements

Recommended improvements to the Mamalahoa Highway and Lindsey Road intersection include signal timing and lane configuration modifications. The specific improvements include the following:

- Signal timing improvements include a leading pedestrian interval, which is a period during which all vehicles have a red light and the pedestrian phase is provided with at least three seconds for pedestrians to stop crossing. Signage would be installed to instruct bicyclists to travel with pedestrians.
- Lane configuration improvements include the following:
    - Extended eastbound right-turn pocket on Lindsey Road, and
    - Westbound departure leg on Lindsey Road to provide only one departure lane.

During the PEL process, the community requested that bollards and raised pedestrian islands be installed at the intersection. These modifications are not included as they would impede turning ability for trucks.

Mamalahoa Highway Multimodal Improvements

Recommended improvements to Mamalahoa Highway between Lindsey Road and Pukalani Road are shown in **Figure 5** and would include mid-block left-turn restrictions. No other improvements or changes would be made in this section.

Figure 5. Conceptual Plan for Improvements to Mamalahoa Highway Between Lindsey Road and Pukalani Road

Recommended improvements to Mamalahoa Highway between Kaomoloa Road and Lindsey Road were developed during the PEL process (see **Section 6.1**) and refined in consultation with adjacent residents (see **Section 6.2.7**), Waimea Elementary School (see **Section 6.2.8**), and Greenwood Center LLC, a planned development across from Waimea Elementary School (see **Section 6.2.9**). These improvements are shown in **Figure 6**, **Figure 7**, and **Figure 8** and include the installation of the following:

- Alternating center two-way left-turn lane fronting the Waimea Office Center
- Landscaped median between Waimea Office Center and Waimea School
- Marked crosswalks with a RRFB at Waimea School, east of Ulu Laau (road to the Waimea Nature Center), and west of Kaomoloa Road
- Raised/separated protected sidewalks and bikeways on both sides of Mamalahoa Highway from approximately 300 feet west of Lindsey Road to Lindsey Road
- Landscaping with street trees from approximately 300 feet west of Lindsey Road to Lindsey Road

- Restriping between Waimea School and Kaomoloa Road to include a shared shoulder and bike lane

Figure 6. Conceptual Plan for Improvements to Mamalahoa Highway Between Kaomoloa Road and Lindsey Road (1 of 3)

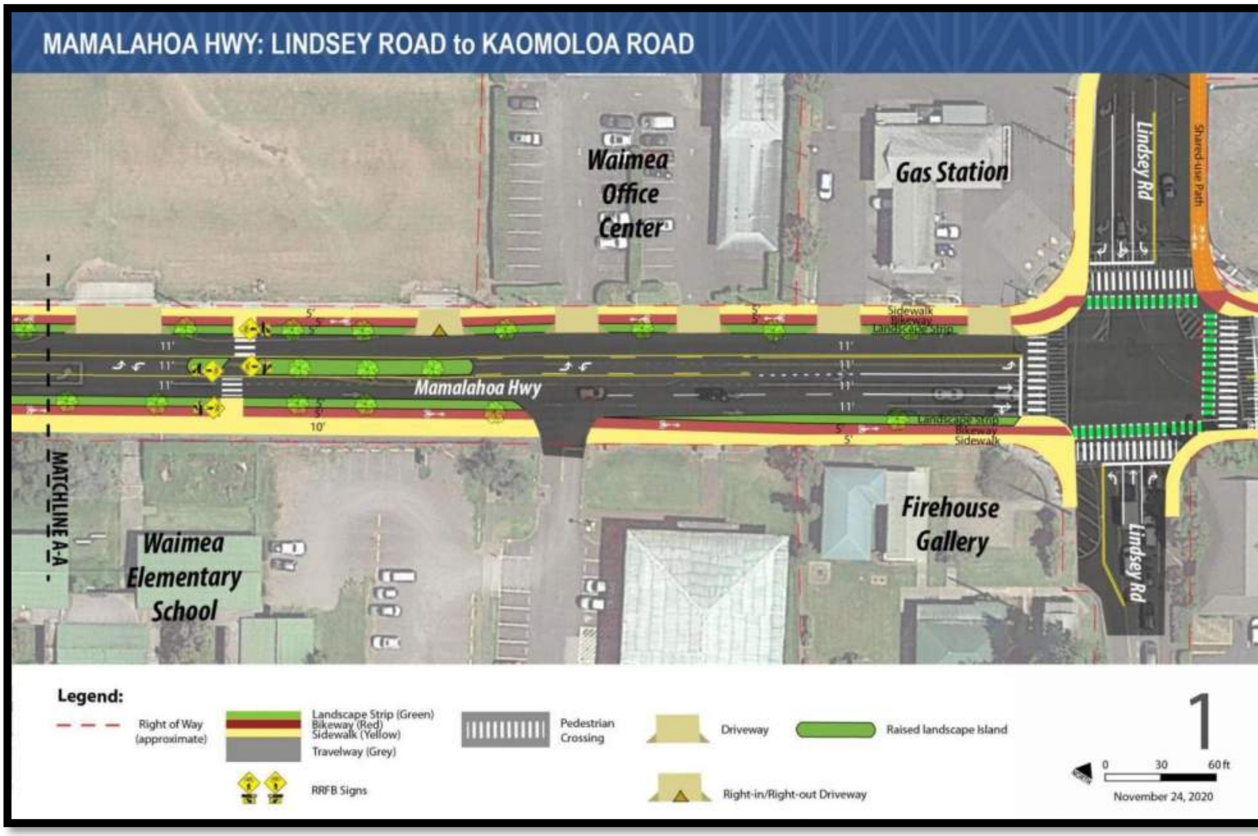


Figure 7. Conceptual Plan for Improvements to Mamalahoa Highway Between Kaomoloa Road and Lindsey Road (2 of 3)

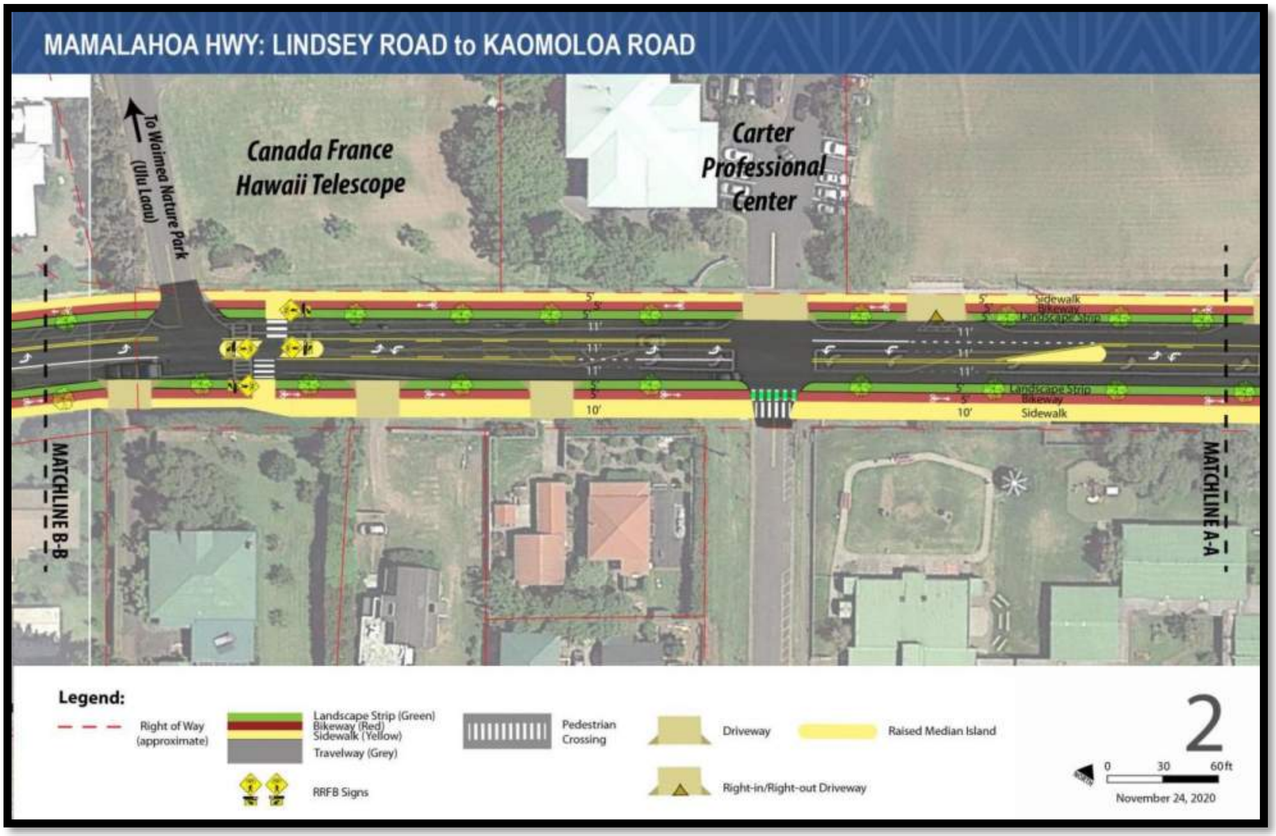
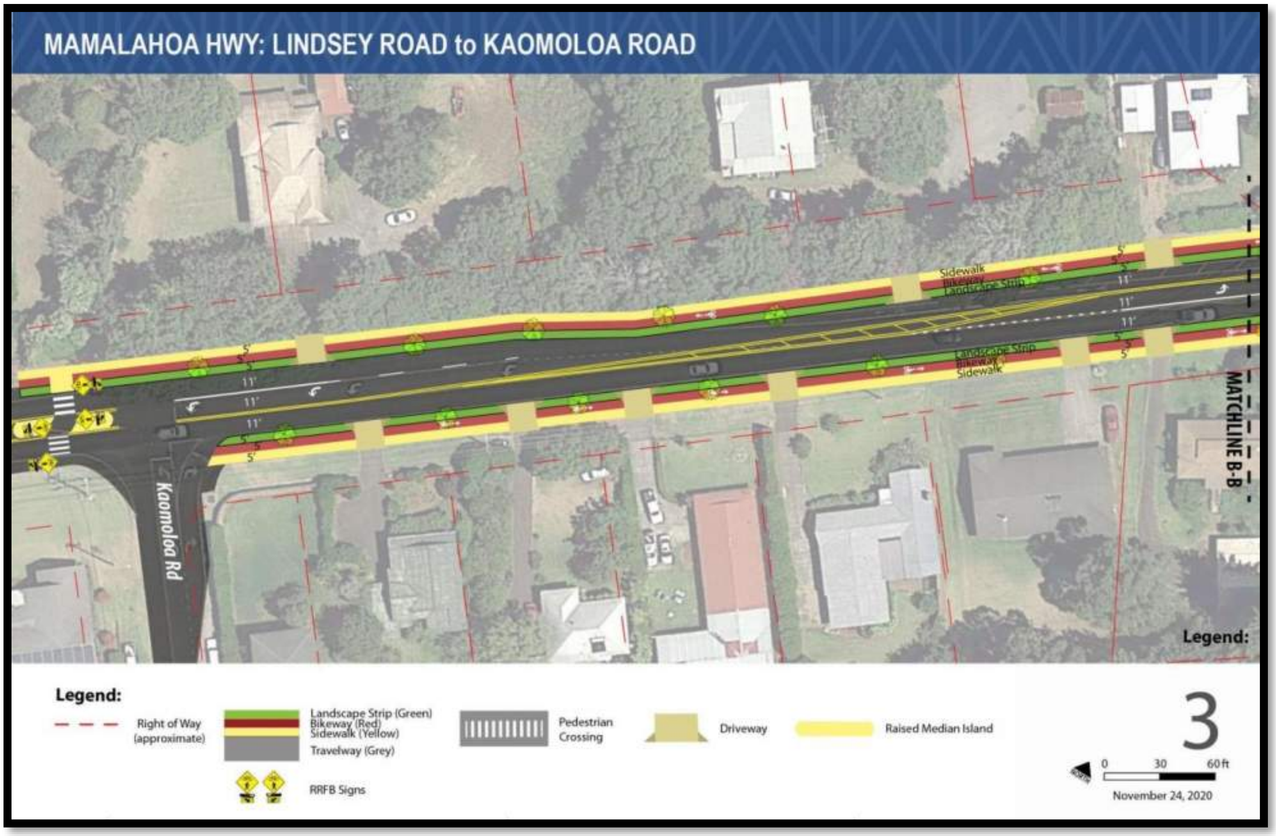


Figure 8. Conceptual Plan for Improvements to Mamalahoa Highway Between Kaomoloa Road and Lindsey Road (3 of 3)



2.3 How the Proposed Action Meets Purpose and Need

A Traffic Mobility Assessment Report was prepared by Fehr & Peers in October 2020 for the project to analyze how the Proposed Action would meet the Purpose and Need. The following sections provide data from the report, which is included in its entirety in **Appendix B**.

2.3.1 Improve Safety

The Proposed Action would increase safety by modifying existing intersections, installation of a roundabout, and the installation of dedicated bicycle and pedestrian facilities. In summary, the Proposed Action would improve safety by changing how two intersections operate and by adding dedicated facilities for pedestrians and bicyclists.

The proposed Kawaihae Road improvements meet the improve safety need in the following ways:

- Roundabouts are a proven safety countermeasure. By reducing the number and severity of conflict points, and because of the lower speeds of vehicles moving through intersection, roundabouts are a significantly safer type of intersection.[1]

[1] FHWA Office of Safety. 2019. Roundabouts and Mini Roundabouts. Available online at: https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/

- The installation of dedicated bicycle and pedestrian facilities would increase safety for bicyclists and pedestrians by increasing protection and minimizing conflicts between bicycle, pedestrian, and motor vehicle traffic.
- The installation of the crosswalk with a rectangular rapid flash beacon at Opelo Road would increase safety for those crossing Kawaihae Road because it achieves very high rates of compliance by bringing attention to pedestrians using the crosswalk.

The proposed Mamalahoa Highway and Lindsey Road intersection improvements meet the improve safety through the installation of sidewalks where they currently do not exist, as well as bicycle lanes, which would increase safety for bicyclists and pedestrians. In addition, leading pedestrian intervals would be included as well as reconfiguration of the westbound departure leg to increase southbound right-turn driver compliance of stopping on red. These modifications would substantially increase pedestrian safety.

As part of the bicycle and pedestrian improvements proposed for the project area, a raised bikeway and enhanced sidewalk are proposed for portions of Kawaihae Road, Lindsey Road, and Mamalahoa Highway. A comfort analysis was conducted for both pedestrian and bicyclist users of the upgraded facilities based on a scale of one to four, with one being the most comfortable and four being the least comfortable. The results of the comfort analyses for the proposed pedestrian and bicycle improvements are presented in **Table 15** and **Table 16**, respectively. All roadway segments and intersections would have an increased pedestrian and bicycle comfort score with the Proposed Action.

Table 15. Pedestrian Comfort Scores with the Proposed Action for Roadway Segments and Intersections

Segment / Intersection	Existing No Project Pedestrian Comfort Score	Existing Plus Project Pedestrian Comfort Score
	SEGMENTS	
Segment 1: Kawaihae Rd between Opelo Rd and Lindsey Rd	4	3
Segment 2: Lindsey Rd between Kawaihae Rd and Mamalahoa Hwy	4	3
Segment 3: Mamalahoa Highway west of Lindsey Rd	4	3
	INTERSECTIONS	
Intersection 1: Opelo Rd / Kawaihae Rd	4	3*
Intersection 3: Lindsey Rd / Mamalahoa Hwy	4	2

Source: Fehr & Peers, 2020.
Notes:
* This intersection receives a comfort score of 3 due to the addition of an RRFB on its east leg.

Table 16. Bicycle Comfort Scores with the Proposed Action for Roadway Segments and Intersections

Segment / Intersection	Existing No Project Bicycle Comfort Score	Existing Plus Project Bicycle Comfort Score
SEGMENTS		
Segment 1: Kawaihae Rd between Opelo Rd and Lindsey Rd	4	1
Segment 2: Lindsey Rd between Kawaihae Rd and Mamalahoa Hwy	4	1
Segment 3: Mamalahoa Highway west of Lindsey Rd	4	1
INTERSECTIONS		
Intersection 1: Opelo Rd / Kawaihae Rd	4	2
Intersection 3: Lindsey Rd / Mamalahoa Hwy	4	3

Source: Fehr & Peers, 2020.

2.3.2 Reduce Congestion

The Proposed Action would reduce congestion by improving access, optimizing operations at intersections, and reducing conflict points.

The proposed improvements were analyzed using Vissim 11 microsimulation software. This tool best reflects the potential operational issues associated with the relatively closely spaced intersections with different traffic control devices (i.e., a signal and roundabout), as well as allows for the most flexibility and innovation with adjusting traffic signal timings.

The existing lane configurations were first analyzed using volumes from counts collected in 2018 to calibrate driver behavior and queueing based on field observations. The proposed improvements were then added to the Vissim network, consisting of a two-way left-turn lane along Kawaihae Road, a roundabout at Kawaihae Road/Lindsey Road, and modifications to the lane configurations and signal timing at Lindsey Road/Mamalahoa Highway. Volume adjustments were made to account for additional permitted movements into and out of the Parker School Driveway under Existing Plus Project conditions.

Under future (2036) conditions, operations are substantially improved at the Kawaihae Road and Lindsey Road intersection but delays at the Lindsey Road and Mamalahoa Highway intersection increase. This is due to the improved operations provided by the roundabout and the two-way left-turn lane along Kawaihae Road, which increase the throughput of the corridor. This higher volume served effectively increases the eastbound demand at the Lindsey Road and Mamalahoa Highway intersection. Leading pedestrian intervals contribute to the delay but substantially enhance pedestrian safety.

Existing and future (2036) roadway segment and intersection LOS with the Proposed Action are provided in **Table 17, Table 18, Table 19,** and **Table 20**.

Table 17. Existing Roadway Segment Level of Service (LOS) with the Proposed Action

Roadway Segment	Classification	Peak Hour	Existing No Project LOS	Existing Plus Project LOS
EASTBOUND/NORTHBOUND				
Kawaihae Rd between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	D	D
		PM	D	D
WESTBOUND/SOUTHBOUND				
Kawaihae Rd between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	D	D
		PM	D	D
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	A	A
		PM	A	A

Source: Fehr & Peers, 2020.

Notes:
* Although the plus project conditions show a lower roadway segment LOS than without the project (experienced by the southbound through and right-turn movements), this is caused by modified signal timings and the introduction of leading pedestrian intervals, a safety enhancement for pedestrians and bicyclists. It should be noted that the overall travel time throughout the corridor only experiences a slight increase under existing plus project conditions

Table 18. Future (2036) Roadway Segment Level of Service (LOS) with the Proposed Action

Roadway Segment	Classification	Peak Hour	Future (2036) No Project LOS	Future (2036) Plus Project LOS
EASTBOUND/NORTHBOUND				
Kawaihae Rd between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	D	D
		PM	**E**	**E**
WESTBOUND/SOUTHBOUND				
Kawaihae Rd between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	A	A
		PM	A	A

Source: Fehr & Peers, 2020.

Notes:
* Although the plus project conditions show a lower roadway segment LOS than without the project (experienced by the southbound through and right-turn movements), this is caused by modified signal timings and the introduction of leading pedestrian intervals, a safety enhancement for pedestrians and bicyclists. It should be noted that the overall travel time throughout the corridor only experiences a slight increase under existing plus project conditions

Table 19. Existing Intersection Level of Service (LOS) with the Proposed Action

Intersection	Traffic Control[1]	Peak Hour	Existing No Project		Existing Plus Project	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd / Lindsey Rd	SSSC / Roundabout	AM	17.6	C (WBT)	7.4	A
		PM	27.8	D (EBL)	8.9	A
Mamalahoa Hwy / Lindsey Rd	Signal	AM	33.0	C	38.3	D
		PM	34.6	C	39.6	D

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

Table 20. Future (2036) Intersection Level of Service (LOS) with the Proposed Action

Intersection	Traffic Control[1]	Peak Hour	Future (2036) No Project		Future (2036) Plus Project	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd / Lindsey Rd	SSSC / Roundabout	AM	**51.8**	**F** (SBL)	12.6	B
		PM	**>100**	**F** (SBL)	28.8	D
Mamalahoa Hwy / Lindsey Rd	Signal	AM	41.9	D	**58.4**	**E**
		PM	44.7	D	51.5	D

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

As shown in **Table 19** and **Table 20**, delays are projected to increase at the Lindsey Road/Mamalahoa Highway intersection with implementation of the Proposed Action. The increase in intersection delay is due in part to the inclusion of leading pedestrian intervals and in part to the reconfiguration of the westbound departure leg to increase southbound right-turn driver compliance of stopping on red. This will substantially enhance pedestrian safety, as discussed in **Section 2.3.1**. However, the overall effect of the project reducing congestion is best measured in travel time through the study corridor.

Travel times through the corridor under existing conditions are provided in **Table 21**. As shown, the Proposed Action would result in no change to eastbound travel times during the AM peak hour and a slight increase to westbound travel times during the AM peak hour. The Proposed Action is projected to result in approximately 20 seconds of travel time savings in each direction during the PM peak hour, indicating that the Proposed Action would offer immediate relief during the period of worst congestion.

Table 21. Change in Travel Times Under Existing Conditions

Intersection	Peak Hour	Travel Time (min:sec)		Change in Travel Time (min:sec / % change)
		Existing No Project	Existing Plus Project	
Kawaihae Road to Mamalahoa Highway Eastbound	AM	2:50	2:50	+0:00 / 0%
	PM	3:24	3:02	-0:22 / -11%
Mamalahoa Highway to Kawaihae Road Westbound	AM	2:19	2:35	+0:16 / 11%
	PM	2:49	2:31	-0:18 / -11%

Source: Fehr & Peers, 2020

As shown in **Table 22**, under Future (2036) conditions the Proposed Action is projected to provide approximately 30 seconds of travel time savings in both directions in the PM peak hour and approximately 40 seconds of travel time savings in the eastbound direction in the AM peak hour. The westbound direction in the AM peak hour would increase approximately 30 seconds due to leading pedestrian intervals and the departure lane reconfiguration at the Lindsey Road and Mamalahoa Highway intersection.

Table 22. Change in Travel Times Under Future (2036) Conditions

Intersection	Peak Hour	Travel Time (min:sec)		Change in Travel Time (min:sec / % change)
		Future (2036) No Project	Future (2036) Plus Project	
Kawaihae Road to Mamalahoa Highway Eastbound	AM	3:43	3:02	-0:41 / -19%
	PM	4:40	4:05	-0:35 / -13%
Mamalahoa Highway to Kawaihae Road Westbound	AM	2:48	3:18	+0:30 / 17%
	PM	3:43	3:12	-0:31 / -14%

Source: Fehr & Peers, 2020

The reduction in conflicts with the Proposed Action along each study segment are shown in **Table 23**. This decrease in conflicts will improve multimodal safety in Waimea. In addition, conflict points will be marked with pavement markings and signage to improve communication between motorists and pedestrians/bicyclists.

Table 23. Conflict Reductions by Segment with the Proposed Action

Intersection Type	Change in Vehicle Conflicts with Project Implementation
Segment 1: Kawaihae Rd Between Opelo Rd and Lindsey Rd (including the Opelo Rd intersection)	-53
Segment 2: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy (including the Kawaihae Rd intersection)	-6
Segment 3: Mamalahoa Hwy west of Lindsey Road	0

Source: Fehr & Peers, 2020

2.4 Project Schedule

Upon completion of environmental documentation and permitting, the Proposed Action would go into the design phase in 2024/2025. It is expected that construction would occur in 2025/2026.

2.5 Permits and Approvals Which May Be Required for the Proposed Action

Implementation of the Proposed Action would require coordination with state and county agencies for permits or approvals. The permits and approvals presented in **Table 24** may be required for the Proposed Action. Permit requirements would be determined through continued agency coordination during the HRS Chapter 343 process.

Table 24. Permits and Approvals Which May Be Required for the Proposed Action

Permit or Approval	Description	Regulation(s)	Administrative Authority
Environmental Assessment and FONSI	Required for projects that "trigger" environmental review, including those that propose the use of state or county lands and the use of state or county funds.	• HRS 343, Environmental Impact Statements • HAR 11-200.1, Environmental Impact Statement Rules	Department of Health (DOH), Office of Environmental Quality Control (OEQC)
Historic Preservation Review	Required for projects that may affect historic property or a burial site.	• HRS 6E	Department of Land and Natural Resources (DLNR), State Historic Preservation Division (SHPD)
Community Noise Permit/ Community Noise Variance	Required for construction projects **exceeding** 78 decibels (dBA) or has a total cost of more than $250,000.	• HRS Chapter 342F • HAR Title 11, Chapter 46	DOH-Indoor and Radiological Health Branch
National Pollutant Discharge Elimination System (NPDES) General Permit Coverage	Coverage under the NPDES General Permit required for stormwater discharge associated with construction activities over 1 acre.	• Clean Water Act, Section 401 • HAR Section 11-55	DOH-Clean Water Branch (CWB)
County Grading Permit	Required when any one of the following items are exceeded: • 100 cubic yards of excavation or fill; • Vertical height of excavation or fill measured at its highest point exceeds 5 feet; or • When the general and localized drainage pattern with respect to abutting properties is altered.	• Hawaii County Code, Chapter 10 – Erosion and Sedimentation Control	County of Hawaii Department of Public Works

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3.0 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND AVOIDANCE AND MINIMIZATION MEASURES

Potential environmental issues were identified in a report prepared by Geometrician Associates during the PEL process, which was presented to and reviewed by the public. Five (5) additional, resource-specific sub-consultant studies were prepared to assess potential impacts from the Proposed Action, which are included as appendices to this EA:

- Traffic Mobility Assessment Report (Fehr & Peers) (see **Appendix B**)
- Noise environment (D.L. Adams and Associates) (see **Appendix C**)
- Biological resources (Geometrician Associates) (see **Appendix D**)
- Cultural resources (ASM Affiliates) (see **Appendix E**)
- Archaeological and historic resources (ASM Affiliates) (see **Appendix F**)

This section of the EA includes a description of the Affected Environment followed by an analysis of Potential Impacts and identification of Avoidance and Minimization Measures for each environmental element.

3.1 Traffic and Transportation

3.1.1 Affected Environment

Fehr & Peers prepared a *Mobility Assessment Report* in October 2020 to document the assessment of the anticipated effects associated with implementation of the Proposed Action (see **Appendix B**).

Existing Transportation System

The existing transportation system within the project area consists of Mamalahoa Highway (Route 190), Kawaihae Road (Route 19), and Lindsey Road (Route 19). The existing Kawaihae Road was constructed in 1934 and serves the town of Waimea and the South Kohala District on the Island of Hawaii. Along with Mamalahoa Highway, Kawaihae Road provides the main thoroughfare within and through Waimea Town.

Mamalahoa Highway is a minor arterial with two lanes and shoulder width of 4 feet. There are partial bike lanes between Lindsay Road and Kaomoloa Road and sidewalks in places between Lindsey Road and Waimea Elementary School as well as on both sides of the roadway between Lindsey Road and Pukalani Road.

Kawaihae Road is a principal arterial consisting of 2 lanes and a shoulder width of 6 feet. The shoulders on both sides are unsigned but bikeable. The pedestrian facilities are within the shoulder on both sides of the roadway between Linsey and Opelo Road.

Lindsey Road is a principal arterial with 4 travel lanes and no shoulder. Sidewalks are located on both sides of the roadway between Mamalahoa Highway and Kawaihae Road. There are no existing bicycle facilities.

Project limits and intersections for each roadway are described in greater detail in **Section 1.3.2**. Additionally, **Section 1.4.2** contains more detailed information and tables analyzing the existing traffic conditions including the current level of service for intersections and roadway segments, travel times, and a pedestrian and bicycle comfort analysis.

Future Traffic Conditions

Methodology

Future traffic conditions were projected to the year 2036 and looked at impacts to pedestrians/bicyclists and motor vehicle traffic volumes under a scenario without the project and a scenario with the project.

Existing (2018) volumes were increased by a total of 9.5% to estimate traffic volumes at the point when the roundabout and signal would experience excessive delays and vehicle queuing and where the intersections would no longer have sufficient capacity during the peak commute periods. The year at which these volumes are reached will depend on when traffic returns to 2018 conditions following the ongoing COVID-19 pandemic, as well as how quickly additional development occurs within the greater Waimea and surrounding areas.

Based on the Hawaii Regional Long-Range Land Transportation Plan (LRLTP) prepared by HDOT, a growth factor of approximately 1.3% per year is projected from 2007 to 2035. Assuming this annual rate of growth and without taking account for reductions in traffic due to the pandemic and various economic downturns, traffic volumes would reach a 9.5% overall increase from 2018 counts in the year 2025.

A growth rate of 1.3% per year is now considered to be overly optimistic given the limited amount of planned development in the Waimea area, the precipitous drop in tourism and economic activity due to the pandemic, and the potential long recovery time for conditions to return to pre-COVID-19 levels. For example, it took 51 months for employment to recover to pre-Great Recession levels after 18 months of a major downturn according to the Economic Policy Institute (Bivens, 2016). Even if the post-pandemic recovery is faster overall, other issues associated with air travel and tourism to Hawaii are expected to moderate traffic growth.

An annual growth rate of 0.5% is considered to be more reasonable to reflect future growth for purposes of analyzing this project. With this annual growth rate and without taking account for reductions in 2018 traffic counts due to the pandemic, traffic volumes would reach a 9.5% overall increase by the year 2036.

Future (2036) Traffic Without Project

After applying the growth rate discussed above, the resulting LOS along project roadway segments and at intersections is shown in **Table 25** and **Table 26**. Future (2036) travel times are shown in **Table 27.**

Table 25. Future (2036) Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Future (2036) No Project LOS
Kawaihae Rd between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	D
		PM	**E**
Kawaihae Rd between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy west of Lindsey Rd	Urban Street Segment	AM	A
		PM	A

Source: Fehr & Peers, 2020.

Table 26. Future (2036) Intersection Level of Service (LOS)

Intersection	Traffic Control[1]	Peak Hour	Future (2036) No Project	
			Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd / Lindsey Rd	SSSC / Roundabout	AM	**51.8**	**F** (SBL)
		PM	**>100**	**F** (SBL)
Mamalahoa Hwy / Lindsey Rd	Signal	AM	41.9	D
		PM	44.7	D

Source: Fehr & Peers, 2020.

Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

Table 27. Future (2036) Study Area Travel Times

Intersection	Peak Hour	Travel Time
Kawaihae Road to Mamalahoa Highway Eastbound	AM	3:43
	PM	4:40
Mamalahoa Highway to Kawaihae Road Westbound	AM	2:48
	PM	3:43

Source: Fehr & Peers, 2020.

3.1.2 Potential Impacts

Construction

Construction of the Proposed Action would require lane closures on Mamalahoa Highway, Lindsey Road, and Kawaihae Road, which would cause changes to traffic patterns, traffic volumes, and travel times. These closures would be sporadic and would be managed through implementation of an MOT Plan. Closures would not be day-long and no detours are anticipated.

Construction of the Proposed Action along Kawaihae Road and at the Kawaihae Road and Lindsey Road intersection would require temporary construction easements, as discussed in **Section 1.3.3**. The construction easement would be negotiated with the landowner and would give HDOT right to use the property during construction. Upon the completion of construction, the temporary construction easement would be terminated.

The arrival and departure of construction equipment and crews may cause short-term increase in traffic volume and traffic delays. Traffic signs and controls would be posted, as appropriate, to reduce traffic flow delays and potential hazards from reduced visibility. Signage would inform roadway users of reduced speed limits in construction zones and potential traffic delays. A maintenance of traffic (MOT) plan would be prepared prior to the start of construction. The MOT plan would include provisions to ensure access to schools, parks, homes, and businesses, as well as maintain access for emergency vehicles. Impacts during construction of the Proposed Action would be short-term and temporary.

Under the No-Action Alternative, no construction would occur and there would be no impacts to public facilities and services.

Operation

As a traffic improvement project, the Proposed Action is not expected to have significant adverse impacts on traffic. Rather, the Proposed Action would provide beneficial impacts due to improved traffic flow, increased pedestrian and bicyclist comfort levels, and improved multimodal safety.

Under the No-Action Alternative, no improvements would be made and traffic conditions in the heart of Waimea Town would continue to deteriorate.

Pedestrian and Bicycle Travel

Pedestrian comfort scores on roadway segments are expected to improve from scores of 4 (i.e., the least comfortable level) to generally scores of 3 with implementation of the Proposed Action. In addition, selected intersections would be significantly enhanced with the addition of signage, striping, warning beacons and reduced crossing widths. Achieving even greater levels of pedestrian comfort on segments would require substantial additional ROW or degradation of operations and safety for other modes. All segments are expected to provide a very good bicycle comfort score of 1 (i.e., the most comfortable level) under Future conditions with implementation of the Proposed Action. Improvements in comfort are also expected for bicycles at all intersections. Additional details are provided in **Section 2.3.1**.

Vehicle Travel Times

Under existing conditions, implementation of the Proposed Action would not change AM peak hour travel times through the study corridor in the eastbound direction, but it would slightly increase AM peak hour travel times in the westbound direction (by 16 seconds). In the PM peak hour, implementation of the

Proposed Action would result in approximately 20 seconds of travel time savings in each direction, indicating that the project would be able to offer immediate relief to the period of worst congestion.

Under future conditions, implementation of the Proposed Action is projected to provide approximately 30 seconds of travel time savings for both directions in the PM peak hour compared to Future No Project conditions. In addition, approximately 40 seconds of travel time savings is projected for traffic in the eastbound direction in the AM peak hour. In the westbound direction in the AM peak hour, travel time is projected to increase by 30 seconds. This increase in one direction in one peak hour is caused in large part by modified departure lane configurations and the introduction of leading pedestrian intervals at the Lindsey Road and Mamalahoa Highway intersection to enhance safety for pedestrians and bicyclists. This local increase in delay experienced at the intersection in the AM peak hour would result in slightly longer travel times through the study area; however, in the PM peak hour the increased delay at the signalized intersection is more than offset by the decreased delays along the Kawaihae Road section due to the additional capacity and reduction in left-turn conflicts provided by the two-way left-turn lane.

Safety

Based on data obtained from HDOT, 53 collisions occurred within the vicinity of the study area from year 2012 through 2014. Collision "hot spots" (i.e., locations with five or more collisions in the three-year time period) were identified at two locations: Kawaihae Road at the Kohala Mountain Road intersection near Waiaka Bridge and Kawaihae Road half-mile east of Ouli Street on a curved section of the roadway. Both of these hot spots are not within the immediate study area. In the immediate study area, two collisions occurred at the Kawaihae Road and Lindsey Road Intersection and two collisions occurred at the Mamalahoa Highway and Lindsey Road intersection.

Collision factors were reviewed to identify any recurring patterns or causes:

- **Kawaihae Road at Kohala Mountain Road:** The presence of rain appeared to be a factor in most of the collisions. Vehicles were reported running off the road, crossing the centerline, and swerving to avoid an obstacle. Drivers were also inattentive, misjudged conditions, or failed to yield.
- **Kawaihae Road east of Ouli Street:** A consistent or primary collision factor was unable to be determined. Most drivers appeared to fail to maintain travel in their lane or crossed the centerline apparently due to a variety of factors included speeding, inattention, or alcohol.
- **Lindsey Road intersections with Kawaihae Road and Mamalahoa Highway:** Three of the four collisions were rear end collisions caused by misjudgment of the driver.

The Proposed Action would improve safety in Waimea by slowing travel speeds at the Kawaihae Road and Lindsey Road intersection via the roundabout. In addition, the Proposed Action would improve multimodal safety in Waimea by:

- Providing separate and designated paths of travel for pedestrians, bicyclists, and automobiles
- Implementing leading pedestrian intervals at the Lindsey Road and Mamalahoa Highway intersection
- Increasing the frequency of demarcated pedestrian crossings to minimize illegal crossings between intersections

3.1.3 Avoidance and Minimization Measures

An MOT Plan would be prepared prior to the start of construction. The purpose of the MOT plan is to provide for the safe and efficient movement of vehicles, bicyclists, and pedestrians through or around temporary traffic control zones while reasonably protecting workers and equipment. The additional objective of the temporary traffic control is the efficient construction and maintenance of the roadway or highway. The MOT Plan would include provisions to ensure access to schools, parks, homes, and businesses, as well as maintain access for emergency vehicles. No other avoidance or minimization measures are proposed or expected to be required.

3.2 Air Quality, Climate, and Climate Change

3.2.1 Affected Environment

Air Quality

The Clean Air Act of 1972 and its 1990 Amendments (CAA) and subsequent legislation regulate air emissions from area, stationary, and mobile sources. Both the U.S. Environmental Protection Agency (USEPA) and the State of Hawaii have instituted Ambient Air Quality Standards (AAQS) to maintain air quality in the interest of public health and secondary public welfare.

At the present time, seven parameters are regulated: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. The Hawaii AAQS are in some cases considerably more stringent than the comparable National Ambient Air Quality Standards (NAAQS). In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. **Table 28** illustrates the NAAQS and State AAQS and the units of measure (micrograms per cubic meter [$\mu g/m^3$] and parts per million [ppm]).

In addition to the NAAQS and the State AAQS, the State of Hawaii Department of Health DOH regulates fugitive dust. HAR Section 11-60.1-33, Fugitive Dust, states that no person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions, and no person shall cause or permit the discharge of visible fugitive dust beyond the property lot line on which the fugitive dust originates (DOH, 2014). This rule applies to construction projects and would, therefore, be applicable to the Proposed Action.

Northeast tradewinds funnel through the saddle between the Kohala Mountains and Mauna Kea and often blow at speeds exceeding 25 miles per hour (mph). Regionally, tradewinds with an east to northeast direction are present on up to 90 percent of summer days and 50 percent of winter days. The strong and steady winds of Kohala contribute to excellent air quality by dispersing human-derived pollutants as well as the volcanic haze (i.e., vog) when Kilauea is erupting. In areas with bare surfaces, however, the strong winds may exacerbate dust problems.

Table 28. State of Hawaii and National Ambient Air Quality Standards

Pollutant	Units	Averaging Time	Maximum Allowable Concentration National Primary	National Secondary	State of Hawaii
Particulate Matter <10 microns (PM_{10})	µg/m^3	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter <2.5 microns ($PM_{2.5}$)	µg/m^3	Annual 24 Hours	12[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide (SO_2)	ppm	Annual 24 Hours 3 Hours 1 Hour	- - - 0.075[e]	- - 0.5[b] -	0.03 0.14[b] 0.5[b] -
Nitrogen Dioxide (NO_2)	ppm	Annual 1 Hour	0.053 0.100[f]	0.053 -	0.04 -
Carbon Monoxide (CO)	ppm	8 Hours 1 Hour	9[b] 35[b]	- -	4.4[b] 9[b]
Ozone (O_3)	ppm	8 Hours	0.070[g]	0.070[g]	0.08[g]
Lead	µg/m^3	3 Months Quarter	0.15[h] 1.5[i]	0.15[h] 1.5[i]	- 1.5[i]
Hydrogen Sulfide	ppb	1 Hour	-	-	25[b]

Notes: [a]Not to be exceeded more than once per year on average over three years.
[b]Not to be exceeded more than once per year.
[c]Three-year average of the weighted annual arithmetic mean.
[d]98th percentile value averaged over three years.
[e]Three-year average of fourth-highest daily 1-hour maximum.
[f]98th percentile value of the daily 1-hour maximum averaged over three years.
[g]Three-year average of annual fourth-highest daily 8-hour maximum.
[h]Rolling 3-month average.
[i]Quarterly average.

Source: DOH, 2015

Climate

Climate in Hawaii is largely dependent on location and elevation. The Proposed Action is located on the north side of the island at an elevation approximately 2,675 feet above mean sea level (msl), creating the cool climate for which Waimea is celebrated. Winds in the area are dominantly northeast trades funneled between Mauna Kea and the Kohala Mountains. The Proposed Action is located at the junction of what are commonly referred to as “the wet side” and “the dry side” of Waimea.

Temperature and rainfall data for the project area was obtained at the Kamuela Climate Station from 1971 to 2000. This data shows that the average maximum temperature at the location is 72.9 degrees Fahrenheit (°F), and the average minimum temperature is 54.9 °F. Rainfall totals approximately 30 inches per year. As shown in **Figure 9**, the warmest months are August, September, and October and the coolest months are January and February. As shown in **Figure 10**, November through March are the wettest months and May through September are the driest months (WRCC, 2009).

Figure 9. Average Monthly Temperature (°F) at Kamuela Climate Station, 1971 to 2000

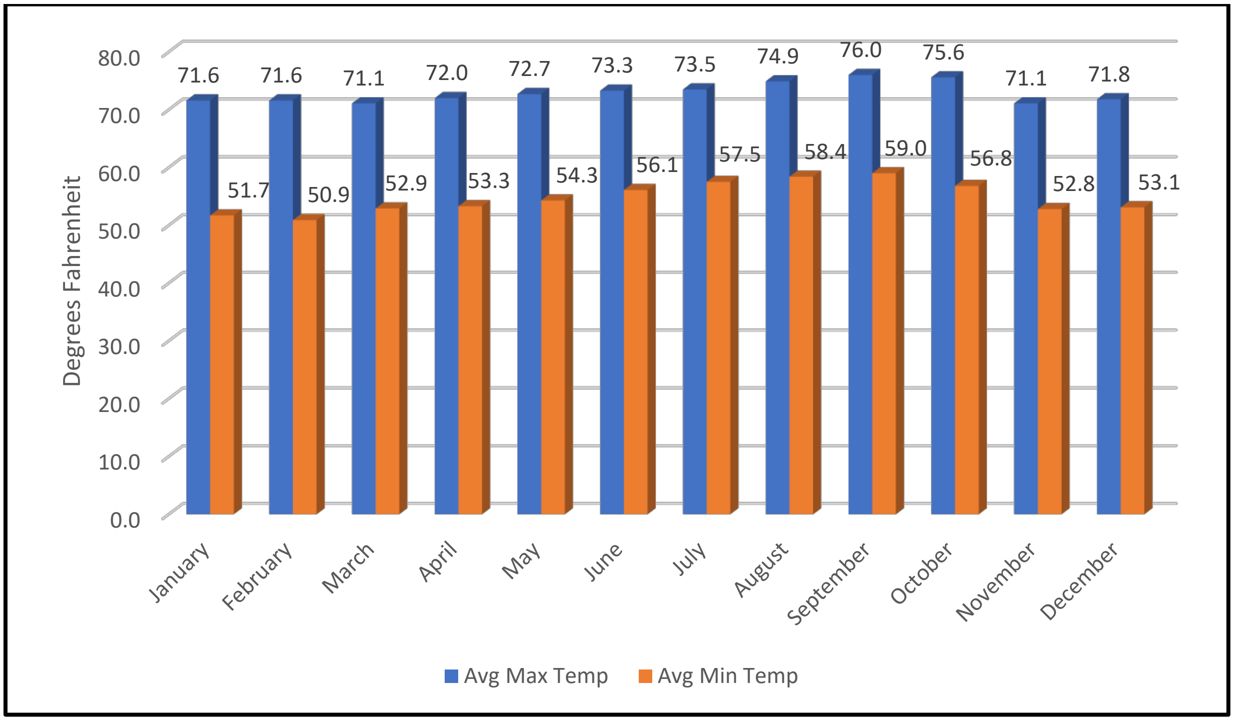
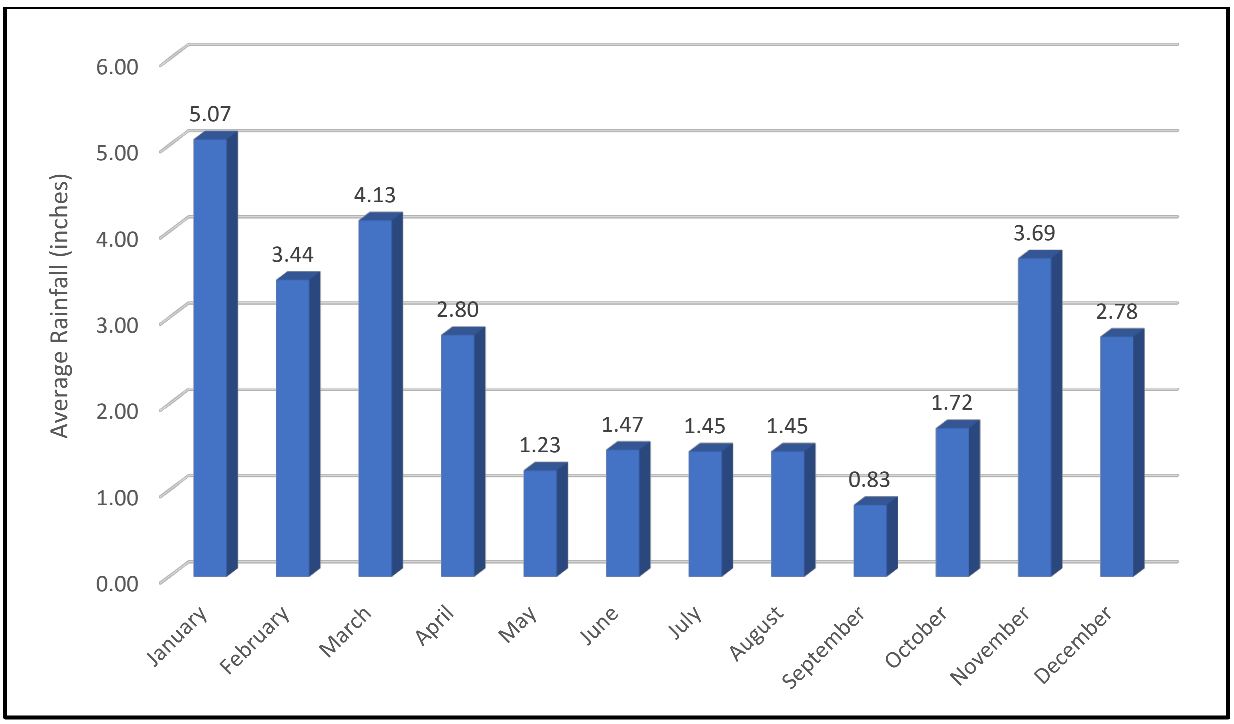


Figure 10. Average Monthly Rainfall (inches) at Kamuela Climate Station, 1971 to 2000



Climate Change

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nation's Intergovernmental Panel on Climate Change. Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. This will be accompanied by the warming of ocean waters, which is expected to be highest in tropical and subtropical seas of the Northern Hemisphere. Wet and dry season contrasts will increase, and wet tropical areas are likely to experience more frequent and extreme precipitation. For Hawaii, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also agriculture, ecosystems, the visitor industry, and public health. For many if not most population centers in Hawaii, the key consideration is sea level rise, which is not of concern for this project within the narrow focus of direct impacts. However, increased fire risk from droughts, higher wind loads from more frequent hurricanes, and greater runoff from more intense rainfall are important considerations in the design of highways and road improvements in any location in Hawaii.

3.2.2 Potential Impacts

Construction

Only short-term construction-related impacts to air quality are anticipated with implementation of the Proposed Action. During construction, potential emission sources that may affect air quality include the following:

- Diesel and/or gasoline-powered construction equipment and motor vehicles would contribute to additional CO and CO_2 in the air.
- Fugitive dust emissions resulting from ground disturbing activities.

Construction would entail grading and vehicle and equipment engine operations during the construction period. Because levels of criteria pollutants in Hawaiʻi are consistently below Federal and State AAQS, and because the prevailing trade winds rapidly carry pollutants offshore limiting the effect on receptors, increases in levels of criteria pollutants at the project sites from construction activities are not expected to be significant. It is not anticipated that Federal or State AAQS would be exceeded during construction activities.

Under the No-Action Alternative, no construction activities would occur and no additional emission sources would be added; therefore, there would be no impact to the existing air quality.

Operation

The pollutants relevant to evaluating potential impacts to air quality from a roadway project are those contained in motor vehicle emissions. Motor vehicles emit carbon monoxide (CO), volatile organic compounds (VOCs), the six priority mobile source air toxics (MSAT), nitrogen oxide (NOx), and lead, which can react in the atmosphere to generate PM_{10} and $PM_{2.5}$ on a regional basis.

Regional air quality impacts are primarily dependent on changes in vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle mix (gasoline-fueled cars vs. diesel-fueled trucks and buses). The Proposed Action is not expected to result in changes to VMT or vehicle mix. However, the Proposed Action would reduce delay in the project area, as discussed in **Section 2.3.2**, and provide safe alternatives for travel in the heart of Waimea Town through the installation of protected pedestrian and bicycle facilities, which could result in less vehicles making in-town trips. Therefore, the Proposed Action would not have a negative impact to air quality and could have a beneficial impact to air quality.

Under the No-Action Alternative, no changes to existing conditions would occur. Traffic congestion within Waimea Town would continue to increase, which could lead to a degradation of air quality at the local level.

3.2.3 Avoidance and Minimization Measures

All construction activities would comply with the provisions of HAR Chapter 11-60.1, Air Pollution Control, and HAR Chapter 11.60.1-33, Fugitive Dust. A dust control plan would be developed and implemented to minimize fugitive dust during construction, to be approved by the DOH. Measures to control fugitive dust during construction may include, but not be limited to, the following:

- Watering of active work areas and project access roads, as needed
- Screening piles of materials from wind, if appropriate
- Covering open trucks carrying construction materials
- Limiting areas to be disturbed at any given time
- Mulching or chemically stabilizing inactive areas that have been disturbed

Additionally, contractors would be required to maintain equipment with emissions controls.

Implementing air quality mitigation measures for long-term, traffic-related impacts are not expected to be required since the Proposed Action is not expected to result in a significant change of VMT, VHT, and vehicle mix.

3.3 Noise

3.3.1 Affected Environment

Noise is defined as unwanted sound and is one of the most common environmental issues of concern to the public. A number of factors affect sound as it is perceived by the human ear. These include the actual level of the sound (i.e., noise), the frequencies involved, the period of exposure to the noise, and changes or fluctuations in the noise levels (HAR, Section 12-200.1 – Occupational Noise Exposure).

The State of Hawaii Community Noise Control Rule (HAR Chapter 11-46) defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to stationary noise sources such as air-conditioning units, exhaust systems, and generators. The accepted unit of measure for noise levels is the decibel (dB). The Community Noise Control Rule does not address most moving sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to construction activities, which may not be stationary.

The State of Hawaii regulates noise exposure in the following statutes and rules:

- HRS, Section 342F – Noise Pollution
- HAR, Section 11-46 – Community Noise Control

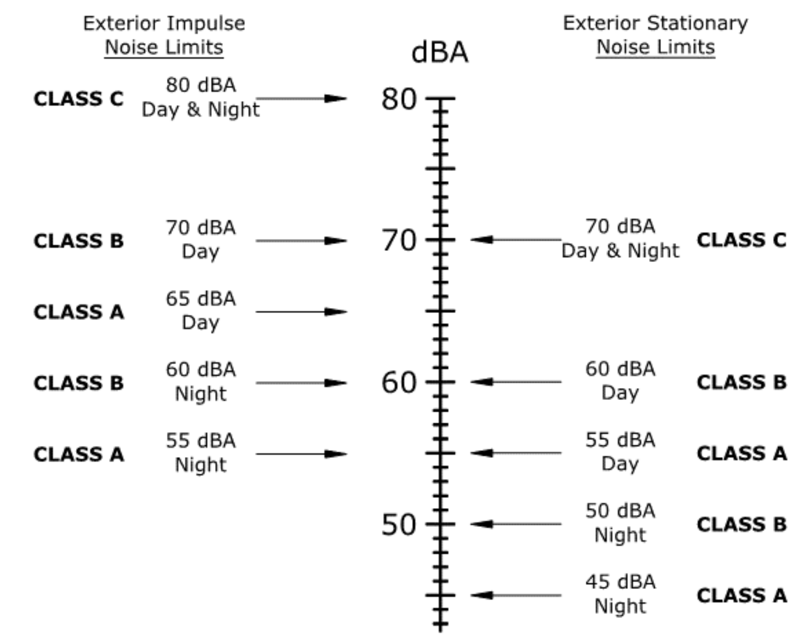
The maximum permissible noise levels are enforced by the DOH for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in **Figure 11**. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is considered by the DOH.

As discussed in **Section 4.2.4**, lands adjacent to Kawaihae Road and Lindsey Road are zoned Village Commercial District and Open. Lands adjacent to the Mamalahoa Highway and Lindsey Road intersection are zoned Village Commercial District and Single-Family Residential. This puts the project area in Class A and Class B Zoning Districts with a maximum permissible sound level during daytime hours (7 AM to 10 PM) of 55 to 60 dBA and a maximum permissible sound level of 45 to 50 dBA during nighttime hours (10 PM to 7 AM). Therefore, a Community Noise Permit would be required from the Indoor and Radiological Health Branch of the DOH.

Figure 11. Hawaii Maximum Permissible Sound Levels for Various Zoning Districts

Zoning District	**Day Hours** (7 AM to 10 PM)	**Night Hours** (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)

IMPULSE NOISE:
The maximum permissible noise limit for impulse noise is 10 dBA above the stationary noise limits.



The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq(h)}$, for traffic noise exposure, which are shown in **Figure 12**. These limits are viewed as "design goals," and all projects meeting these limits are deemed in conformance with FHWA noise standards. Calculation of traffic noise levels are conducted using a FHWA traffic noise model. Most land within the project area is located in land use categories B and C, which have an exterior $L_{eq(h)}$ of 67 dBA. There are also properties in land use category D, which has an interior $L_{eq(h)}$ of 52 dBA.

Figure 12. FHWA/HDOT Noise Abatement Criteria for Highway Noise

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	HOURLY EQUIVALENT SOUND LEVEL L_{eq}
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	RESIDENTIAL	67 dBA (EXTERIOR)
C	ACTIVE SPORT AREAS, AMPHITHEATERS, AUDITORIUMS, CAMPGROUNDS, CEMETERIES, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PARKS, PICNIC AREAS, PLACES OF WORSHIP, PLAYGROUNDS, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, RECREATION AREAS, SECTION 4(F) SITES, SCHOOLS, TELEVISION STUDIOS, TRAILS, AND TRAIL CROSSINGS	67 dBA (EXTERIOR)
D	AUDITORIUMS, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PLACES OF WORSHIP, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, SCHOOLS, AND TELEVISION STUDIOS .	52 dBA (INTERIOR)
E	HOTELS, MOTELS, OFFICES, RESTAURANTS/BARS, AND OTHER DEVELOPED LANDS, PROPERTIES OR ACTIVITIES NOT INCLUDED IN A-D OR F.	72 dBA (EXTERIOR)
F	AGRICULTURE, AIRPORTS, BUS YARDS, EMERGENCY SERVICES, INDUSTRIAL, LOGGING, MAINTENANCE FACILITIES, MANUFACTURING, MINING, RAIL YARDS, RETAIL FACILITIES, SHIPYARDS, UTILITIES (WATER RESOURCES, WATER TREATMENT, ELECTRICAL), AND WAREHOUSING	N/A
G	UNDEVELOPED LANDS THAT ARE NOT PREMITTED	N/A

HDOT's *Highway Noise Policy and Abatement Guidelines* (2016) adopts FHWA's design goals for traffic noise exposure. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy defines "approach" as at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" as an increase of at least 15 dB. HDOT's highway noise policy only applies to FHWA Type 1 projects, which are those that involve "construction of a highway on new location or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes" (FHWA, 2017).

Locations that are determined to be impacted by traffic noise levels are considered for traffic noise abatement. Abatement measures must meet Feasibility and Reasonableness criteria, which are defined as follows:

- **Feasibility:** Deals with engineering considerations.
- **Reasonableness:** Uses cost-effectiveness criteria to arrive at a decision.

Where noise abatement is warranted based on the NAC, construction of noise barriers must be considered. Other types of abatement may also be considered, including traffic management measures, alteration of project alignment, and insulation of public use or non-profit institutional structures. Planting of vegetation or landscaping is not considered an acceptable noise abatement measure.

For non-residential properties, feasibility is defined as follows:

- Achievement of at least a 5 dBA noise reduction
- Determination that it is possible to design and construct the barrier after considering issues relating to safety, barrier height, topography, drainage, utilities, and maintenance.

Reasonableness is defined as follows (and must be collectively achieved):

- Consideration of the viewpoints of the property owners and residents of the benefited receptors.
- Cost-effectiveness (up to $60,000 per benefitted receptor) of the noise abatement measures.
- Noise reduction design goals.

D.L. Adams conducted an assessment to determine the potential impacts of the Proposed Action on the existing and future noise environment. The assessment includes the following:

- Existing acoustical environment, including long-term and short-term noise measurements
- Potential noise impacts
- Recommended noise impact mitigation

The *Environmental Noise Assessment* is included in its entirety in **Appendix C**.

To assess the existing acoustical environment within the project corridor, two types of noise measurements were conducted. The first noise measurement type consisted of continuous long-term ambient noise level measurements. The second type of noise measurement was short-term.

The long-term noise levels were measured between July 31, 2020 to August 4, 2020 at three measurement locations: a private residence located on the southwestern side of the intersection of Kawaihae Road and

Opelo Road, approximately 30 feet south of the centerline of the road; on the northern side of Kawaihae Road within the property line of Hawaii Preparatory Academy, approximately 30 feet north of the centerline of the road; and within the property line of The Parker School on the eastern side of the Kawaihae Road and Lindsay Road intersection, approximately 50 feet east of the centerline of the road.

The results of the long-term measurements are represented in **Table 29**, which shows the hourly equivalent sound level, L_{eq}, during day (7:00 AM to 10:00 PM) and night (10:00 PM to 7:00 AM) and average calculated day-night level, L_{dn}.

Table 29: Summary of Long-Term Noise Measurement Results (dBA)

Measurement Location	Average Daytime L_{eq}	Average Nighttime L_{eq}	Average L_{dn}
Private Residence - 65-1219 Opelo Road (L1)	68	62	70
Hawaii Preparatory Academy (L2)	68	65	72
Parker School (L3)	62	57	64

Source: D.L. Adams, October 2020

The long-term noise measurement results show that ambient sound levels at all locations are relatively dynamic and depend significantly on the vehicular traffic patterns of Kawaihae Road and Lindsey Road. The dominant noise source for all locations is vehicular traffic noise along Kawaihae Road and Lindsey Road. Secondary noise sources include birds, wind, and occasional aircraft flyovers.

The short-term noise levels were measured between July 31, 2020 and August 4, 2020 at locations in the vicinity of the long-term measurement locations and at spots S1, S2, and S3. The results of these short-term measurements are presented in **Table 30**.

Table 30: Summary of Short-Term Noise Measurement Results (dBA)

Measurement Location	AM L_{eq} (10:00AM)	PM L_{eq} 3:00 PM
Private Residence - 65-1219 Opelo Road (S1)	68	62
Waimea Community Center (S2)	68	65
Intersection Mamalahoa Highway and Lindsey Road (S3)	62	57

Source: D.L. Adams, October 2020

The dominant short-term noise source at Location S1, a private residence on Opelo Road, was vehicular traffic on Opelo Road and Kawaihae Road with secondary noise sources including birds and occasional aircraft flyovers. The dominant noise source at Location S2, Waimea Community Center, is vehicular traffic on Kawaihae Road with secondary noise sources including recreational activity in Waimea Community Park and occasional aircraft flyovers. The dominant noise source at Location S3, the intersection of Mamalahoa Highway and Lindsey Road, is vehicular traffic along Lindsey Road and Mamalahoa Highway. Any secondary sources at Location S3 were imperceptible above vehicular traffic noise.

3.3.2 Potential Impacts

Construction

The study area along Kawaihae Road is zoned primarily as a village commercial district, which includes multi-family rental residential, commercial, hotel, school and house of worship uses, as well as some areas designation for active and passive recreation. Land uses along Lindsey Road and Mamalahoa Highway within the study area include commercial and school uses. The Hawaii Community Noise Control Rules state that the primary land use designation shall be used to determine the applicable zoning district class. Maximum permissible noise levels are specified by the State rules for daytime and nighttime hours, but ambient noise levels are also taken into account. Construction noise levels are expected to exceed the daytime limits and a permit must be obtained from the State HDOH to allow the operation of construction equipment.

Much of the project area can be considered noise sensitive as schools, houses of worship, parks and businesses along Kawaihae Road, Lindsey Road and Mamalahoa Highway may be impacted by the project construction noise due to their proximity to the project. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Noise emissions for anticipated construction equipment are shown in **Table 31**.

The improvements are expected to involve demolition, excavation for deep drywells, utility adjustment, installation of new concrete sidewalks, curbs and gutters, and repaving activities. Demolition and excavation activities involving hoe rams, excavators, concrete saws, drills and jackhammers will likely be the loudest construction activity, with concrete sidewalk installation and paving operations loudest during the remainder of construction.

Due to the proximity of construction activities to neighboring property lines, exceedances of HDOT property line limits are expected. Noise mitigation during construction is discussed in **Section 3.3.3**.

Table 31. General Construction Equipment Noise Emissions

Type of Equipment	Acoustical Use Factor (%)[a]	Noise Level at 50 feet (dBA)[b]	Impact Device[c]
Excavators	40	85	
Backhoe	40	80	
Hoe Ram	20	90	Yes
Loader	40	80	
Generators	40	80	
Dump Trucks	40	84	
Vacuum Excavator	40	85	
Water Truck	40	84	
Pickup Trucks	40	55	
Concrete Saw Cutter	20	90	
Concrete Mixer	40	85	
Paver	50	85	
Cold Planer	40	85	
Shuttlebuggy	50	85	
Rubber Tire Roller	20	85	
Steel Drum Roller w/ vibration	20	90	

Type of Equipment	Acoustical Use Factor (%)[a]	Noise Level at 50 feet (dBA)[b]	Impact Device[c]
Saw	50	85	
K/P Broom Street Sweeper	10	80	
Grader	40	80	
Jackhammer	20	85	Yes
Core Drilling Machine	20	84	
Dozer	40	85	

a. The acoustical usage factor is an estimate of the fraction of time each piece of construction equipment is operating at full power (i.e., the equipment will be operating in its loudest condition). The usage factors value is based on the Federal Highway Administration Roadway Construction Noise Model (RCNM) [Reference 6] database.

b. The A-weighted maximum sound level (Lmax) values are based on the RCNM construction equipment noise database.

c. Impact equipment is equipment that generates an impulsive noise produced by the periodic impact of a mass on a surface which is of short duration and high intensity, characterized by abrupt onset and rapid decay, and often rapidly changing spectral composition.

Source: FHWA, 2015.

Operation

Noise impacts are determined by comparing future noise levels with the Proposed Action to a set of NAC for a land use category and to existing noise levels. Traffic noise levels were calculated using the FHWA's Traffic Noise Model.

The existing road conditions were modeled for peak hour AM (10:00 AM) and PM (4:00 PM) traffic and vehicular noise analysis was completed at 41 noise receiver locations. Of the 41 noise receiver locations, ten receivers are calculated to approach or exceed the FHWA/HDOT exterior noise abatement criteria (NAC) under existing (2018) conditions. A summary of the noise receiver locations that approach or exceed the FHWA/HDOT exterior NAC under existing roadway conditions are presented in **Table 32**.

Table 32: Existing (2018) Traffic Noise Impacts

Location TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptor (dBA)
6-5-07-53 (School)	50	C/D	70	45
6-5-07-3	57	C/D	70	45
6-5-09-36	41	B	66	--
6-5-09-88	38	B	66	--
6-5-09-34	34	B	67	--
6-5-09-33	43	B	67	--
6-5-09-32	68	B	66	--
6-5-09-26	40	B	66	--
6-5-03-46	43	C/D	73	48
6-5-03-6	50	C/D	73	48

Source: D.L. Adams, October 2020

Of the 41 noise receiver locations, eight receivers are calculated to approach or exceed the FHWA/HDOT exterior NAC under future (2036) conditions. A summary of the noise receiver locations that approach or exceed the FHWA/HDOT exterior NAC for projected 2036 traffic volumes with the Proposed Action are presented in **Table 33**, shown in **Figure 13**, and discussed by NAC Activity Category below.

Table 33: Future (2036) With Project Predicted Traffic Noise Impacts

Location TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptor (dBA)
6-5-07-53 (Sports Field)	90	C	67	--
6-5-07-53 (School)	50	C/D	76	51
6-5-07-3	57	C/D	71	46
6-5-09-88	38	B	66	--
6-5-03-34	34	B	66	--
6-5-03-46	43	C/D	70	45
6-5-03-6	50	C/D	69	44
6-5-03-29	40	C/D	67	42

Source: D.L. Adams, October 2020

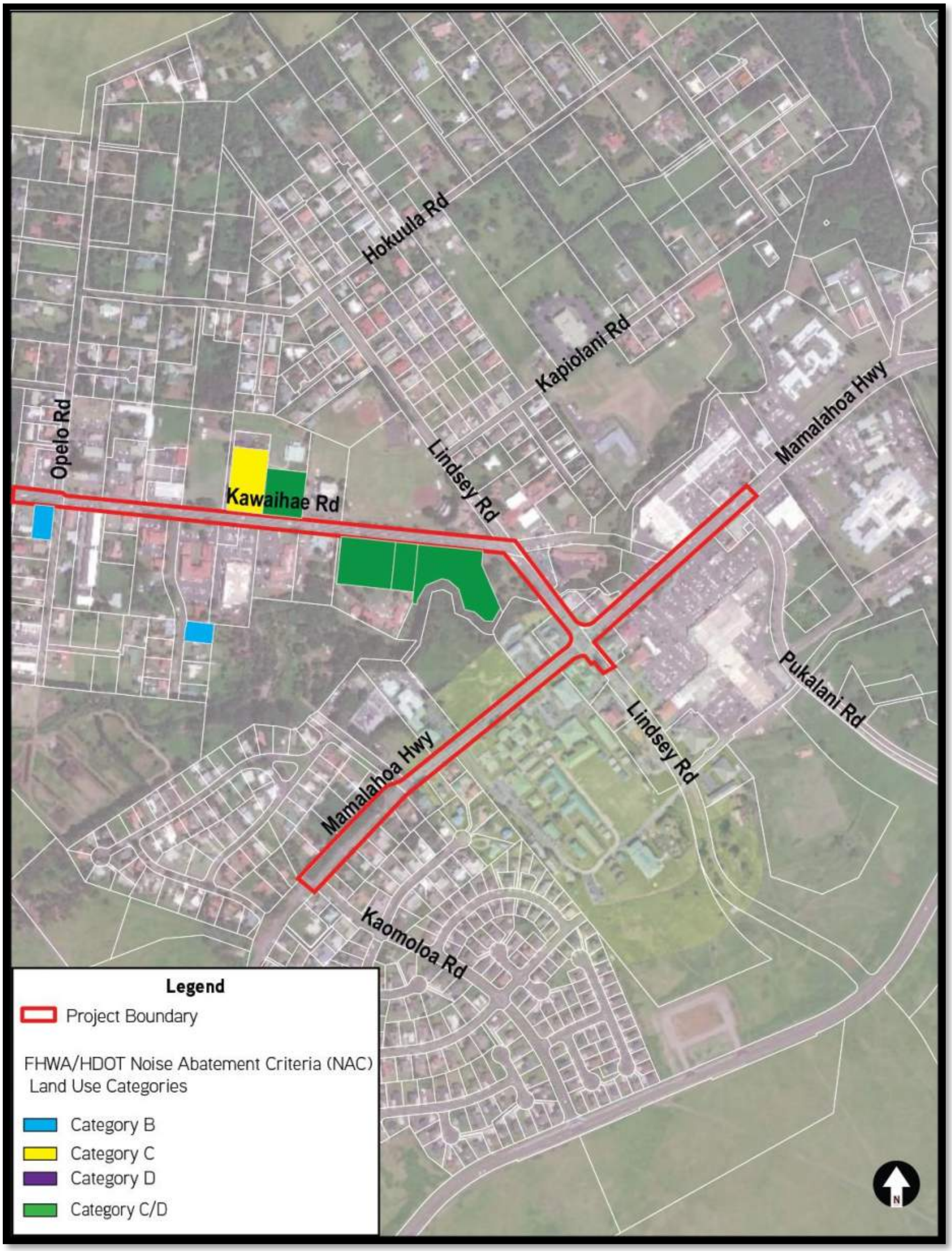
NAC Activity Category D

Five receptors could be classified as NAC Activity Category D, which have interior design guidelines. With the assumed 25 dB facade noise level reduction from aluminum single hung windows, interior noise levels at these receptors are predicted to be less than the 52 dBA L_{eq} interior noise level criteria. Therefore, additional noise mitigation is not required for these receptors.

At the Hawaii Preparatory Academy, interior noise levels would be 51 dBA, thereby approaching the 52 dBA L_{eq} interior noise level criteria. This building already has air conditioning allowing for maintenance of a closed window condition and appears to include insulated windows. Therefore, a noise barrier along the property line would be the only available mitigation measure. The noise barrier would need to break line of site from the second-floor windows to the roadway. DLAA modeled the noise reducing effectiveness of a 10-foot noise barrier along the property line on Kawaihae Road. The 10-foot noise barrier would result in a noise reduction at the school by less than 1 dBA; therefore, it would not provide a significant reduction of noise levels and would not meet the Feasibility and Reasonableness criteria according to HDOT's Highway Noise Policy and Abatement Guidelines (2016).

While noise level impacts were identified, available noise mitigation measures (e.g., noise barriers) are not expected to achieve the acoustical criteria to be considered reasonable and feasible. Therefore, no noise mitigation measures are recommended.

Figure 13. Noise Receiver Locations that Approach or Exceed the FHWA/HDOT NAC with the Proposed Action (2036)



NAC Activity Category C

One receptor, the Hawaii Preparatory Academy Athletic Field, is considered NAC Activity Category C. With the project under 2036 traffic conditions, noise levels at the field would reach the NAC threshold of 67 dBA L_{eq}. A 10-foot-tall barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels at the field by 2 dBA. DLAA modeled the noise reducing effectiveness of a 10-foot noise barrier along the property line on Kawaihae Road. The 10-foot noise barrier would result in a noise reduction by 2 dBA; however, it would not meet the Feasibility and Reasonableness criteria according to HDOT's Highway Noise Policy and Abatement Guidelines (2016).

While noise level impacts were identified, available noise mitigation measures (e.g., noise barriers) are not expected to achieve the acoustical criteria to be considered reasonable and feasible. Therefore, no noise mitigation measures are recommended.

NAC Activity Category B

Two receptors, 65-1319 Kawaihae Road and 65-1323 Kawaihae Road, are classified as NAC Activity Category B. With the project under 2036 traffic conditions, noise levels at these receptors would approach the NAC threshold of 67 dBA L_{eq}. A 10-foot-tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels by less than 1 dBA. DLAA modeled the noise reducing effectiveness of a 10-foot noise barrier along the property line on Kawaihae Road. The 10-foot noise barrier would result in a noise by less than 1 dBA; therefore, it would not provide a significant reduction of noise levels and would not meet the Feasibility and Reasonableness criteria according to HDOT's Highway Noise Policy and Abatement Guidelines (2016).

While noise level impacts were identified, available noise mitigation measures (e.g., noise barriers) are not expected to achieve the acoustical criteria to be considered reasonable and feasible. Therefore, no noise mitigation measures are recommended.

Under the No Action Alternative, nine receivers are calculated to approach or exceed the FHWA/HDOT exterior NAC under future (2036) conditions, as shown in **Table 34**. Therefore, the No Action Alternative would have more significant noise impacts than the Proposed Action.

Table 34: Future (2036) No Project Predicted Traffic Noise Impacts

Location TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptor (dBA)
6-5-07-53 (School)	50	C/D	70	45
6-5-07-3	57	C/D	71	46
6-5-09-36	41	B	66	--
6-5-09-88	38	B	67	--
6-5-03-34	34	B	67	--
6-5-09-33	43	B	67	--
6-5-09-32	68	B	67	--
6-5-03-46	43	C/D	73	48
6-5-03-6	50	C/D	74	49

Source: D.L. Adams, October 2020

3.3.3 Avoidance and Minimization Measures

Construction

Noise generated from short-term construction activities and the use of machinery would be minimized by requiring contractors to adhere to state and county noise regulations, including HRS Chapter 342F, Noise Pollution, and HAR Chapter 11-46, Community Noise Control. In the event that work occurs after normal working hours (i.e., at night or on weekends), or if permissible noise levels are exceeded, appropriate permitting and monitoring, as well as development of administrative and engineering controls, would be employed.

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels, a permit must be obtained from DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels. In order for DOH to issue the construction permit, the contractor must submit a permit application explaining the construction activities. DOH may also require the contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the HDOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities are:

- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels . . . before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels . . . before 9:00 a.m. and after 6:00 p.m. on Saturday."
- "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of hoe rams and jack hammers 25 pounds or larger, high pressure sprayers, chain saws, and pile drivers are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers.

The DOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

Operation

While noise level impacts were identified with and without the Proposed Action, available noise mitigation measures (e.g., noise barriers) are not expected to achieve the acoustical criteria to be considered reasonable and feasible. However, the Proposed Action does result in reduced impacts at some receptors. Therefore, no permanent noise mitigation measures are proposed or expected to be required.

3.4 Topography and Soils

3.4.1 Affected Environment

The island of Hawaii is the youngest of the eight main Hawaiian Islands and consists of five separate shield volcanoes that overlap each other. These include Kohala, Mauna Kea, Hualalai, Mauna Loa, and Kilauea. Both Mauna Loa and Kilauea are still active, and the island of Hawaii is still growing. The Proposed Action is located at approximately 2,675 feet above mean sea level. The topography of the project area is flat.

The majority of the Proposed Action is underlain by Waimea medial very fine sandy loam, 0 to 6 percent slopes. The portion of Mamalahoa Highway east of Lindsey Road is underlain by Kikoni medial silt loam, 0 to 3 percent slopes (see **Figure 14**).

- **Waimea medial very fine sandy loam, 0 to 6 percent slopes:** This soil type is located between 2,000 and 6,000 feet elevation and is located on ash fields on lava flows. The parent material is basic volcanic ash. This soil type is 40 to 60 inches deep before hitting lithic bedrock, is well drained, and has low runoff (NRCS, 2019b).
- **Kikoni medial silt loam, 0 to 3 percent slopes (2llwf):** This soil type is located between 2,600 and 3,600 feet elevation and is located on ash fields on aa lava flows. The parent material is basic volcanic ash over aa lava. This soil type has more than 80 inches depth to restrictive feature, is well drained, and has very low runoff (NRCS, 2019a).

The project area is in an urban area and does include any agricultural lands.

3.4.2 Potential Impacts

Construction

Effects on topography and soils from construction of the Proposed Action would be limited to the potential for disturbed soils in the construction area to be eroded as a result of being carried away by storm water runoff or wind and the potential for contaminants to be present that could be imparted to soils. Contaminants in soils have the potential to be transported in normal runoff flows to receiving waters, be leached into groundwater, or pose a direct health risk to people living, working, or playing in or near the soil area. Due to the generally flat topography of the study area, minimal grading would be required. Any grading would be in conformance with the Hawaii County Grading Ordinance.

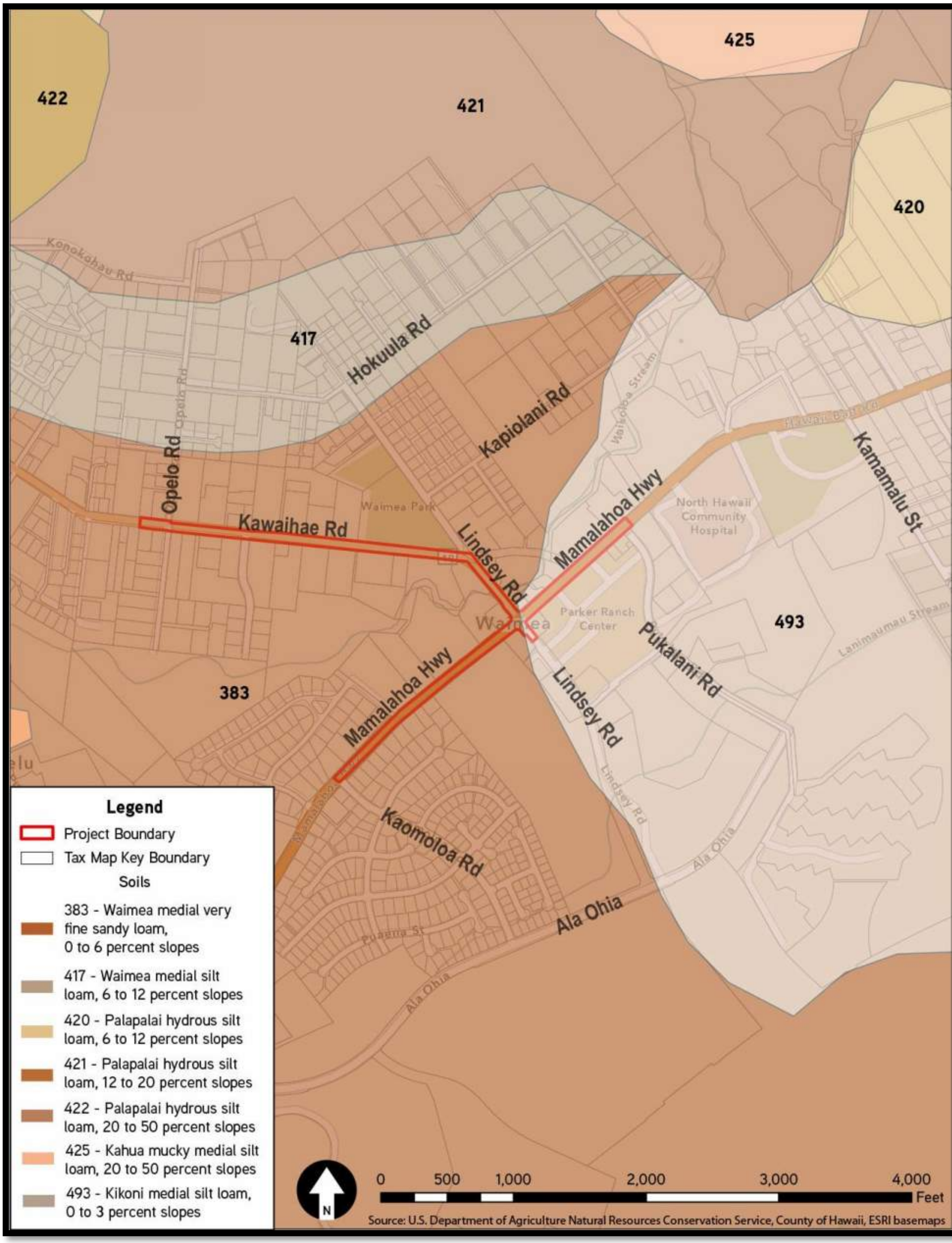
Under the No-Action Alternative, no construction activities would occur and there would be no impacts to topography or soil resources.

Operation

The Proposed Action would have no impacts on topography or soils after construction. Since the Proposed Action is located in an urban area, there would be no impacts to agricultural lands.

Under the No-Action Alternative, no changes would be made to topography or soils.

Figure 14. Soils



3.4.3 Avoidance and Minimization Measures

Any grading would be in conformance with the Hawaii County Grading Ordinance. In addition, HDOT would obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharge associated with construction activities. As part of the permit process, HDOT would prepare a construction site Best Management Practices (BMP) Plan that would include an erosion and sediment control plan, a site-specific plan to minimize erosion of soil and discharge of other pollutants into State waters, and descriptions of measures that would minimize the discharge of pollutants via stormwater after construction is complete.

BMPs would include some or more of the following measures:

- Watering or applying dust suppressants at active work areas and project access roads, as needed
- Installing dust screens or wind barriers around the construction site
- Installation of Filter Sock Perimeter Controls adjacent and down slope from disturbed areas
- Cleaning nearby pavements and paved roads after construction
- Covering open trucks carrying construction materials and debris
- Limiting areas to be disturbed at any given time

BMPs would be installed prior to ground-disturbing activities and would be inspected and maintained throughout the construction period.

3.5 Natural Hazards

3.5.1 Affected Environment

The island of Hawaii is susceptible to potential natural hazards, including flooding, earthquakes, hurricanes and tropical storms, tsunami, and lava flows. The Hawaii Emergency Management Agency operates a system of civil defense sirens throughout the state to alert the public of emergencies and natural hazards, especially tsunamis and hurricanes. There is a civil defense siren located within the project area along Kawaihae Road adjacent to the ballfields at Waimea Park.

Floods

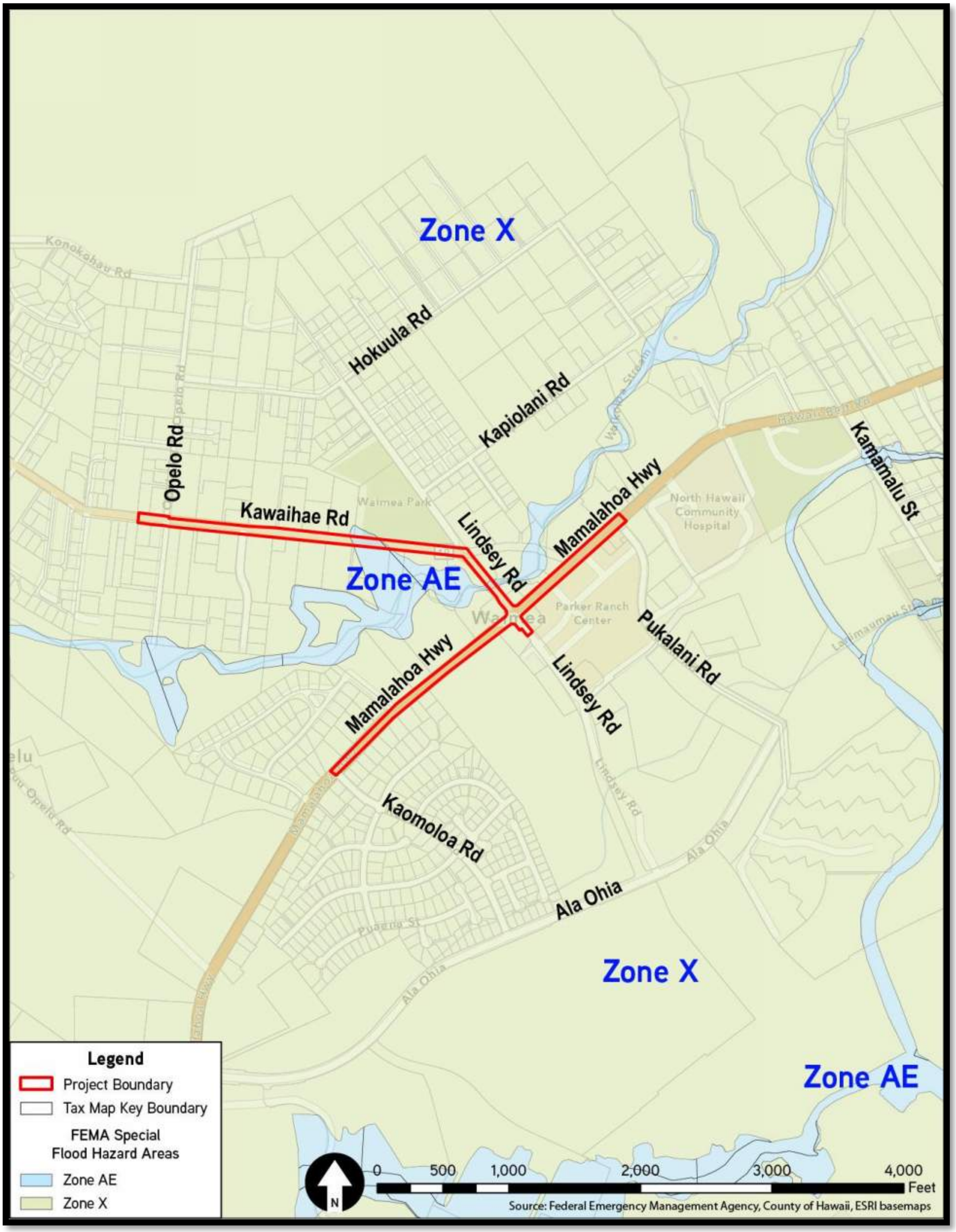
The Federal Emergency Management Agency (FEMA) creates Flood Insurance Rate Maps (FIRM) that delineate flood hazard areas.

As shown in **Figure 15**, the Proposed Action is located mostly in Flood Hazard Zone X (i.e., outside the 500-year floodplain). However, Lindsey Road crosses Waikoloa Stream, which is in Flood Hazard Zone AE. In addition, there is an area of Kawaihae Road on the west side of Waimea Park that is also within Flood Hazard Zone AE (FEMA, 2019).

Tsunami

A tsunami involves the generation of a series of destructive ocean waves that can affect all shorelines. These waves can occur at any time with limited or no warning and are most commonly generated by earthquakes in marine and coastal regions (NOAA, 2017). The Proposed Action is not located within the tsunami evacuation zone.

Figure 15. FEMA Flood Hazard Zones

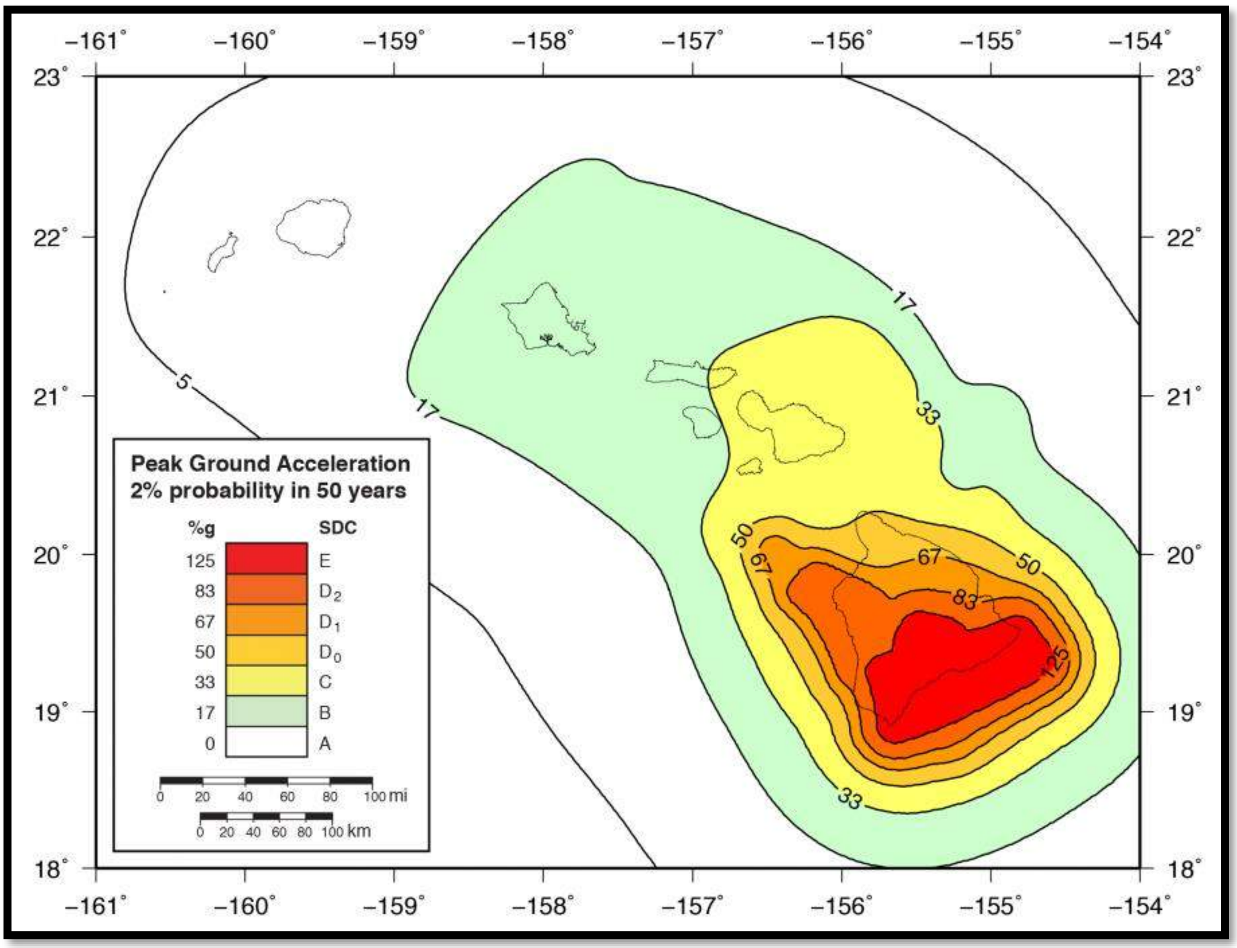


Earthquakes

Strong earthquakes endanger people and property by shaking structures and by causing ground cracks, ground settling, and landslides. The size of an earthquake is commonly expressed by its magnitude on the Richter scale, which is a measure of the relative size of the earthquake wave recorded on seismographs. Thousands of earthquakes occur every year in Hawaii, most on and around the Island of Hawaii. Many of these earthquakes are directly related to volcanic activity.

Seismic hazards for the state of Hawaii are based on past earthquakes and corresponding ground shaking and are categorized in Seismic Design Categories (SDCs) that reflect the likelihood of experiencing earthquake shaking of various intensities. As shown in **Figure 16**, the Proposed Action is located in an area designated as SDC D_0. SDC descriptions are provided in **Table 35**.

Figure 16. Seismic Hazard Zones



Source: USGS, 2017

Table 35. Seismic Design Category Descriptions

Seismic Design Category	Earthquake Hazard	Potential Effects of Shaking
A	Very small probability of experiencing damaging earthquake effects.	
B	Could experience shaking of moderate intensity.	Moderate Shaking – Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
C	Could experience strong shaking.	Strong shaking – Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built structures.
D_0 D_1 D_2	Could experience very strong shaking (the darker the color, the stronger the shaking).	Very strong shaking – Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.
E	Near major active faults capable of producing the most intense shaking.	Strongest shaking – Damage considerable in specially designed structures; frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Shaking intense enough to completely destroy buildings.

Source: USGS, 2017

Hurricanes and Tropical Storms

The Hawaiian Islands are seasonally affected by Pacific hurricanes from June through November. On average, there are between four and five tropical cyclones observed in the Central Pacific every year. The state has been affected by significant hurricanes over the years. These include Hiki (1950), Nina (1957), Dot (1959), Iwa (1982), Iniki (1992), and Iselle (2014). According to a report presented at the International Union of Conservation of Nature World Conservation Congress, global climate change could mean that Hawaii may experience more frequent and more severe hurricanes in the future.

Lava Flow

The Proposed Action is located at the approximate boundary between the lava flows from Kohala and Mauna Kea. As shown in **Figure 17**, the Proposed Action is located at the approximate boundary of Lava Zone 8 and Lava Zone 9. Lava Zone 8 is the older part of the dormant volcano Mauna Kea. Only a few percent of the land in Lava Zone 8 has been covered by lava in the past 10,000 years. Lava Zone 9 is associated with Kohala, which last erupted over 60,000 years ago.

3.5.2 Potential Impacts

Construction

Construction of the Proposed Action would not create conditions that would exacerbate natural hazards. The County of Hawaii Civil Defense directs and coordinates the County's emergency preparedness and response program to ensure prompt and effective action when natural or man-caused disaster threatens or occurs anywhere in the County of Hawaii. Construction personnel would respond to any emergency messages or alerts, as appropriate, to ensure their safety during construction.

Under the No-Action Alternative, no construction activities would occur and there would be no change in existing conditions.

Operation

A small portion of Lindsey Road and Kawaihae Road are located in Flood Zone AE. Any development that occurs within Flood Zone AE cannot increase the water surface elevation of the base flood at any point when combined with all other existing and anticipated development (Hawaii County Code Section 27-18). The proposed development must be certified by a professional civil engineer licensed in the State of Hawaii, with supporting data, that the proposed development would not cause any increase in base flood elevations during the occurrence of the base flood discharge. The Proposed Action would comply with the requirements of Hawaii County Code Section 27-18; therefore, the Proposed Action is not expected to increase the area's exposure to flooding.

The project area has a very low risk of lava inundation but is in an area of high seismic activity. The Proposed Action would modify the existing roadways and would be constructed in compliance with current regulations and accepted design criteria and guidance to protect against impacts from earthquakes.

Under the No-Action Alternative, impacts associated with natural hazards would be the same as current conditions.

Figure 17. Lava Flow Hazard Zones

3.5.3 Avoidance and Minimization Measures

To minimize impacts associated with natural hazards, the Proposed Action would comply with the following:

- Hawaii County Code Section 27-18, Floodplain Management
- 2018 International Building Code

3.6 Water Resources

3.6.1 Affected Environment

Surface Waters and Wetlands

The Proposed Action is in the Waiulaula watershed. The area of the watershed is 74.3 square miles with maximum elevation of 13,609 feet. There is one stream within the proposed project area: Waikoloa Stream. Waikoloa Stream is crossed by Lindsey Road between Mamalahoa Highway and Kawaihae Road. The stream has a concrete bridge and culvert.

There are no wetlands within the project area.

Groundwater

Groundwater in Hawaii occurs in volcanic rock aquifers. In these aquifers, freshwater commonly occurs as a body of water called a freshwater lens that floats on saltwater and is separated from the saltwater by a zone of transition that contains brackish water. As shown in **Figure 18**, the Proposed Action overlays the Mahukona aquifer system within the Kohala aquifer sector. Aquifers in the Mahukona aquifer system are perched over Hawi Volcanics. Kawaihae port and the town of Waimea are the main economic centers. Surface water from the wettest part of the aquifer system in the mountains near Waimea is diverted for domestic and farm use. Wells supply domestic water to upscale subdivisions in the dry area between Kawaihae and Mahukona (Mink and Lau, 1993).

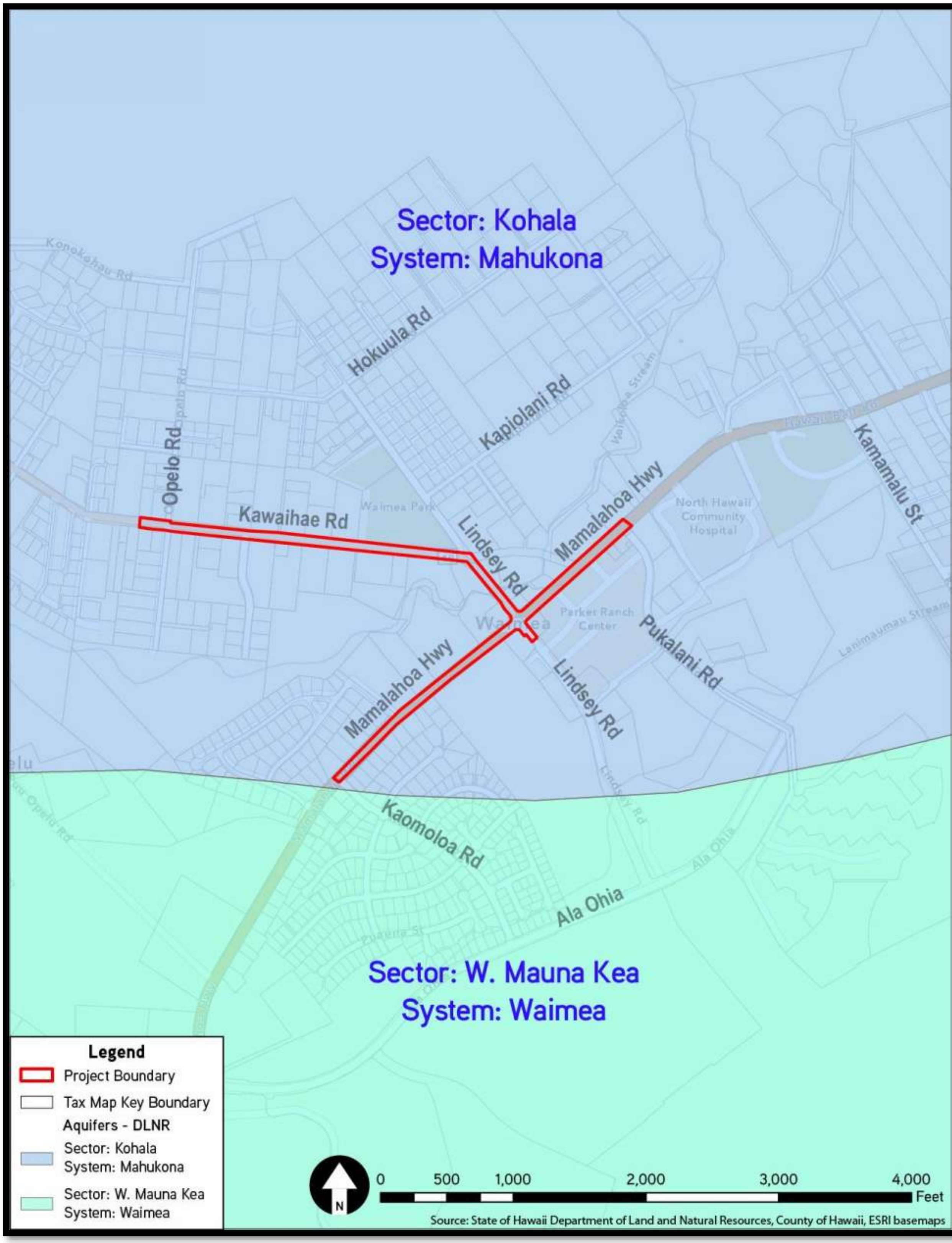
3.6.2 Potential Impacts

Construction

Construction of the Proposed Action may produce sediment from soil erosion during and after excavation. Contaminants associated with equipment during construction may impact surface water and groundwater. Construction plans and specifications would include BMPs to minimize erosion on the project site during and after construction, as well as measures to contain runoff on-site during construction. Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent areas and Waikoloa Stream. Therefore, impacts to water resources during the short-term construction period would be less than significant.

Under the No-Action Alternative, no construction activities would occur and therefore there would be no construction-related impacts.

Figure 18. DLNR Aquifers



Operation

Potential sources of pollution from the operation of roads include solids, heavy metals, and organics from fuels and motor oils. Stormwater flowing over impermeable surfaces may pick up petroleum residues and transport them off the roadway. Contaminated stormwater can degrade the quality of surface waters if they are nearby or filter through soils and degrade groundwater resources. The Proposed Action involves modifications to existing roadways and would not significantly increase the amount of impermeable surfaces. The increase in impermeable surfaces would be related to the construction of protected sidewalks and bikeways and would not increase travel lanes for vehicles. Therefore, the Proposed Action is not anticipated to have any significant adverse impacts on surface water or groundwater resources.

Under the No-Action Alternative, there would be no changes from existing conditions.

3.6.3 Avoidance and Minimization Measures

HDOT would obtain coverage under the NPDES General Permit for stormwater discharge associated with construction activities. As part of the permit process, HDOT would prepare a construction site BMP Plan that would include an erosion and sediment control plan, a site-specific plan to minimize erosion of soil and discharge of other pollutants into State waters, and descriptions of measures that would minimize the discharge of pollutants via stormwater after construction is complete.

BMPs would include some or more of the following measures:

- Watering or applying dust suppressants at active work areas and project access roads, as needed
- Installing dust screens or wind barriers around the construction site
- Installation of Filter Sock Perimeter Controls adjacent and down slope from disturbed areas
- Cleaning nearby pavements and paved roads after construction
- Covering open trucks carrying construction materials and debris
- Limiting areas to be disturbed at any given time
- Fueling of project-related vehicles and equipment would take place away from the aquatic environment. A contingency plan for accidental spills of petroleum products would be developed and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases.
- Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain.
- All deliberately exposed soil or under-layer materials used near water would be protected from erosion and stabilized as soon as possible with geotextile, filter fabric, vegetation matting, or hydroseeding.

3.7 Biological Resources

3.7.1 Affected Environment

A flora and fauna survey was conducted of the project area by Geometrician Associates in April 2020. This survey was undertaken to provide an assessment of the overall biological environment, the presence or absence of threatened and endangered species protected under the Endangered Species Act and/or HRS Chapter 195D, potential impacts of the Proposed Action, and to identify potential avoidance and minimization measures. The *Biological Survey* report is provided in **Appendix D**.

The field survey involved a full pedestrian botanical survey of the involved ROW, as well as an "over the fence" survey of plants on adjacent properties that had any potential to be impacted directly or indirectly by construction and operation. The objectives of the botanical survey were to:

- Describe the vegetation
- List all native plant species encountered
- Identify rare, threatened, or endangered plant species

The field survey also included a limited faunal survey focused on generating a list of birds and introduced mammals, reptiles, or amphibians observed during the botanical survey.

Flora

Vegetation in the vicinity of the Proposed Action has been completely transformed by removal of tree cover, planting with traditional Hawaiian crops, introduction and promotion of pasture grasses maintained by heavy cattle grazing, and urban development and landscaping. Vegetation in the project area is completed "managed" by vegetation control or landscaping. The only unmanaged vegetation within the project area is the riparian area adjacent to the Waikoloa Stream Bridge. In the area of the corridor, the stream has a concrete bridge and culvert. Plant species along the stream are all non-native.

[redacted]

Most of the vegetation in the project area is non-native; however, native plants have been deliberately planted as part of landscaping. The main native plant used in landscaping is the ohia tree. Several Polynesian introductions are also present in areas just outside the ROW, including kalo, kukui, and ti. There are no threatened or endangered plant species known within the project vicinity, and there is no critical plant habitat present. A full list of plant species identified within and adjacent to the project area is provided in **Table 36**.

Table 36. Plant Species Identified Within and Adjacent to the Project Area

Common Name	Scientific Name	Life Form	Status
Koa	*Acacia Koa*	Tree	E
Koaia	*Acacia Koaia*[1]	Tree	E
Kukui, Candlenut	*Aleurites moluccana*	Tree	P
Hapuu ii	*Cibotium menziesii*	Fern	E
Kalo, Taro	*Colocasia esculenta*	Shrub	P
Ki, Ti	*Cordyline fruticose*	Shrub	P
Pycreus	*Cyperus polystachyos*	Sedge	I
Kokio keokeo	*Hibiscus waimeae* ssp. *Waimeae*	Shrub	E
Uala, Sweet potato	*Ipomoea batatas*	Vine	P
Ohia	*Metrosideros polymorpha*	Tree	E
Kupukupu	*Nephrolepis cordifoloa*	Herb	I
Pohinahina	*Vitex rotundifolia*	Herb	I
Moa	*Psilotum nudum*	Fern Ally	I
Ko, Sugar cane	*Saccharum officinarum*	Herb	P
Ilima	*Sida fallax*	Shrub	I
Palaa	*Sphenomeris chinensis*	Fern	I

[1] Usually considered a subspecies of *Acacia koa*

E = Endemic; I = Indigenous; P = Polynesian introduction

Source: Geometrician Associates, April 2020

Fauna

Birds

Only a few species of birds were detected during the field survey, which are listed in **Table 37**. Most of these species are typical of those found in urban habitats near pastures.

Table 37. Bird Species Identified Within and Adjacent to the Project Area

Common Name	Scientific Name
Japanese white-eye	*Zosterops japonicus*
Mourning dove	*Zenaida macroura*
Zebra dove	*Geopelia striata*
Scaly-breasted munia	*Lonchura punctulata*
Common myna	*Acridotheres tristis*
House sparrow	*Passer domesticus*
House finch	*Carpodacus mexicanus*
African silverbill	*Lonchura cantans*
Domestic chicken	*Gallus gallus domesticus*
Pacific golden plover	*Pluvialis fulva*

Source: Geometrician Associates, April 2020

Mammals, Reptiles, and Amphibians

The only live mammals observed during the field survey were wild small Indian mongooses, domestic cats, and domestic dogs. Other mammals, including rats, mice, and pigs, are probably occasionally present in the project area.

No reptiles or amphibians were detected during the field survey; however, coqui frogs are likely to occur.

Invertebrates and Aquatic Fauna

No systematic survey of invertebrates was conducted given the low probability of the presence of threatened, endangered, or rare species and the low likelihood that project activities would adversely affect them.

Special Status Species

No listed or proposed threatened or endangered plant species were identified during the field survey. Since the project area is an urban corridor devoted to transportation, it is unlikely that listed or proposed threatened or endangered plant species would be found.

The Hawaiian hoary bat is ubiquitous throughout the Island of Hawaii and are presumed to be present within the project area. These bats are known to favor habitat near water bodies and forest/pasture interfaces, although they are also known to occur in villages and small cities. Bats may roost and forage for flying insects near the large grove of trees that are present *mauka* of the project area on the foothills of the Kohala Mountains. It is possible that they could roost in some of the trees and shrubs taller than 15 feet within and adjacent to the project area.

No individuals within the Solanaceae family were identified, including tree tobacco, the known host for the endangered Blackburn’s sphinx moth.

The riparian environment present around Waikoloa Stream is unlikely to have the endangered orangeblack damselfly or other endangered damselfies. The stream itself does have some value for transiting oopu alamoo fish.

3.7.2 Potential Impacts

Construction

Construction activities are unlikely to have impacts to fauna species since the project area is in an urban environment and species are accustomed to noise and human activity. There would be minimal vegetation removal for construction of the roundabout at the Lindsey Road and Kawaihae Road intersection.

Impacts to the endangered Hawaiian hoary bat could occur due to vegetation removal. During clearing, grubbing, or tree trimming/cutting, the removal of tall, woody vegetation can temporarily displace bats using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season from about June 1st to September 15th each year, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled.

Impacts to seabirds could occur from the use of nighttime lighting during construction and/or operation. Artificial lighting can adversely impact seabirds that may pass through the area at night causing disorientation which could result in collision with manmade objects or grounding of birds.

Aquatic species may be impacted by increased turbidity and sedimentation in Waikoloa Strem. Construction plans and specifications would include BMPs to minimize erosion on the project site during and after construction, as well as measures to contain runoff on site during construction. Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent areas and Waikoloa Stream. Therefore, impacts to aquatic species during construction would be less than significant.

Under the No-Action Alternative, no construction activities would occur and therefore there would be no construction-related impacts.

Operation

The Proposed Action would have no impacts to flora and fauna upon completion of construction.

Under the No-Action Alternative, there would be no changes from existing conditions.

3.7.3 Avoidance and Minimization Measures

The following measures would be implemented to minimize potential impacts to the Hawaiian hoary bat, seabirds, and aquatic fauna, and to avoid impacts related to the spread of Rapid Ohia Death.

Hawaiian hoary bat

To minimize impacts to the endangered Hawaiian hoary bat, no trees taller than 15 feet would be trimmed or removed between June 1st and September 15th when juvenile Hawaiian hoary bats that are not capable of flying may be roosting in the trees. In addition, the Proposed Action would not include the use of barbed wire.

Seabirds

To minimize impacts to seabirds, no construction lighting or unshielded equipment maintenance lighting would be used after dark between the months of April and October. All permanent lighting would be shielded in strict conformance with the Hawaii County Outdoor Lighting Ordinance (Hawaii County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

Aquatic Fauna

The following measures would be implemented to minimize impacts to water quality of Waikoloa Stream:

- Turbidity and siltation from project-related work would be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and curtailment of work during rainy weather conditions.
- No project related materials (fill, revetment rock, pipe, etc.) would be stockpiled in the water (stream channels, wetlands, etc.).
- Implementation of a litter-control plan and development of a Hazard Analysis and Critical Control Point Plan to prevent attraction and introduction of non-native species.

- Fueling of project-related vehicles and equipment would take place away from the aquatic environment. A contingency plan for accidental spills of petroleum products would be developed and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases.
- Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain.
- All deliberately exposed soil or under-layer materials used near water would be protected from erosion and stabilized as soon as possible with geotextile, filter fabric, vegetation matting, or hydroseeding.

Rapid Ohia Death

The following measures would be implemented to minimize the spread of Rapid Ohia Death:

- A survey of any locations where tree cutting may occur would be conducted within two weeks prior to tree cutting to determine if there are infected ohia trees. If infected trees are identified, the following measures would be implemented:
    - The U.S. Fish and Wildlife Service, University of Hawaii Cooperative Extension Service, U.S. Department of Agriculture (USDA) Forest Service, and USDA Agricultural Research Service would be contacted for further guidance.
- Both prior to cutting and after the project is complete, the following measures would be implemented:
    - Tools used for cutting infected ohia trees would be cleaned with a 70% rubbing alcohol solution or a freshly-prepared 10% solution of chlorine bleach and water as long as the tools are oiled afterwards. Chainsaw blades would be brushed clean.
    - Vehicles used off-road in infected areas will be thoroughly cleaned and tires and the undercarriage will be pressure washed with detergent.
    - Shoes and clothing worn in infected areas would be cleaned by dipping shoe soles in 70% rubbing alcohol and washing clothing in hot water with detergent.
    - Any ohia trees removed would be stacked and removed by onsite chipping conducted according to the latest protocol and disposed of in such a way that it does not spread Rapid Ohia Death.

3.8 Cultural and Historic Resources

3.8.1 Affected Environment

Cultural Resources

A Cultural Impact Assessment (CIA) was prepared by ASM Associates in March through May 2020. The CIA was conducted pursuant to Act 50 and in accordance with the Office of Environmental Quality Control's (OEQC) *Guidelines for Assessing Cultural Impacts,* adopted by the Environmental Council, State of Hawaii, on November 19, 1997.

A Cultural Impact Assessment for the Waimea Roadway Improvements Project is provided in **Appendix E** and includes the following:

- Introduction and general description of the project area
- Physical and cultural context of the project area, including prior archaeological and cultural studies conducted in the vicinity of the project area
- Methods and results of the consultation process
- Discussion of potential cultural impacts, as well as appropriate actions and strategies to mitigate any impacts

Traditional accounts generally describe the plains, the puu, the rains, the winds, and other culturally significant aspects of the Waimea area. Although these are natural phenomena, early historic accounts show an intimate connection between these features and the staunch, agriculturally industrious native people who called Waimea home. Both historic and modern-day descriptions identify Waimea as a city; however, traditionally Waimea was a kalana, a unique land division comprised of multiple traditional land units. Collectively, these land units contributed to the overall abundance and productivity of the Waimea area.

Archaeological and historical records show that the project area was used during Precontact and Early Historic times for a variety of traditional Hawaiian cultural activities and practices, including travel, residential, and subsistence production and procurement. By the late 1840s and early 1850s, the shift from the traditional land management system to private, fee-simple land ownership set the foundation for the expansion of Hawaii's ranching history, most notably the growth of Parker Ranch. Throughout the 19th century, Parker Ranch continued to expand its operations thereby further solidifying the paniolo-ranching lifestyle unique to Waimea.

By the turn of the 20th century and after the overthrow of the Hawaiian monarchy, the Territory of Hawaii established the Waimea Homestead in the areas north and southwest of the current project area. Kawaihae Road was realigned and incorporated into the homestead lots and Opelo Road was laid out. Lindsey Road was named in honor of the prolific Lindsey family who had long-standing ties to Waimea and Parker Ranch's beginnings.

With the onset of World War II, the population of Waimea grew to accommodate the influx of U.S. Marines stationed at Camp Tarawa. Pipelines to provide water to the camp were installed along all three roads in the project area. Several U.S. Army installations were located immediately adjacent to the project area, including a recreation field at the current location of Waimea Park, a main hospital in the converted Waimea Ranch Hotel building, and a hospital school at the junction of Lindsey Road and Mamalahoa Highway. Within a year of the Japanese surrender, the U.S. military had all but left the town, and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry.

While Parker Ranch and the paniolo-ranching lifestyle persist as the social and economic center of Waimea, new community infrastructure, including parks, have become a vital component of Waimea's development. Richard Smart, Parker Ranch's sixth generation heir set aside a parcel on the southwest corner of Lindsey Road and Kawaihae Road for the creation of Lanakila Park, named in honor of his maternal grandmother. The buildings occupying the lot were demolished in 1959, and the park was formally dedicated in 1962.

As a result of the consultation process, several culturally significant sites were identified:

- Manaua Rock: located west of and well beyond the project area boundary
- Poha of Wiliwiliwai: located southeast and well beyond the project area boundary
- Lalamilo-Waimea agricultural field system: encompassed the project area and nearby vicinity
- Historic dry-stacked stone wall: located on the boundary of Lanakila Park and the Annunciation Catholic Church property

The consultation process also identified ongoing cultural practices that take place within Waimea Park, specifically the annual Moku O Keawe Makahiki competitions and associated ceremonies. While this event is a more recent development, the practices and rituals of observing Makahiki is a long-standing traditional Hawaiian practice.

Historic Resources

Archaeological Literature Review and Field Inspection

An Archaeological Literature Review and Field Inspection (LRFI) was prepared by ASM Associates in March through May 2020. The LRFI was conducted to support this EA as well as HRS Chapter 6E review of the proposed project and included a literature search to identify known archaeological and historic properties within the vicinity of the project and an archaeological field inspection. The field inspection consisted of a visual inspection of 100% of the ground surface of the project area, plus a 10-foot buffer beyond the estimated project area boundary. The locations of any potential historic properties were noted, and photographs were taken of the potential historic properties and the project area. *An Archaeological Literature Review and Field Inspection for the Waimea Roadway Improvements Project* is provided in **Appendix F**.

The results of the literature search show that archaeological studies in Waimea have identified surface and subsurface archaeological sites and features associated with Hawaiian occupation of the Waimea Plain dating from the 1400s through the 20th century, along with deposits left by ranching activity and World War II-era military activities at Camp Tarawa. Subsurface historic properties have been identified in the vicinity of the project area. These include habitation sites and both Precontact and Historic period burials with little or no surface indications.

Most of the project area consists of existing paved roads and adjacent unpaved portions of the ROW. Any above-ground historic properties in the unpaved shoulders of the road would most likely be rock walls, although other ranching-related features are possible.

Lanakila Park is a former kuleana parcel that is known to have been a house lot occupied at least as early as the mid-19th century and almost certainly earlier than that. During the 20th century this parcel was developed, gradually acquiring five buildings used for lodging and a variety of commercial activities. Two of these buildings were demolished for the creation of Lanakila Park. No other aboveground historic features other than those built for the par, some of which date to the mid-1960s, are anticipated on this parcel. It is possible that subsurface deposits associated with the Historic period use of the parcel may have survived the ground disturbance associated with the park's construction.

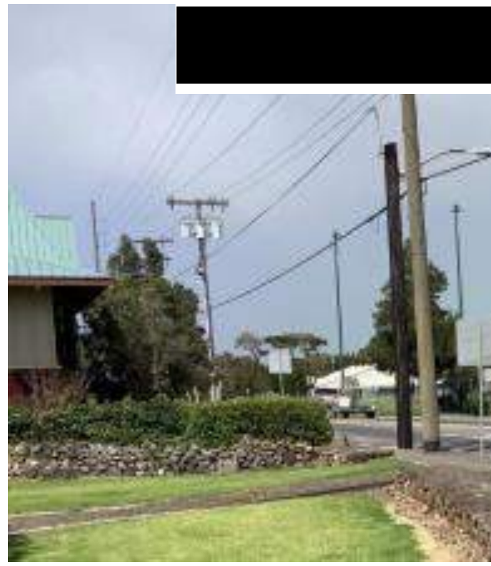
The field inspection was conducted on March 6, 2020. No historic properties of any kind were observed within the project area within the existing ROW for Lindsey Road, Kawaihae Road, or Mamalahoa Highway. The project area on both sides of Kawaihae Road and Opelo Road have been disturbed by roadside improvements to facilitate drainage and access to businesses located along the road. The

Mamalahoa Highway portion of the project area is even more developed with modern concrete sidewalks on either side of the roadway. No historic features of Mamalahoa Highway (Site 30187) were observed.

Two historic features were identified during the field inspection on TMK (3) 6-5-003:005. With respect to the potential for subsurface archaeological and historic properties, prior studies in the area have shown that the ability to predict the locations of buried sites lacking surface features is limited.

- **Dry-Stacked Rock Wall:** Located on the boundary between Lanakila Park and the Annunciation Catholic Church parcel.
- **Lanakila Park Cobble-paved Walkway and Rock Wall:** The park was originally constructed in 1962, and thus the age of the park qualifies it as a historic property as defined by HRS Chapter 6E-2. There are two structures within the park and within the project area that meet the 50-year historic threshold: cobble-paved walkway and rock wall located along Lindsey Road.

[redacted]



[redacted]

[redacted]

Archaeological Inventory Survey

HDOT consulted with the State Historic Preservation Division (SHPD) under HRS Chapter 6E-8 in a letter dated June 30, 2021, regarding project effects to Lanakila Park and/or the need for any additional surveys and/or monitoring. In a letter dated August 24, 2021, SHPD requested that an archaeological inventory survey (AIS) with a subsurface testing component be conducted and that an AIS report meeting the requirements of HAR Section 13-276-5 be submitted to SHPD for review and acceptance prior to initiation of project related work.

An AIS was conducted by ASM Affiliates and included subsurface testing which was conducted on March 25, 2022. *An Archaeological Inventory Survey for the Waimea Roadway Improvements Project* is located in **Appendix F**.

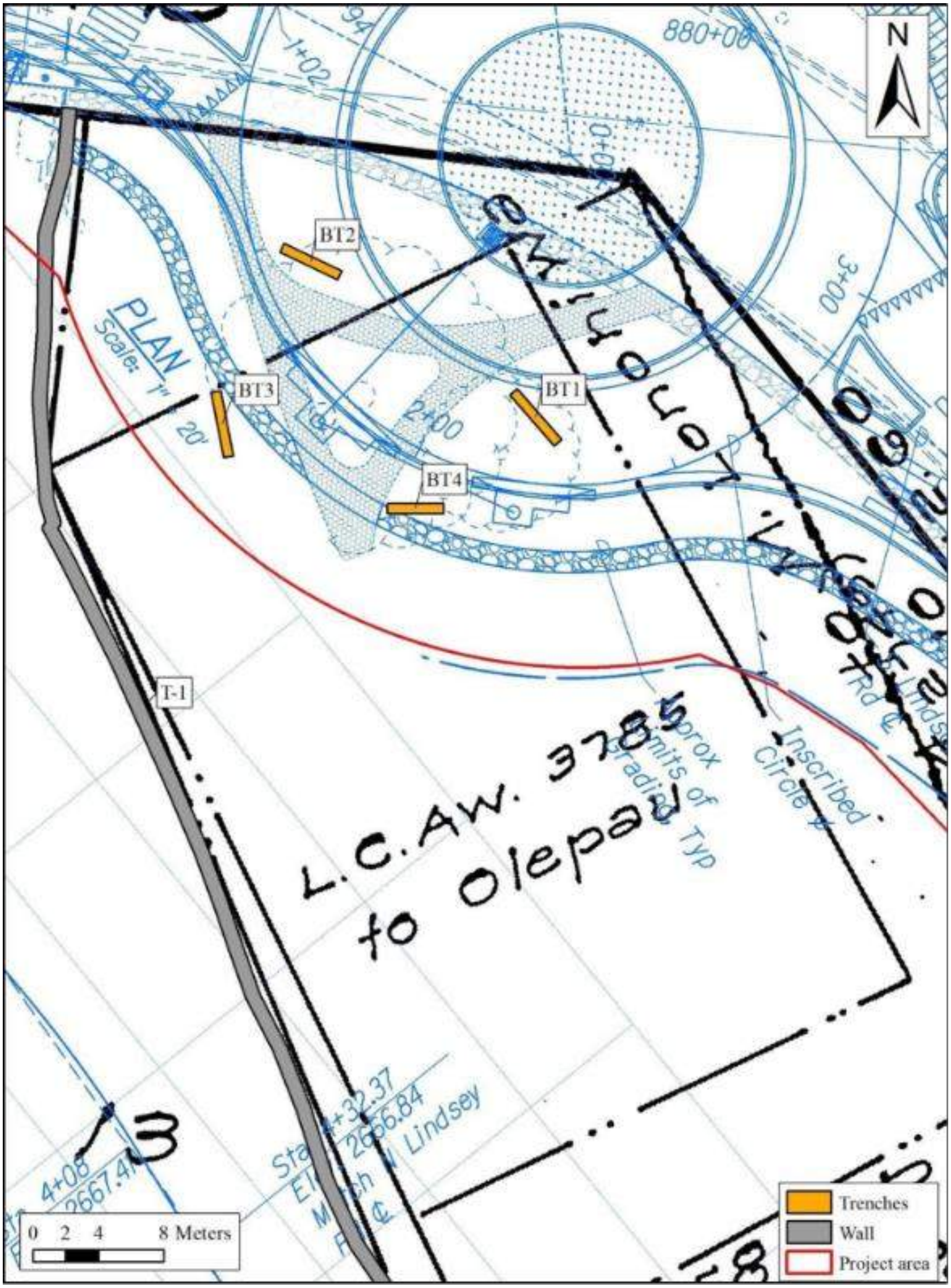
The purpose of the subsurface testing was to identify subsurface archaeological features. Of particular concern was the mapped located of the former Kuleana parcel (LCAw. 3479 to Olepau) where it was considered possible that buried deposits associated with the Kuleana and a historically documented pahale may be found. Four backhoe trenches were placed within the Kuleana where ground disturbance associated with the Proposed Action would occur, as shown in **Figure 19**.

The AIS identified one subsurface historic property:

- **Site 50-10-06-T-1:** A multi-component site containing architectural and archaeological features representing two distinct periods of land use during the 20th century.
    - The older component of the site is a buried rubbish deposit associated with residential and commercial use of the parcel between the 1920s and the 1940s. The site occupies almost the entire 1.04-acre parcel, extending across an area measuring approximately 80 meters (north to south) by 50 meters (east to west). The deposit was encountered during subsurface testing in BT-3 at depths between 107 and 230 centimeters below the ground surface, with an estimated horizontal extent of 165 centimeters by 165 centimeters. Cultural material recovered from the deposit in BT-3 consisted primarily of discarded glass containers associated with the consumption of beverages and food, along with household products. Other artifacts included fragments of ceramic tableware, kitchen tools, and household furnishing. A total of 226 articles were sampled. The overall impression is that the deposit is a trash dump used by the inhabitants of one of the residences known to have been located on the parcel.
    - The younger component of the site is Lanakila Park, which was constructed in 1962 and is discussed above.

Subsurface testing did not identify any deposits that could be associated with the pahale known to have been located within the Kuleana parcel.

Figure 19. Location of Backhoe Trenches within Kuleana Parcel



The recorded archaeological site was assessed for its significance based on criteria established and promoted by SHP and contained in HAR Section 13-275-6. For a resource to be considered significant, it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a. Be associated with events that have made an important contribution to the broad patterns of our history.
b. Be associated with the lives of persons important in our past.
c. Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value.
d. Have yielded, or is likely to yield, information important for research on prehistory or history.
e. Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts – these associations being important to the group's history or cultural identity.

Site 50-10-06-T-1 is assessed to be significant under Criterion d for the information yielded during the AIS. Of the 226 artifacts sampled, 121 were temporally diagnostic and manufacturing dates could be determined. These dates were determined primarily from makers marks on ceramics and bottles. Sources for this dating information included the Society for Historic Archaeology's bottle identification web page (Lindsey 2014), ceramics dating references (e.g., Allen et al. 2013; Choy 2014; Ross and Campbell 2022), online newspaper advertisements, and ASM Affiliate's reference collection. Of the datable artifacts, nearly all of them were or were likely, manufactured during the second half of the 1930s. This is especially true for glass containers, of which 59 were marked with manufacturing dates between 1930 and 1939. The ages of the remainder of the datable artifacts could only be determined to age ranges spanning five years to several decades, but none older than about 1906 (in this case, Dai Nippon beer bottles which can only be dated between 1906 and 1941). No artifacts potentially dated later than 1950, and very few potentially dated later than 1941.

Based on the analysis of the artifacts sampled, the site is adequately documented, and no further work is recommended. HDOT submitted the AIS report to SHPD in a letter dated September 12, 2022. In a letter dated March 28, 2023, SHPD requested a Reconnaissance Level Survey (RLS) Report for Lanakila Park. HDOT is currently completing an RLS Report and will continue coordinating with SHPD on a determination.

3.8.2 Potential Impacts

Construction

Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style. Additional potential impacts will be identified upon the completion of the RLS Report.

Under the No-Action Alternative, no construction activities would occur; therefore, there would be no impacts to archaeological or historic resources.

Operation

The Proposed Action includes modifications to existing roadways. These roads would continue to be used as they are under current conditions and there would be no impacts to archaeological and historic resources upon completion of construction.

Under the No-Action Alternative, there would be no changes from existing conditions.

3.8.3 Avoidance and Minimization Measures

HDOT is currently consulting with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

3.9 Socioeconomics and Environmental Justice

3.9.1 Affected Environment

Title VI/Environmental Justice

HDOT is a recipient of Federal financial assistance and is required to comply with various nondiscrimination laws and regulations, the focal point of which is Title VI of the Civil Rights Act of 1964. Title VI bars discrimination against anyone in the United States because of race, color, or national origin by any agency receiving Federal funds. An important component of the HDOT Title VI program is the commitment to developing and implementing environmental justice strategies.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. FHWA identifies environmental justice populations as the following:

- **Low-Income:** A person whose median income is at or below the Department of Health and Human Services poverty guidelines.
- **Minority:** A person who is black, Hispanic/Latino, Asian American, American Indian or Alaskan Native, and Native Hawaiian and Other Pacific Islander.

The FHWA states that the U.S. Department of Transportation is committed to following the principles of environmental justice, which include the following:

- To avoid, minimize, or mitigate disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority and low-income populations.

- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

Due to Hawaii's diverse population, environmental justice populations are based on the following:

- **Low-Income:** Percent of households below the poverty line is higher than the overall county.
- **Minority:** The minority population is over the county's mean minority population.

Population and Demographics

The overall population of Hawaii County has exhibited relatively stable growth over the past few decades. The population of Hawaii County in 1990 was 120,317; the population in 2000 was 148,677; and the population in 2010 was 185,079. There was a 23.6% increase in population between 1990 and 2000 and a 24.5% increase between 2000 and 2010.

The Proposed Action is located in the Waimea Census Designated Place (CDP). As shown in **Table 38**, the Waimea CDP has a lower percentage of those classified as white alone (i.e., non-minority) (31.2%) than the County of Hawaii (33.7%). Therefore, the Waimea CDP meets the environmental justice criteria based on minority status.

Table 38. Race and Minority Characteristics of the Project Area Compared to the State of Hawaii and County of Hawaii (2010)

	County of Hawaii	Waimea CDP
Total	185,079	**9,212**
Population of one race	130,544 70.5%	6,078 66.0%
White Alone	62,348 33.7%	2,878 31.2%
Black or African American	1,020 0.6%	30 0.3%
American Indian or Alaska Native	869 0.5%	22 0.2%
Asian	41,050 22.2%	1,597 17.3%
Native Hawaiian and Other Pacific Islander	22,389 12.1%	1,456 15.8%
Some other race	2,868 1.5%	95 1.0%
Two or more races	54,535 29.5%	3,134 34.0%

Source: U.S. Census Bureau, 2019

Income and Economy

Waimea includes a wide variety of economic activities, such as tourism, agriculture, and ranching. The major businesses in Waimea are the Parker Ranch and two observatories: W.M. Keck Observatory and Canada France Hawaii Telescope. There is a local hospital and retail facilities that attract patrons from the northern areas of the island, including the North Kohala District, Hamakua District, and South Kohala District. Waimea has a wide variety of stores and services, including two shopping centers anchored by supermarkets. Smaller shopping centers offer antiques, art galleries, and furnishings. Tourism is supported by activities on ranch land and locally owned restaurants.

As shown in **Table 39**, the Waimea CDP has a higher household income and lower poverty rate than the county. Therefore, the Waimea CDP does not meet the environmental justice criteria based on income.

Table 39. Household Income and Poverty Rate (2018)

	County of Hawaii	Waimea CDP
Median Household Income	$62,409	$91,074
Poverty Rate	15.6%	10.3%
Source: U.S. Census Bureau, 2019		

3.9.2 Potential Impacts

Construction

Construction of the Proposed Action would require the County of Hawaii to provide the State of Hawaii with interim jurisdiction of the portions of Mamalahoa Highway, Lindsey Road, and Kawaihae Road within the project area.

Under the No-Action Alternative, no construction would occur and an interim jurisdiction change for portions of Mamalahoa Highway, Lindsey Road, and Kawaihae Road would not be required.

Operation

The Proposed Action involves improvements to existing roadways within Waimea Town. The primary impact on socioeconomic conditions from the Proposed Action would be a reduction in travel time through Waimea Town as discussed in **Section 2.3.2**, which would provide residents and visitors improved access within town. In addition, the Proposed Action would increase the multimodal network in the heart of Waimea Town, which could increase quality of life for Waimea residents and visitors. The Proposed Action would not affect the area's population or cause economic strain. The Proposed Action would not have adverse impacts on the socioeconomic characteristics of the area and could have beneficial impacts on quality of life.

The Proposed Action is located in an area with a higher household income and lower poverty rate than the county; therefore, the Proposed Action does not meet the environmental justice criteria based on income. While the Proposed Action is located within a community with a higher percentage of minorities than the county (i.e., meets the environmental justice criteria based on minority status), it would not disproportionately affect the community in an adverse manner. Benefits would include a safer roadway, ease of mobility, and would increase the multimodal network in the heart of Waimea Town, thereby enhancing the quality of life for Title VI populations.

Under the No-Action Alternative, there would be no changes from existing conditions. Traffic congestion within the heart of Waimea Town would remain as-is and travel times would continue to increase over time. There would be no increase in the multimodal network in Waimea Town.

3.9.3 Avoidance and Minimization Measures

No avoidance or minimization measures are proposed or expected to be required.

3.10 Public Facilities and Services

3.10.1 Affected Environment

Schools

As shown in **Figure 20**, there are four schools within the vicinity of the Proposed Action: Waimea Elementary School, Parker School, Waimea Country School, Hawaii Preparatory Academy, and Montessori Education Center of Hawaii.

- **Waimea Elementary School:** Waimea Elementary School is a kindergarten (K) through 5th grade public school located on Mamalahoa Highway at the west end of the project area. The student population at the school during the 2018-2019 school year was 505 (HIDOE, 2019). The entrance to the school is located on Mamalahoa Highway.
- **Waimea Middle Public Conversion Charter School (PCS):** Waimea Middle PCS serves grades 6-8. The student population is 258 (SPCSC, 2020). The school is located behind Waimea Elementary School and is accessed from Mamalahoa Highway.
- **Parker School:** Parker School is a private school that services kindergarten through 12th grade. The school is divided into Lower School (K – 5), Middle School (6-8), and Upper School (9-12). There are 314 students that attend the school (Schoolyard, 2020). The school is located at the Lindsey Road and Kawaihae Road intersection, and the entrance to the Lower School parking lot and student drop off/pick up is on Lindsey Road.
- **Waimea Country School:** Waimea Country School is a small, independent elementary school serving grades K-5. The school is located on Kawaihae Road approximately 450 feet west of the Kawaihae Road and Lindsey Road intersection.
- **Hawaii Preparatory Academy:** Hawaii Preparatory Academy is a K-12 co-ed day and boarding school in Waimea. The Lower and Middle Schools are located on Kawaihae Road between Lindsey Road and Opelo Road. The Upper School is located on Kohala Mountain Road west of the project area. The school serves approximately 600 students per school year, with 200 in Lower and Middle Schools (100% day school) and 400 in Upper School (50% day school, 50% boarding) (HPA, 2020).

Police, Fire, and Medical Services

The County of Hawaii Police Department is divided into two patrol districts: Area I (East Hawaii) and Area II (West Hawaii). Waimea is located in the South Kohala District of Area II, which has a service area of 688 square miles between the North Kohala District at Kiowa and the Kona District at Kauai Point. The police station is located at 67-5185 Kamamalu Street in Waimea, which is approximately 0.5 mile east of the project area (see **Figure 21**). During fiscal year 2017-2018, police officers conducted 128 major traffic investigations and 458 minor traffic investigations for a total of 586 collisions. In addition, officers respond to burglary and theft calls, conduct drug investigations, and provide traffic enforcement (HPD, 2018).

The County of Hawaii Fire Department is primarily responsible for fire protection and suppression, pre-hospital emergency medical services, land and sea search and rescue, hazardous materials response, ocean safety, and fire prevention and public education for the County of Hawaii. The Waimea Fire Station (West Battalion, Station No. 9) provides fire protection and suppression services in Waimea. The station is located at 67-5175 Kamamalu Street in Waimea, which is on the east end of the project area (see **Figure 21**). Backup support is provided by Engine Company No. 14 in South Kohala.

The North Hawaii Community Hospital is a full-service acute care hospital located at 67-1125 Mamalahoa Highway approximately 0.3 mile east of the project area. The hospital serves approximately 30,000 residents and visitors of the northern region of the island of Hawaii, which includes the North and South Kohala Districts and portions of the Hamakua and North Kona Districts.

Recreational Facilities

As shown in **Figure 22**, there are two parks within the proposed project area: Lanakila Park and Waimea Park. There is one park within the vicinity of the project area: Waimea Nature Park.

- **Lanakila Park:** Lanakila Park is located on the west side of Lindsey Road at the intersection with Kawaihae Road. The park totals 1.04 acres and was created by Richard Smart and named in honor of his maternal grandmother. The park was formally dedicated in 1962. The park contains a short walking path and a gazebo.
- **Waimea Park:** Waimea Park is located on the north side of Kawaihae Road at the intersection with Lindsey Road. The park totals 10.5 acres and serves as Waimea's recreation center with a community center, playfields, tennis courts, skate park, basketball court, and playground. Parking is available along the northern section of Lindsey Road.
- **Waimea Nature Park:** The Waimea Nature Park (Ulu Laau) is a natural preserve located on 10 acres in the heart of Waimea along Waikoloa Stream west of the project area. The park provides an area for peaceful recreation, as well as a place where residents and visitors can learn about the native plants of Hawaii. The park is a popular place for dog walking.

3.10.2 Potential Impacts

Construction

Construction of the Proposed Action would require lane closures on Mamalahoa Highway, Lindsey Road, and Kawaihae Road, which would cause changes to traffic patterns, traffic volumes, and travel times. The arrival and departure of construction equipment and crews may cause short-term increase in traffic volume and traffic delays. Traffic signs and controls would be posted, as appropriate, to reduce traffic flow delays and potential hazards from reduced visibility. Signage would inform roadway users of reduced speed limits in construction zones and potential traffic delays. A maintenance of traffic (MOT) plan would be prepared prior to the start of construction. The MOT plan would include provisions to ensure access to schools, parks, homes, and businesses, as well as maintain access for emergency vehicles. Impacts during construction of the Proposed Action would be short-term and temporary.

Under the No-Action Alternative, no construction would occur and there would be no impacts to public facilities and services.

Figure 20. Schools within the Vicinity of the Proposed Action

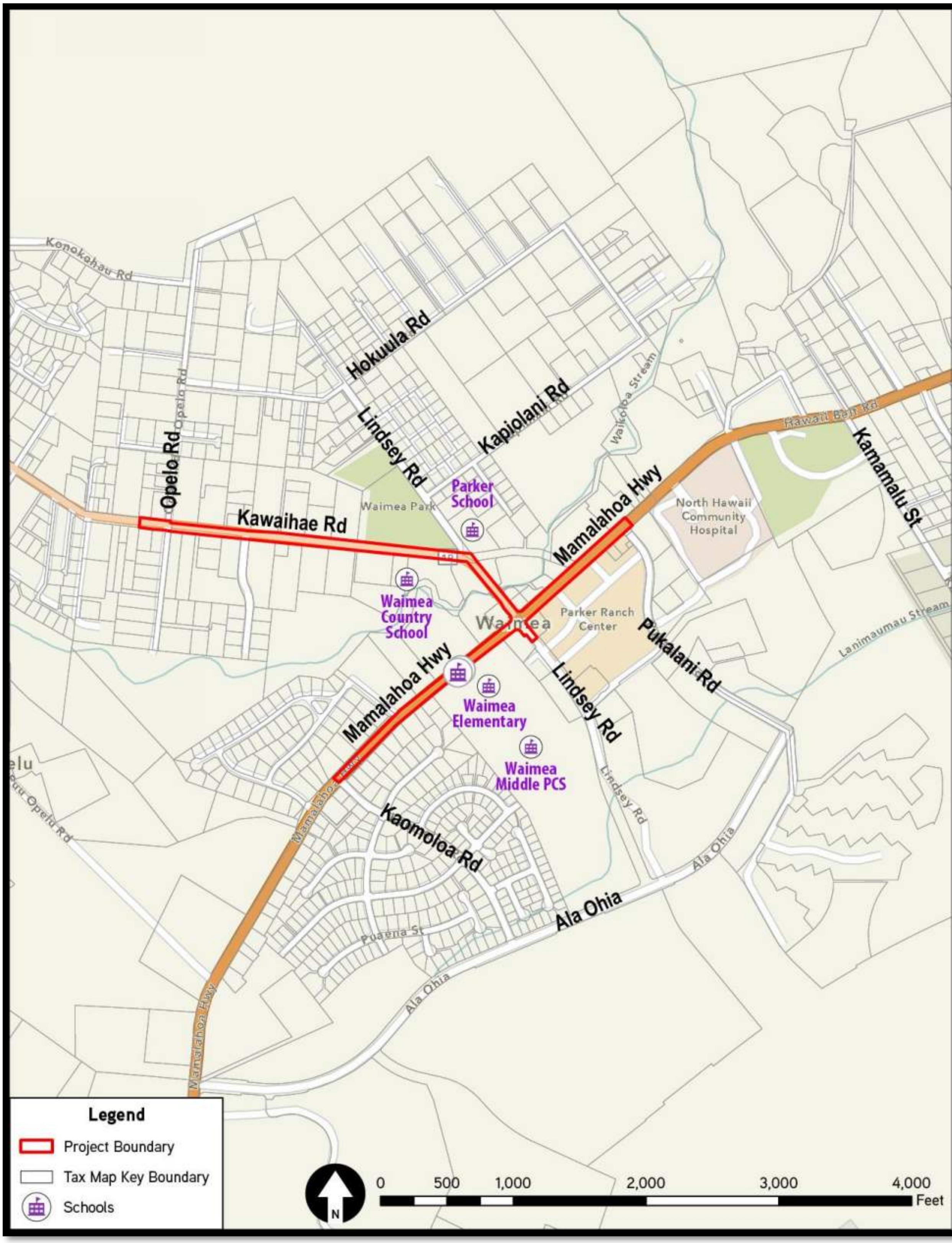
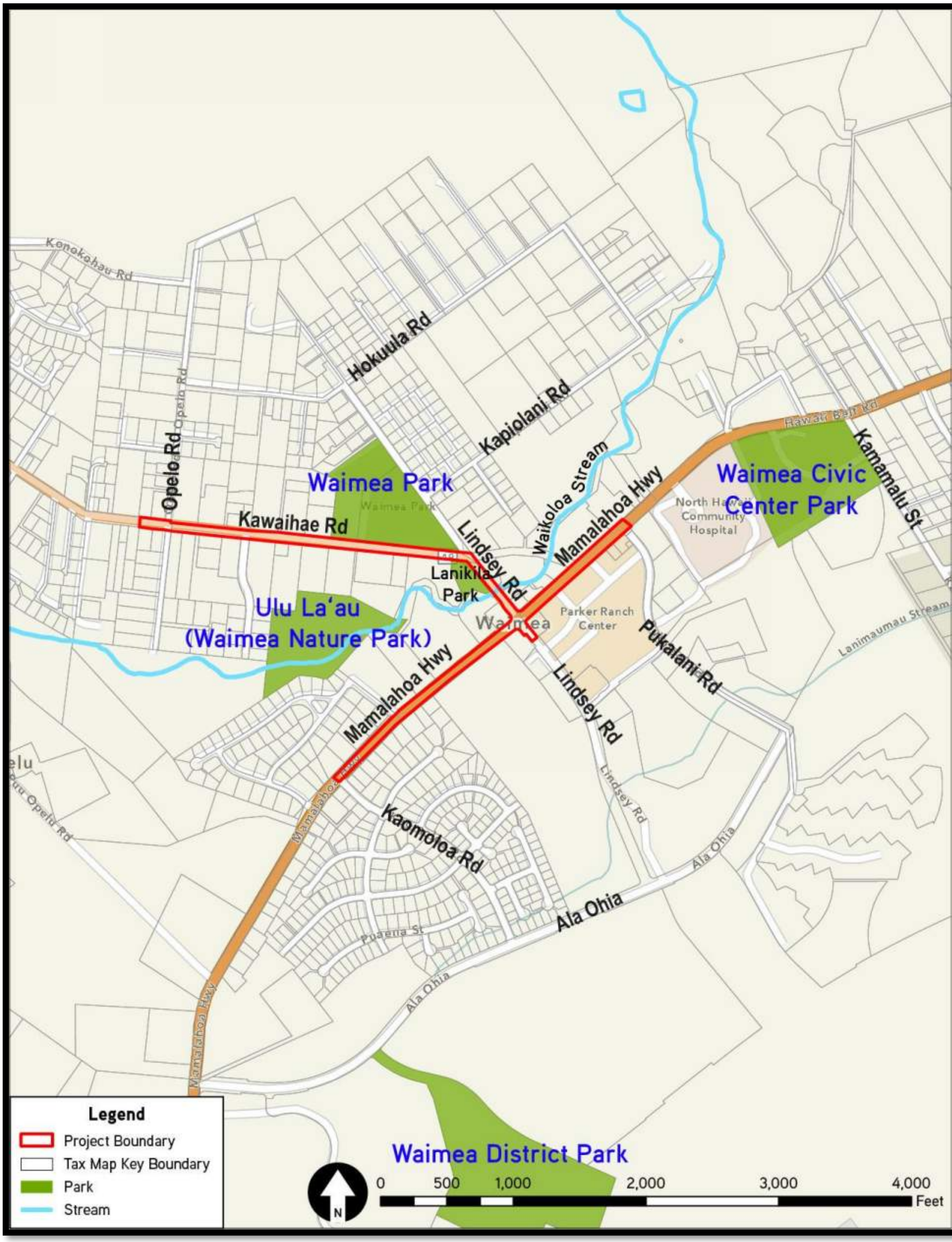


Figure 21. Police and Fire Stations

Figure 22. Parks and Recreation Areas



3.10.3 Operation

The Proposed Action would improve safety and reduce congestion through the heart of Waimea Town. The Proposed Action would not affect area population or introduce new school-aged children to the area; therefore, no additional demands would be placed on Department of Education facilities. The proposed multimodal improvements would benefit parents and children by providing safe access to schools within the project area.

The Proposed Action would also benefit police, fire, and medical services by improving traffic flow in the heart of Waimea Town. The Proposed Action would reduce travel times through town as discussed in **Section 2.3.2**, which would reduce response times for emergency vehicles. The Proposed Action would also improve safety, which would reduce automobile accidents and associated emergency vehicle response needs.

The following impacts to parks and recreational facilities would occur with the Proposed Action:

- The Proposed Action would result in the acquisition and loss of approximately 0.21 acre of Lanakila Park. There would be no change to the use of the park.
- The Proposed Action would result in the acquisition of 175 square feet of Waimea Park. The area to be acquired is not within the improved area of the park and would not have adverse impacts to the use of the park.
- There would be no direct impacts to Waimea Nature Park.

The Proposed Action would increase the multimodal network in the heart of Waimea Town, which would provide better access to the parks.

Impacts to public facilities and services are expected to be primarily beneficial.

Under the No-Action Alternative, there would be no changes from existing conditions.

3.10.4 Avoidance and Minimization Measures

A MOT plan would be prepared prior to the start of construction, which would include provisions to ensure access to schools, parks, homes, and businesses, as well as maintain access for emergency vehicles. No other avoidance or minimization measures are proposed or expected to be required.

3.11 Secondary Impacts

Secondary impacts are those effects that are caused by an action and are later in time or farther removed in distance but are reasonably foreseeable. They may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water or other natural systems. The Proposed Action would not involve a change in land use and would not induce growth. Therefore, the Proposed Action would not have secondary impacts.

3.12 Cumulative Impacts

Cumulative impacts refer to the impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant impacts taking place over time.

As discussed in **Section 1.2.3**, there are five other transportation projects in various degrees of planning within the project area:

- Waiaka Bridge Project/Kawaihae Road (State Route [SR] 19) and Kohala Mountain Road (SR 150)
- Parker Ranch Connector Road
- Lindsey Road Extension
- Ala Ohia Road Extension
- Waimea Trails and Greenway (*Ke Ala Kahawai O Waimea*)

In addition, as part of the PEL process a mini-bypass was identified. HDOT plans to construct the mini-bypass at a later date when funding becomes available. Cumulatively, these projects would increase circulation and the multimodal network in Waimea Town, which would improve travel within and through Waimea Town.

All projects would be required to comply with HRS Chapter 343 and the National Environmental Policy Act, as applicable, to ensure that impacts to resources are minimized and/or mitigated to the extent practicable.

4.0 RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

4.1 State Planning Documents

4.1.1 The Hawaii State Plan

The Hawaii State Plan, codified as HRS Chapter 226, provides goals, objectives, policies, and priorities for the State. The Hawaii State Plan also provides a basis for determining priorities, allocating limited resource, and improving coordination of State and County plans, policies, programs, projects, and regulatory activities. It establishes a set of themes, goals, objectives, and policies that are meant to guide the State's long-range growth and development activities. The Proposed Action is consistent with the following applicable objectives and policies:

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 Hawaii's land-based, shoreline, and marine resources.
    (2) Effective protection of Hawaii'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:
    (3) Take into account the physical attributes of areas when planning and designing activities and facilities.
    (6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.
    (8) Pursue compatible relationships among activities, facilities, and natural resources.

<u>Discussion</u>: The Proposed Action is located inland away from shoreline and marine resources. The Proposed Action would include earth-moving activities but would not include any work within existing streams or waterways. To protect shoreline and marine resources from adverse impacts associated with water quality, the State of Hawaii has adopted water quality standards. Generally, these standards require submittal and adherence to the conditions in a NPDES permit, which requires compliance with BMPs during construction to minimize soil erosion into adjacent waterways and to maintain water quality during operation. A NPDES permit would be required for the Proposed Action.

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 Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.
(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:
    (1) Promote the preservation and restoration of significant natural and historic resources.

(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.

Discussion: The Proposed Action is located inland in a built environment and would not have any impact on scenic, or natural beauty resources.

As discussed in **Section 3.8**, the Proposed Action may impact Site 50-10-06-T-1, a multi-component site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early 20th century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- Archaeological monitoring would occur during construction, if required by SHPD.
- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

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 Hawaii'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:
   (4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.
   (6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

Discussion: The Proposed Action would improve safety and reduce congestion in the heart of Waimea Town. Congestion relief can contribute to improvements in air quality by reducing travel delays, engine idle time, and unproductive fuel consumption. The addition of pedestrian and bicycle facilities would encourage more people to travel short distances in town by modes other than motor vehicles, which would also contribute to improvements in air quality.

The State of Hawaii has adopted water quality standards. Generally, these standards require submittal and adherence to the conditions in a NPDES permit, which requires compliance with BMPs during construction to minimize soil erosion into adjacent waterways and to maintain water quality during operation. A NPDES permit would be required for the Proposed Action.

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

(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.
(b) To achieve the general facility systems objective, it shall be the policy of this State to:
    (4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.

Discussion: The 2019 Hawaii State Legislative Session enacted an additional increase of $2 per day to the vehicle rental surcharge tax to fund highway capacity and congestion projects. The additional revenue generated will be bonded and allow HDOT to fund needed capacity and congestion projects. Based upon the bonding authorization and project apportionment, the total funds available for this project over time is estimated at $65M, though the initial apportionment available is estimated at $20M. This source of funding, which is a state tax, is an excellent one for implementing the recommended alternatives of the Waimea Regional Safety Study.

The County of Hawaii has approved a General Excise Tax surcharge of 0.5 percent dedicated to transit, roadway, and other transportation needs in the county. It is expected that these two funding resources would be used for the Proposed Action.

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

(b) 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 through the state.
(c) To achieve the transportation objectives, it shall be the policy of this State to:
    (1) Design, program, and develop a multi-modal 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.
    (4) Provide for improved accessibility to shipping, docking, and storage facilities.
    (6) Encourage transportation systems that serve to accommodate present and future development needs of communities.
    (11) Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation.
    (13) Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency.

Discussion: The Proposed Action includes multimodal safety and operations improvements to existing roadways within the town of Waimea. The installation of dedicated bicycle and pedestrian facilities would encourage greater use of those modes which are now under-represented due to real and perceived safety problems. In addition, the Proposed Action would reduce congestion in the heart of Waimea Town.

Freight trucks utilize Kawaihae Road and Mamalahoa Highway to deliver goods to Waimea, as well as to go to/from Kawaihae Harbor and Hilo Harbor. The Proposed Action would improve accessibility to shipping, docking, and storage facilities by reducing travel times.

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:
    (3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.
    (5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.
    (6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.

Discussion: The Proposed Action includes multimodal safety and operations improvements to existing roadways within the town of Waimea. The installation of dedicated bicycle and pedestrian facilities would encourage greater use of those modes which are now under-represented due to real and perceived safety problems.

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.
(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.

Discussion: The Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations.

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:

(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;
(10) Encourage planning and management of the natural and built environments that effectively integrate climate change policy.

Discussion: The Proposed Action would reduce congestion through intersection improvements and installation of bicycle and pedestrian facilities. Congestion relief can contribute to improvements in air quality by reducing travel delays, engine idle time, and unproductive fuel consumption. The addition of pedestrian and bicycle facilities would encourage more people to travel short distances in town by modes other than motor vehicles, which would also contribute to improvements in air quality. Improvements to air quality through the reduction of greenhouse gases will assist with lessening climate change.

Climate change can lead to increased fire risk from droughts, higher winds from more frequent hurricanes, and greater runoff from more intense rainfall. The Proposed Action would be designed with these considerations.

The following themes of Part I of the Hawaii State Plan are not applicable to the Proposed Action for the following reasons:

- **Section 226-5.** Objective and policies for population: The Proposed Action would not result in population growth.
- **Section 226-6.** Objectives and policies for the economy – in general: The Proposed Action would not result in increased and diversified employment opportunities other than the temporary construction jobs.
- **Section 226-7.** Objectives and policies for the economy – agriculture. The Proposed Action would improve existing roadways within an urban area; thus, the Proposed Action would not impact agriculture.
- **Section 226-8.** Objective and policies for the economy – visitor industry: The Proposed Action does not involve the visitor industry.
- **Section 226-9.** Objective and policies for the economy – federal expenditures: The Proposed Action does not include the use of federal funds.
- **Section 226-10.** Objective and policies for the economy – potential growth and innovative activities: The Proposed Action does not include opportunities for investment or employment growth.
- **Section 226-10.5.** Objective and policies for the economy – information industry: The Proposed Action does not include nor impact telecommunications or information technology resources.
- **Section 226-15.** Objective and policies for facility systems – solid and liquid wastes. The Proposed Action does not include development of solid or liquid waste facilities.
- **Section 226-16.** Objective and policies for facility systems – water. The Proposed Action does not include development or use of water supply systems.
- **Section 226-18.** Objectives and policies for facility systems – energy. The Proposed Action does not involve energy generation.
- **Section 226-18.5.** Objective and policies for facility systems – telecommunications. The Proposed Action does not include new telecommunication facilities.

- **Section 226-19.** Objectives and policies for socio-cultural advancement – housing. The Proposed Action does not include development of housing.
- **Section 226-20.** Objectives and policies for socio-cultural advancement – health. The Proposed Action does not include health facilities or services.
- **Section 226-21.** Objectives and policies for socio-cultural advancement – education. The Proposed Action does not include educational programs or facilities.
- **Section 226-22.** Objectives and policies for socio-cultural advancement – social services. The Proposed Action does not include social services or activities.
- **Section 226-24.** Objectives and policies for socio-cultural advancement – individual rights and personal well-being. The Proposed Action would have no impact to personal rights and personal well-being.
- **Section 226-25.** Objectives and policies for socio-cultural advancement – culture. The Proposed Action would have no impacts to cultural identities, traditions, values, customs, and arts of Hawaii's people.
- **Section 226-27.** Objectives and policies for sociocultural advancement – government. The Proposed Action would have no impact on government services.

The themes of Part II of the Hawaii State Plan are not applicable to the Proposed Action since the Proposed Action does not involve the preparation of planning documents.

The following themes of Part III of the Hawaii State Plan are not applicable to the Proposed Action for the following reasons:

- **Section 226-103.** Economic priority guidelines. The Proposed Action would not stimulate economic growth or encourage business expansion and development, including the sugar and pineapple industries, diversified agriculture and aquaculture, water use and development, energy use and development, the information industry, or the visitor industry.
- **Section 226-104.** Population growth and land resources priority guidelines. The Proposed Action would not result in population growth nor any change in land use.
- **Section 226-105.** Crime and criminal justice. The Proposed Action does not involve the criminal justice system.
- **Section 226-106.** Affordable housing. The Proposed Action would not provide housing.
- **Section 226-107.** Quality education. The Proposed Action would have no impact on education opportunities or facilities.
- **Section 226-108.** Sustainability. The Proposed Action would have no impact on sustainability.

4.1.2 State Land Use Law

Hawaii was the first of the fifty States to have a State Land Use Law and a State Plan. Today, Hawaii remains unique among the fifty states with respect to the extent of control that the state exercises in land use regulation. The State Land Use Law, HRS Chapter 205, was originally adopted by the State Legislature in 1961. This law establishes an overall framework of land use management whereby all lands in the State of Hawaii are classified into one of four land use districts: Urban, Agricultural, Conservation, and Rural.

The State Land Use Law is administered by the Land Use Commission. The Commission is "responsible for preserving and protecting Hawaii's lands and encouraging those uses to which lands are best suited."

Discussion: As shown in **Figure 23**, the Proposed Action is in an area designated Urban. The Urban District includes lands characterized by "city-like" concentrations of people, structures, and services. Infrastructure improvements are a permitted use within the State Land Use Urban District; therefore, the Proposed Action is consistent with State Land Use Law.

Figure 23. State Land Use Districts

4.1.3 Hawaii Coastal Zone Management Program

The National Coastal Zone Management (CZM) Program was created with the passage of the Coastal Zone Management Act of 1972 (CZMA). Hawaii's CZM Program, established pursuant to HRS Chapter 205A, as amended, is administered by the State of Hawaii Office of Planning and provides for the beneficial use, protection, and development in the State's coastal zone. The objectives and policies of the Hawaii CZM Program encompass a wide array of concerns including impacts to recreational resources, historic and archaeological resources, coastal scenic resources and open space, coastal ecosystems, coastal hazards, and the management of development. The Hawaii CZM area includes all lands within the State and the areas seaward to the extent of the State's management jurisdiction. Therefore, the Proposed Action is located within the CZM area.

The Proposed Action is consistent with the following objectives and policies of the Hawaii CZM Program:

RECREATIONAL RESOURCES
Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

1) Improve coordination and funding of coastal recreational planning and management.
2) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:
    a) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas.
    b) Requiring replacement of coastal resources having significant recreational value including, but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable.
    c) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.
    d) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation.
    e) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources.
    f) 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.
    g) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing.
    h) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Hawaii Revised Statutes, section 46-6.

Discussion: The Proposed Action does not impact shoreline recreational resources and is not located on the coastline; therefore, policies regarding shoreline recreational resources are not applicable. To protect the recreational value of coastal waters, the State of Hawaii has adopted water quality standards. Generally, these standards require submittal and adherence to the conditions in a NPDES permit. This permit requires compliance with BMPs during construction to minimize soil erosion into adjacent waterways and to maintain water quality during operation. A NPDES permit will be required for the Proposed Action.

HISTORIC RESOURCES

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

1) Identify and analyze significant archaeological resources.
2) Maximize information retention through preservation of remains and artifacts or salvage operations.
3) Support state goals for protection, restoration, interpretation, and display of historic resources

Discussion: As discussed in **Section 3.8**, the Proposed Action may impact Site 50-10-06-T-1, a multi-component site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early 20th century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- Archaeological monitoring would occur during construction, if required by SHPD.
- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

SCENIC AND OPEN SPACE RESOURCES

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

1) Identify valued scenic resources in the coastal zone management area.
2) Ensure that new developments are compatible with their visual environment by designing and

locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline.

3) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.
4) Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion: The Proposed Action is located inland, away from shoreline; therefore, there will be no effect on the quality of the coastal open space and scenic resources.

COASTAL ECOSYSTEMS
Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources.
2) Improve the technical basis for natural resource management.
3) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance.
4) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs.
5) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Discussion: The Proposed Action includes earth-moving activities but does not include any work within existing streams or waterways. To protect coastal ecosystems from adverse impacts associated with water quality, the State of Hawaii has adopted water quality standards. Generally, these standards require submittal and adherence to the conditions in a NPDES permit, which requires compliance with BMPs during construction to minimize soil erosion into adjacent waterways and to maintain water quality during operation. A NPDES permit would be required for the Proposed Action.

ECONOMIC USES
Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

1) Concentrate coastal development in appropriate areas.
2) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as 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.
3) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

a) Use of presently designated locations is not feasible;
b) Adverse environmental effects are minimized; and
c) The development is important to the State's economy.

Discussion: The Proposed Action is not coastal dependent but would provide improvements to public roadways used to transport goods across the island to/from Kawaihae Harbor, Hilo Harbor, and points in between. Therefore, the Proposed Action supports the Economic Uses objective.

COASTAL HAZARDS
Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

1) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards.
2) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards.
3) Ensure that developments comply with requirements of the Federal Flood Insurance Program.
4) Prevent coastal flooding from inland projects.

Discussion: The Proposed Action is located inland, away from potential coastal hazards. As discussed in **Section 3.5.1**, a portion of the Proposed Action is located within Flood Hazard Zone AE. To mitigate against potential flooding, the Proposed Action would be designed and built in compliance with all applicable flood hazard rules and regulations of the Hawaii County Code Chapter 27.

MANAGING DEVELOPMENT
Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

1) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development.
2) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements.
3) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion: The Proposed Action is the result of the PEL Process discussed in **Section 1.2.1** and **Section 6.1**. The PEL process included seven PEL meetings between October 2018 and August 2019 and a walk audit where interested parties were encouraged to provide input on potential roadway improvements in the Waimea area. Specifically, the PEL process included the following:

- Identification of the problems that "Need" to be addressed.
- Documentation of those "Needs" with data.
- Identification of the Affected Environment
- Community input (from PEL Meetings)

- Consultation with stakeholders and agencies
- Preparation of the "Purpose and Need" statement
- Identification of "Alternatives" that meet the Purpose and Need.
- Narrowing of Alternatives to a reasonable number

This EA is a result of the narrowing of alternatives during the PEL process and evaluates the multimodal improvements within Waimea Town. Pre-assessment consultation was conducted, and the comments and responses are provided in **Appendix A**. In addition, the public was ~~will be~~ provided an opportunity for input during the Draft EA public comment period.

PUBLIC PARTICIPATION
Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

1) Promote public involvement in coastal zone management processes.
2) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities.
3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion: The Proposed Action is the result of the PEL Process discussed in **Section 1.2.1** and **Section 6.1**. As part of the preparation of this EA, pre-assessment consultation was conducted. Comments received and responses are provided in **Appendix A**. In addition, the public was ~~will be~~ provided an opportunity for input during the Draft EA public comment period.

BEACH PROTECTION
Objective: Protect beaches for public use and recreation.

Policies:

1) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion.
2) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities.
3) Minimize the construction of public erosion-protection structures seaward of the shoreline.
4) Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor.
5) Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.

Discussion: The Proposed Action is located inland, away from shoreline; therefore, there will be no effect on the use of beaches for public use and recreation.

MARINE RESOURCES
Objective: Promote the protection, use, and development of marine and coastal resources to assure

their sustainability.

Policies:

1) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial.
2) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency.
4) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone.
5) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources.
6) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion: The Proposed Action is located inland, away from marine resources. To protect marine water quality, the Proposed Action will be designed and constructed in compliance with all applicable Federal, State, and County regulations pertaining to storm water management, as discussed in **Section 3.4**.

4.2 County of Hawaii Planning Documents

4.2.1 General Plan (February 2005)

The Hawaii County General Plan is the policy document for the long-range comprehensive development of the island of Hawaii. The purposes of the General Plan are as follows:

- Guide the pattern of future development in this County based on long-term goals;
- Identify the visions, values, and priorities important to the people of this County;
- Provide the framework for regulatory decisions, capital improvement priorities, acquisition strategies, and other pertinent government programs within the County organization and coordinated with State and Federal programs.
- Improve the physical environment of the County as a setting for human activities; to make it more functional, beautiful, healthful, interesting, and efficient.
- Promote and safeguard the public interest and the interest of the County as a whole.
- Facilitate the democratic determination of community policies concerning the utilization of its natural, man-made, and human resources.
- Effect political and technical coordination in community improvement and development.
- Inject long-range considerations into the determination of short-range actions and implementation.

The County's existing General Plan that was adopted in 2005 is currently undergoing revision. The initial draft of the new General Plan 2040 has undergone public review (comment period ended on October 31, 2019) and the recommended plan is currently being prepared. The General Plan 2040 will undergo public review in Winter 2020-2021, and the plan is expected to be adopted in late-2021.

The following analyzes the Proposed Action's consistency with the goals and policies of the 2005 General Plan. The Proposed Action is consistent with the following goals and policies of the 2005 General Plan:

FLOODING AND OTHER NATURAL HAZARDS

Goals:

(a) Prevent damage to man-made improvements.
(b) Control pollution.
(c) Prevent damage from inundation.
(d) Reduce surface water and sediment runoff.

Policies:

(a) Any development within the Federal Emergency Management Agency designated flood plain must be in compliance with Chapter 27.
(g) Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works and in compliance with all State and Federal laws.
(q) Consider natural hazards in all land use planning and permitting.

Discussion: The Proposed Action is located far inland, away from potential coastal hazards. As discussed in **Section 3.5.1**, Lindsey Road crosses Waikoloa Stream, which is in Flood Hazard Zone AE. In addition, there is an area of Kawaihae Road on the west side of Waimea Park that is also within Flood Hazard Zone AE. To mitigate against potential flooding, the Proposed Action would be designed and built in compliance with all applicable flood hazard rules and regulations of the Hawaii County Code.

HISTORIC SITES

Goals:

(a) Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.

Policies:

(c) Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.

Discussion: As discussed in **Section 3.8**, the Proposed Action may impact Site 50-10-06-T-1, a multi-component site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early 20th century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- Archaeological monitoring would occur during construction, if required by SHPD.

- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

NATURAL BEAUTY

Goals:

(b) Protect scenic vistas and view planes from becoming obstructed.

Policies:

(a) Increase public pedestrian access opportunities to scenic places and vistas.

Discussion: The Proposed Action is located inland in a built environment and would not have any impact on scenic, or natural beauty resources. The Proposed Action includes the installation of bicycle and pedestrian facilities that would increase pedestrian access opportunities to scenic places and vistas.

NATURAL RESOURCES AND SHORELINE

Goals:

(d) Protect rare or endangered species and habitats native to Hawaii.
(e) Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural areas.
(f) Ensure that alterations to existing landforms, vegetation, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of an earthquake.

Policies:

(p) Encourage the use of native plants for screening and landscaping.
(s) Establish a system of pedestrian access trails to places of scenic, historic, cultural, natural, or recreational values.
(u) Ensure that activities authorized or funded by the County do not damage important natural resources.

Discussion: The Proposed Action includes landscaping along Kawaihae Road between Lindsey Road and Opelo Road. Native plants would be used in this landscaping.

The Proposed Action includes the installation of bicycle and pedestrian facilities that would increase pedestrian access to trails, such as the Waimea Stream Trail and Waimea Nature Park.

TRANSPORTATION

Goals:

(a) Provide a transportation system whereby people and goods can move efficiently, safely, comfortably and economically.
(b) Make available a variety of modes of transportation that best meets the needs of the County.

Policies:

(a) A framework of transportation facilities that will promote and influence desired land use shall be established by concerned agencies.

(e) Develop a comprehensive, islandwide multi-modal transportation plan that identifies the location and operation of automobile, mass transit, bicycle and pedestrian systems, in coordination with appropriate Federal and State agencies.

Discussion: The Proposed Action includes multimodal safety and operations improvements to existing roadways within the town of Waimea. The installation of dedicated bicycle and pedestrian facilities would encourage greater use of those modes which are now under-represented due to real and perceived safety problems. In addition, the Proposed Action would reduce congestion in the heart of Waimea Town. Freight trucks utilize Kawaihae Road and Mamalahoa Highway to deliver goods to Waimea, as well as to go to/from Kawaihae Harbor and Hilo Harbor. The Proposed Action would improve accessibility to shipping, docking, and storage facilities by reducing travel times.

The following objectives are not applicable to the Proposed Action: Environment, Economic, Energy, Housing, Public Facilities, Public Utilities, Recreation, and Land Use.

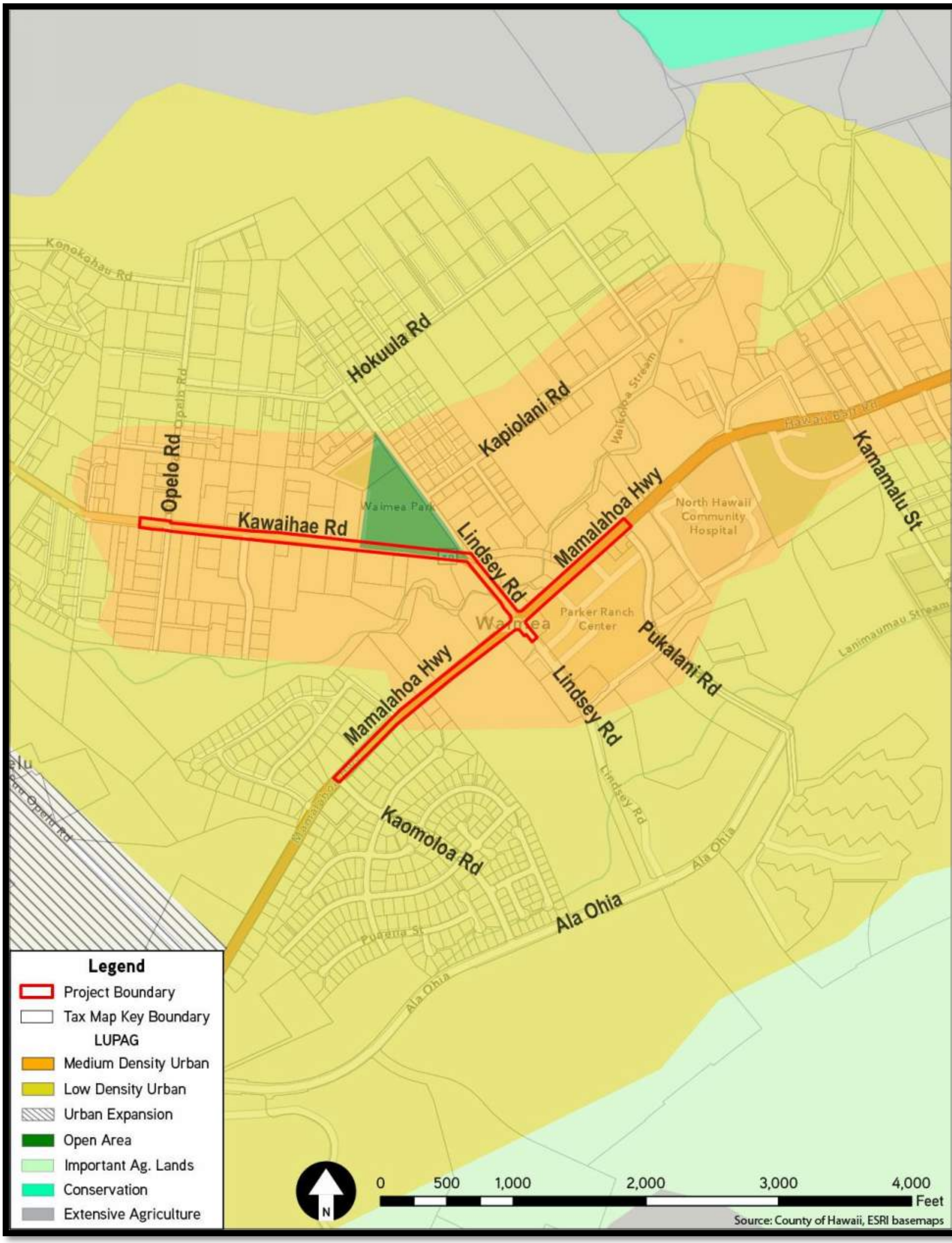
4.2.2 Land Use Pattern Allocation Guide

The Land Use Pattern Allocation Guide (LUPAG) is part of the Hawaii County General Plan. LUPAG is a design tool that guides the direction and quality of future developments. Specifically, LUPAG designations guide decisions related to future land use.

As shown in **Figure 24**, the Proposed Action is located within two LUPAG Districts:

- **Medium Density Urban:** Village and neighborhood commercial and single family and multiple family residential and related functions (multiple family residential -- up to 35 units per acre).
- **Open Area:** Parks and other recreational areas, historic sites, and open shoreline areas.

Figure 24. Land Use Pattern Allocation Guide (LUPAG)



4.2.3 South Kohala Community Development Plan

Community Development Plans (CDP) translate broad General Plan goals, policies, and standards into implementation actions for specific geographic regions around the island. CDPs serve as a forum for community input into land use, delivery of government services, and various other matters pertaining to the planning area.

The Proposed Action is located in the South Kohala CDP planning area. The final South Kohala CDP was enacted as a County Ordinance in November 2008 (Ordinance No. 2008-159). The South Kohala CDP translates the community input into Policies and Action Plans that shape the future land use of the district and translates broad General Plan statements into specific actions.

The Proposed Action is consistent with the following General Policies of the South Kohala CDP:

GENERAL POLICY NO. 1: PRESERVE THE CULTURE AND SENSE OF PLACE OF SOUTH KOHALA COMMUNITIES

Sub-policy 1.1: Preserve cultural and historic sites and structures

Discussion: As discussed in **Section 3.8**, the Proposed Action may impact Site 50-10-06-T-1, a multi-component site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early 20th century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- Archaeological monitoring would occur during construction, if required by SHPD.
- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

GENERAL POLICY NO. 2: PROVIDE FOR THE TRANSPORTATION AND CIRCULATION NEEDS OF THE SOUTH KOHALA COMMUNITY AND FOR COMMUTERS TO/FROM SOUTH KOHALA

Sub-policy 2.2: Establish bicycle, pedestrian, and equestrian travel ways to link up the communities within the District (Waikoloa Village, Waimea, Puako, Kawaihae, and the resort nodes) while also establishing alternative travel ways within the individual communities.

Discussion: The Proposed Action includes multimodal safety and operations improvements to existing roadways within the town of Waimea. The installation of dedicated bicycle and pedestrian facilities would encourage greater use of those modes which are now under-represented due to real and perceived safety problems.

The South Kohala CDP also includes the Waimea Town Conceptual Plan, which presents general guidelines for the long-range (20+ year look-ahead) future of Waimea Town. The Proposed Action is consistent with the following Policies for land use presented in the Waimea Town Conceptual Plan:

WAIMEA POLICY NO. 1: PRESERVATION OF WAIMEA'S SENSE OF PLACE

Strategy 1.3: Protect important cultural and historic sites, structures, and landscapes.

Strategy 1.6: Recognize and protect significant trees and other plants in Waimea.

Discussion: As discussed in **Section 3.8**, the Proposed Action may impact Site 50-10-06-T-1, a multi-component site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early 20th century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required, which may include reconstructing the walkway in a similar style. In addition, the following measures would be implemented to minimize potential impacts to unknown archaeological and historic resources:

- Archaeological monitoring would occur during construction, if required by SHPD.
- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

The Proposed Action would be constructed mostly within existing ROW. The removal of significant trees and other plants is not expected.

WAIMEA POLICY NO. 5: TIMELY IMPLEMENTATION OF NEEDED TRANSPORTATION AND CIRCULATION IMPROVEMENTS

Strategy 5.1: Plan, design, and construct walkways and bikeways within the existing rights of way of the main Waimea Roads: Kawaihae Road and Mämalahoa Highway.

Strategy 5.5: Implement short-term traffic mitigation improvements in and around Waimea Town Center.

Discussion: The Proposed Action would include multimodal safety and operations improvements to existing roadways within the town of Waimea, including the following:

- Installation of a roundabout at the Kawaihae Road and Lindsey Road intersection,
- Roadway improvements along Kawaihae Road between Lindsey Road and Opelo Road, including bicycle and pedestrian treatments along both sides of the Kawaihae Road to Opelo Road

- Intersection improvements at Mamalahoa Highway and Lindsey Road
- Bicycle and pedestrian treatments along Mamalahoa Highway between Waimea School and Pukalani Road

The Proposed Action would improve safety and reduce congestion within Waimea Town.

4.2.4 County of Hawaii Zoning Code

The Hawaii County Code 25, Zoning Code, defines permitted land uses within the State Land Use “Urban” and “Agricultural” districts. For each zoning district, the code defines required building setbacks, height limits, and other constraints. As shown in **Figure 25**, the Proposed Action is adjacent to three zoning districts:

- **Zone CV-7.5**: Village Commercial District (minimum land area of 7,500 square feet, required for each building site)
- **Zone RS-7.5:** Single-Family Residential District (minimum building site area of 7,500 square feet)
- **OPEN:** Open District

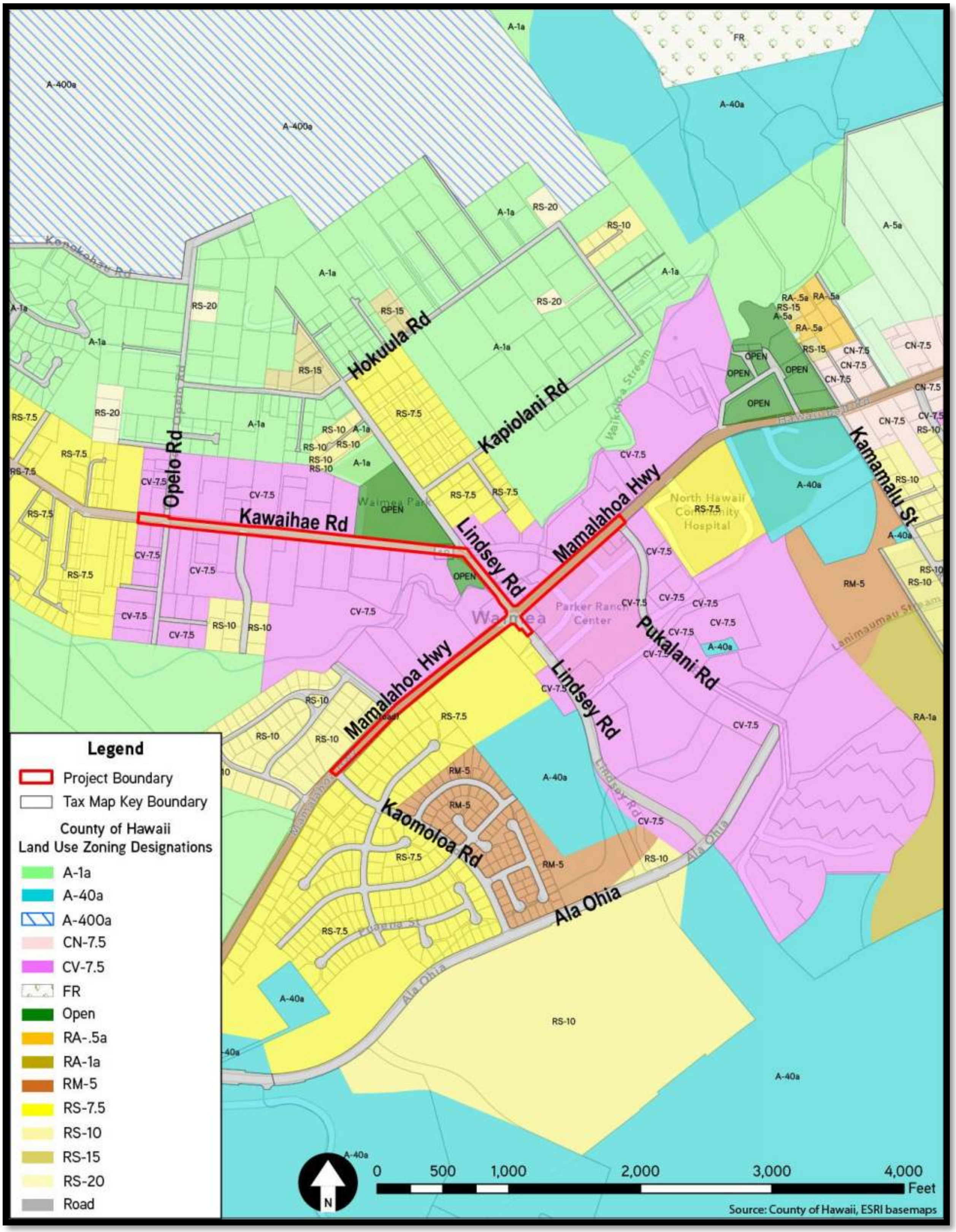
The existing roadways are non-zoned areas.

4.2.5 Special Management Area

The Special Management Area (SMA) is the area of the island that is in close proximity to the shoreline. The SMA permit was established in 1975 with the enactment of Act 176, Shoreline Protection Act. Pursuant to HRS Chapter 205A, all state and county agencies shall enforce the CZM objectives and policies defined in HRS Chapter 205A-2 (see **Section 4.1.3**). The County of Hawaii Planning Department administers SMA permits for the island of Hawaii.

The Proposed Action is located inland, away from shoreline, and is not located within the SMA.

Figure 25. County of Hawaii Zoning



4.3 Department of Hawaiian Home Lands Planning Documents

4.3.1 Department of Hawaiian Home Lands General Plan

The *Department of Hawaiian Home Lands General Plan* (DHHL, 2002) provides goals and objectives to support the mission of managing Hawaiian Home Lands effectively and to develop and deliver lands to native Hawaiians. There are goals and objectives for the following: land use planning, residential uses, agricultural and pastoral uses, water resources, land and resource management, economic development, and building healthy communities. The goals and objectives related to residential uses, agricultural and pastoral uses, water resources, land and resource management, economic development, and building healthy communities are not applicable to the Proposed Action. The Proposed Action is consistent with the following land use planning goals and objectives:

LAND USE PLANNING

Goals:

Develop livable, sustainable communities that provide space for or access to the amenities that serve the daily needs of its residents.

Objectives:

- Direct urban growth to priority development areas based on infrastructure availability, feasible site conditions, beneficiary preferences, and job opportunities.
- Develop improved relationships with the Counties to ensure reliable and adequate delivery of services to homesteaders.

Discussion: The Proposed Action would provide beneficial impacts to the heart of Waimea Town and adjacent areas due to improved traffic flow, increased pedestrian and bicyclist comfort levels, and improved multimodal safety within Waimea Town. These beneficial impacts would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town. In addition, the Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations thereby allowing faster response times to DHHL properties outside of the project area.

4.3.2 Hawaii Island Plan

The *Department of Hawaiian Home Lands Hawaii Island Plan* (DHHL, 2002b), hereafter referred to as the Hawaii Island Plan, provides a comprehensive assessment of DHHL properties on Hawaii Island, as well as a summary of beneficiary interest in these lands by award type (i.e., residential, agricultural, or pastoral). The goal of the Hawaii Island Plan is to assess and recommend future uses for Hawaiian Home Lands. There are two DHHL tracts adjacent to the Proposed Action: Lalamilo and Puukapu.

The Lalamilo tract is a 232-acre parcel located in the Kamuela area of the South Kohala District and was historically used as pasture land. Northern portions of the parcel front Waimea-Kawaihae Road and the Lalamilo House Lots subdivision. Public services such as schools, fire stations, medical care, and shopping are readily available. The Hawaii Island Plan identifies Lalamilo as a “Priority Tract” recommended for residential use. Extensive lands are available for development on the tract, and beneficiaries support residential use in the area.

The Puukapu tracts 1 and 2 are comprised of two 100-acre lots and one 192-acre lot located in the saddle of the Mauna Kea and Kohala Mountains. Puukapu tract 3 is a 378-acre tract of rolling hills on the upper slopes of Kamuela. Puukapu tracts 1 and 2 are recommended for homestead supplemental agriculture and general agriculture uses, and the Puukapu tract 3 is recommended for homesteading pastoral use. The Hawaii Island Plan identifies the Puukapu tracts as "Non-Priority."

Discussion: The Proposed Action would increase safety by modifying existing intersections, installation of a roundabout, and the installation of dedicated bicycle and pedestrian facilities in the heart of Waimea Town. In addition, the Proposed Action would reduce congestion by improving access, optimizing operations at intersections, and reducing conflict points. Overall, the Proposed Action would provide beneficial impacts due to improved traffic flow, increased pedestrian and bicyclist comfort levels, and improved multimodal safety within Waimea Town. These beneficial impacts would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town. In addition, the Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations thereby allowing faster response times to DHHL properties outside of the project area.

4.3.3 Waimea Nui Regional Plan

The *Waimea Nui Regional Plan* (DHHL, 2012) focuses on applying the goals, policies, and land use designations to specific homestead areas. The *Waimea Nui Regional Plan* identifies infrastructure projects, including development, roads, water, utilities, and public facilities. Roadway projects identified include, but are not limited to, the following: Waimea Traffic Circulation Improvements, Mamalahoa Highway – Lindsey Road to Kamamalu Street, Lindsey Road Pedestrian Safety Improvements, and Kawaihae Road Pedestrian Safety Improvements.

Discussion: The Proposed Action would improve pedestrian safety within the heart of Waimea Town along Mamalahoa Highway, Lindsey Road, and Kawaihae Road, which is consistent with the roadway projects identified in the *Waimea Nui Regional Plan*. The Proposed Action would also improve traffic flow through Waimea. The benefits associated with the Proposed Action would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town.

5.0 FINDINGS AND CONCLUSIONS

5.1 Significance Criteria

HAR Chapter 11-200.1 provides significance criteria for which all projects in Hawaii are assessed. These significance criteria and their relationship to the Proposed Action are as follows:

(1) Irrevocably commit a natural, cultural, or historic resource.

Construction of the Proposed Action would have short-term and temporary impacts to natural resources that would be minimized with the implementation of Avoidance and Minimization Measures and BMPs, as discussed for water resources and biological resources in **Section 3.6.3** and **Section 3.7.3**, respectively.

Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style. HDOT is continuing to consult with SHPD under HRS Chapter 6E-8 regarding project effects to Lanakila Park and will incorporate any mitigation measures required. In addition, **Section 3.8.3** identifies additional measures that would be implemented to minimize potential impacts to unknown archaeological and historic resources.

(2) Curtail the range of beneficial uses of the environment.

The Proposed Action includes modifications to existing roadways to improve safety and reduce congestion. The Proposed Action would not curtail the range of beneficial uses of the environment; rather, the infrastructure improvements would allow for more efficient travel for all modes within Waimea Town.

(3) Conflict with the State's environmental policies or long-term environmental goals established by law.

HRS 344 states that "It shall be the policy of the State, through its programs, authorities, and resources to:

(1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.

(2) Enhance the quality of life by:

  (A) Setting population limits so that the interaction between the natural and artificial environments and the population is mutually beneficial;

  (B) Creating opportunities for the residents of Hawaii to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;

  (C) Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and

(D) Establishing a commitment on the part of each person to protect and enhance Hawaii's environment and reduce the drain on nonrenewable resources."

As discussed in **Chapter 3.0**, the Proposed Action would have less than significant impacts to environmental resources. Avoidance and Minimization Measures would be implemented to further reduce impacts.

(4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community or State.

The Proposed Action would include a road exchange between the County of Hawaii and the State of Hawaii. Specifically, the County of Hawaii and State of Hawaii are negotiating a roadway exchange to turn over the affected roads to the State. This would facilitate construction during the interim period, and ultimately, the State would be responsible for operations and maintenance.

The Proposed Action would have beneficial impacts on the socioeconomic conditions due to a reduction in travel time through Waimea Town as well as an increase in the multimodal network in the heart of Waimea Town, as discussed in **Section 2.3.2**.

The Proposed Action would have no impacts on cultural practices of the community or State.

(5) Have a substantial adverse effect on public health.

The Proposed Action includes modifications to existing roadways to improve safety and reduce congestion. The Proposed Action would decrease travel times within Waimea Town, including for emergency response vehicles, as discussed in **Section 2.3.2**. The Proposed Action would also increase the multimodal network within the heart of Waimea Town, which would provide greater opportunities for residents and visitors to walk or ride a bike through town. Overall, the Proposed Action would have a beneficial effect on public health.

(6) Involve adverse secondary impacts, such as population changes or effects on public facilities.

The Proposed Action would not have substantial secondary impacts, as it would not invoke population changes or effects on public facilities.

(7) Involve a substantial degradation of environmental quality.

Construction of the Proposed Action would result in the removal of portions of the dry-stacked rock wall, cobble-paved walkway, and rock wall at Lanakila Park. In addition, there would be a reduction in the size of the park. These impacts are expected to be minimal and could be mitigated by reconstructing the walkway in a similar style.

No long-term impacts to any other resource, as discussed in **Chapter 3.0**, are anticipated with implementation of the Proposed Action. Any impacts would be during the construction phase and would be short-term and temporary and would be minimized through the implementation of appropriate BMPs.

(8) Is individually limited but cumulatively has a considerable effect upon the environment or involves a commitment for larger actions.

Cumulative impacts refer to the impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant impacts taking place over time.

As discussed in **Section 1.2.3**, there are five other transportation projects in various degrees of planning within the project area:

- Waiaka Bridge Project/Kawaihae Road (State Route [SR] 19) and Kohala Mountain Road (SR 150)
- Parker Ranch Connector Road
- Lindsey Road Extension
- Ala Ohia Road Extension
- Waimea Trails and Greenway (*Ke Ala Kahawai o'Waimea*)

In addition, as part of the PEL process a mini-bypass was identified. HDOT plans to construct the mini-bypass at a later date when funding becomes available. These projects would increase circulation and the multimodal network in Waimea Town, which would improve travel within and through Waimea Town.

All projects would be required to comply with HRS Chapter 343 and the National Environmental Policy Act, as applicable, to ensure that impacts to resources are minimized and/or mitigated to the extent practicable.

(9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.

No rare, threatened, or endangered species were identified in the project area. However, impacts to the endangered Hawaiian hoary bat could occur due to vegetation removal. Impacts to seabirds could occur from the use of nighttime lighting during construction and/or operation. Aquatic species may be impacted by increased turbidity and sedimentation in Waikoloa Stream.

Avoidance and Minimization Measures would be implemented to minimize potential impacts to rare, threatened, or endangered species, as discussed in **Section 3.7.3**.

(10)Have a substantial adverse effect on air and water quality or ambient noise levels.

The Proposed Action is not expected to result in changes to VMT or vehicle mix. However, the Proposed Action would reduce delay in the project area, as discussed in **Section 2.3.2**, and provide safe alternatives for travel in the heart of Waimea Town through the installation of protected pedestrian and bicycle facilities, which could result in less vehicles making in-town trips. Therefore, the Proposed Action would not have a negative impact to air quality and could have a beneficial impact to air quality.

The Proposed Action involves modifications to existing roadways and would not significantly increase the amount of impermeable surfaces. The increase in impermeable surfaces would be related to the construction of protected sidewalks and bikeways and would not increase travel lanes for vehicles. Therefore, the Proposed Action is not anticipated to have any significant adverse impacts on surface water or groundwater resources.

(11)Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The Proposed Action is not located in a tsunami zone, sea level rise exposure area, beach, erosion-prone area, estuary, fresh water, or coastal waters.

A small portion of Lindsey Road and Kawaihae Road are located in Flood Zone AE. The Proposed Action would comply with the requirements of Hawaii County Code Section 27-18; therefore, the Proposed Action is not expected to increase the area's exposure to flooding.

The project area is in an area of high seismic activity. The Proposed Action would modify the existing roadways and would be constructed in compliance with current regulations and accepted design criteria and guidance to protect against impacts from earthquakes.

(12)Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.

The Proposed Action would improve existing roadways within the heart of Waimea Town. There would be no new construction; therefore, there would be no impact to visual resources.

(13)Requires substantial energy consumption or emit substantial greenhouse gases.

The Proposed Action would not require substantial energy consumption other than during the construction period with the use of construction equipment, which would be short-term and temporary.

The Proposed Action would reduce delay in the project area, as discussed in **Section 2.3.2**, and provide safe alternatives for travel in the heart of Waimea Town through the installation of protected pedestrian and bicycle facilities, which could result in less vehicles making in-town trips. Therefore, the Proposed Action could result in a reduction of the emission of greenhouse gases.

5.2 Finding of No Significant Impact

Based on the significance criteria set forth in HAR Chapter 11-200.1 and discussed in **Section 5.1**, HDOT, Highways Division has determined that the Proposed Action would not have any significant adverse environmental impacts and that an Environmental Impact Statement is not required for the project. HDOT, Highways Division has determined that a Finding of No Significant Impact is appropriate for the Waimea Roadway Improvements Project.

6.0 AGENCIES AND ORGANIZATIONS CONSULTED

6.1 Planning and Environment Linkages (PEL) Process

6.1.1 PEL Meetings

Seven PEL meetings were held between October 2018 and August 2019:

- Meeting 1: Introduction to PEL and Discussion of Regional Setting and Needs (October 10, 2018)
- Meeting 2: Development of the Purpose and Need Statement (December 5, 2018)
- Meeting 3: Continued discussion on Community Needs and Discussion on ways to address those Needs within the resources and funding available (March 6, 2019)
- Meeting 4: Continued discussion on the Identification of Alternatives and Identify Supporting and Restraining Forces (March 27, 2019)
- Meeting 5: Review Conceptual Engineering Drawings of Alternatives (May 29, 2019)
- Meeting 6: Narrow and Prioritize Alternatives (June 26, 2019)
- Meeting 7: Review of the PEL process and Recommendations (August 7, 2019)

Invitations to the PEL meetings were sent by mail and email a minimum of two weeks prior to the meeting date to a mailing list comprised of residents, government officials, and agency representatives. Notices of the meetings were also posted on billboards and store windows throughout Waimea Town a minimum of two weeks prior to the meeting date. Notices were published in the *Hawaii Tribune Herald* and *West Hawaii Today* the Sunday prior to and day of the meeting. Radio advertisements ran for five days prior to and day of the meeting on radio stations KAPA and KBIG.

The project website contains meeting notices, presentations, and handouts. After each meeting, a Summary Report was prepared and posted on the website. Furthermore, an audio presentation summarizing all meetings is available on the project website.

There were between 25 and 40 attendees at each PEL meeting, not including staff. Attendees were provided with comment forms to provide written comments, as well as contact information to provide written comments by email. A total of 79 written comments were received.

A summary of the PEL Meetings is provided in **Table 40**. This table demonstrates how the community members helped to develop the purpose and need and identify alternatives that could meet the purpose and need.

Table 40. Summary of PEL Meetings

#	Date	Summary
1	October 10, 2018	Seven "Needs" were presented for discussion: 1. **Speed and Safety:** Where are there safety concerns? 2. **Traffic Congestion:** Where is it? What causes it? 3. **Truck Traffic:** Does it need to go through town? Does the mix of trucks with other traffic cause any problems? 4. **Maintenance:** What sections of road experience flooding or other regular maintenance problems? 5. **Bridges:** What problems occur at bridges? 6. **Intersections:** Which intersections have problems and what is the cause? 7. **Bicyclists and Pedestrians:** What problems do active modes face in Waimea? A total of 45 comments were recorded during the discussion. Needs that garnered the most comments were "Traffic Congestion" and "Speed and Safety" with 24 and 20 comments, respectively. The next most commented Need was "Bicyclists and Pedestrians" with 12 comments.
2	December 5, 2018	Based on input from PEL Meeting #1, the draft Purpose and Need statement was presented at PEL Meeting #2. It included two primary "Purposes": • **Safety:** Improve Safety for all modes • **Relieve Congestion:** Relieve Congestion on the regional network of roads Three additional goals and objectives were also identified: • **Protect culture and values:** Maintain the rural/paniolo character of the town center • **Regional System Preservation and Asset Management:** Improve condition of roadways, intersections, and bridges • **Security:** Provide an alternate route for truck traffic and emergency vehicles
3	March 6, 2019	The community "brainstormed" a list of potential projects that would meet the Purpose and Need statement that had been developed based on community input received at the first two PEL Meetings. A total of 31 projects were identified. Twenty-seven (27) of the projects were divided into three distinct groups: Bypass, Lindsey Road and Intersection Improvements, and multimodal. Six (6) of the

#	Date	Summary
		projects were determined to be either outside the study area or are being completed under a separate project.
4	March 27, 2019	Continued the discussion on the identification of alternatives and identified the supporting and restraining forces for each. Breakout group discussions followed a "Force Field Analysis," which includes consideration of the following four questions: 1. What would it look like if a project was successful? 2. What are two or three forces that would support the project? 3. What are two or three forces that would restrain the project? 4. What else is pertinent to making this happen?
5	May 29, 2019	Reviewed the conceptual engineering drawings of preliminary alternatives and discussed revisions.
6	June 26, 2019	Narrowed and prioritized alternatives. Discussion of revisions that were made to alternatives based on community input at PEL Meeting #5, which included the following: • Add a rectangular rapid flash beacon at the intersection of Kawaihae Road and Opelo Road • Geometric changes to the roundabout at the Kawaihae Road and Lindsey Road intersection • Add bollards to the pedestrian islands at the Mamalahoa Highway and Lindsey Road intersection • Omit the extension of the Waimea Stream Trail from Mahua Street to Church Row • Move the connection of the East Alignment with Ala Ohia Road to align with the proposed Lindsey Road extension
7	August 7, 2019	Confirmed all the actions that occurred during the PEL process, including confirming the Purpose and Need and Alternatives. The group indicated their consensus through a show of hands and other verbal ("yes") and non-verbal (head nod) affirmations.

6.1.2 Walk Audit

[redacted]

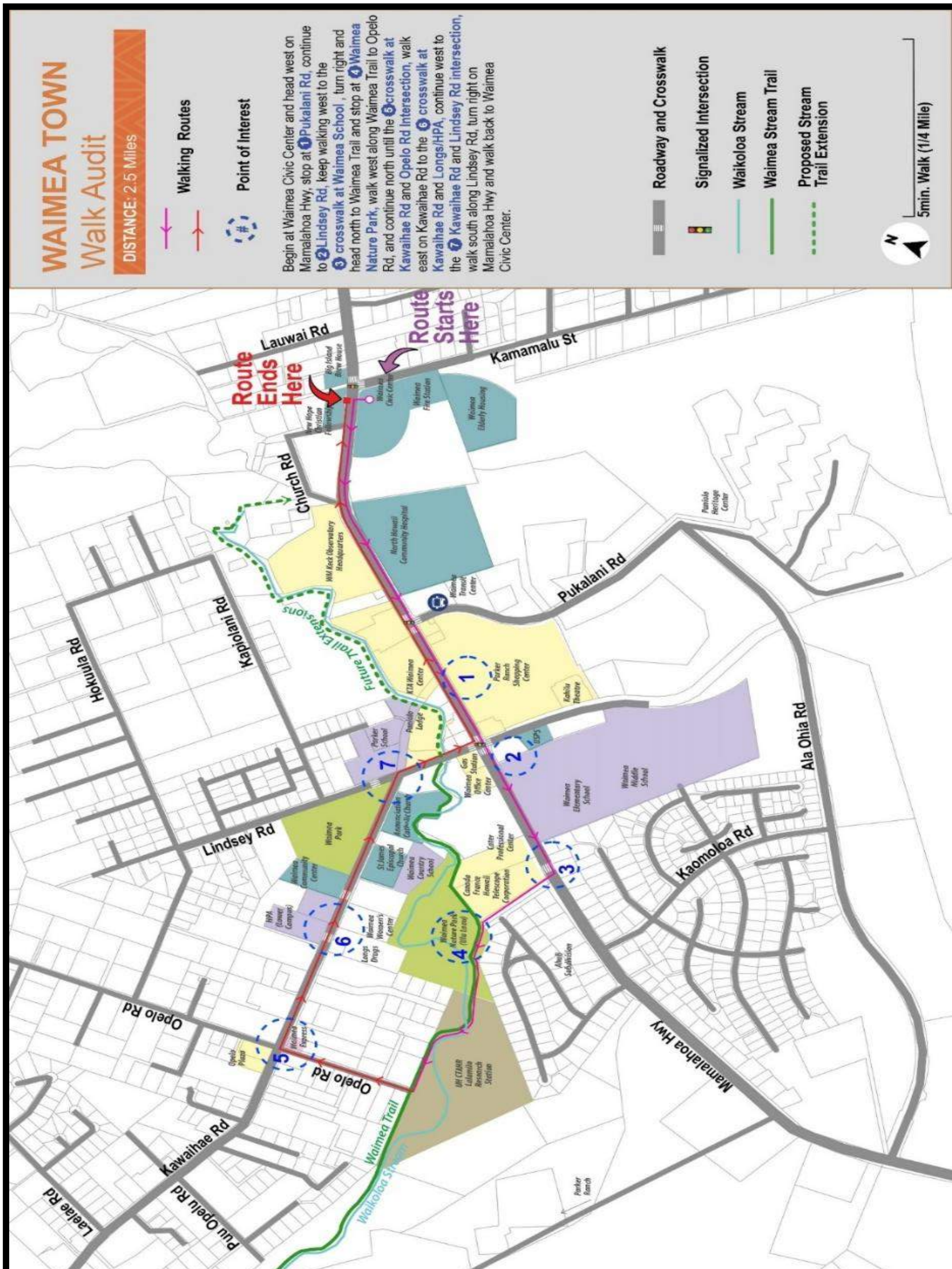
A walk audit in Waimea Town was conducted twice on April 22, 2019 (morning and afternoon). The walk audit focused on roadway sections and intersections identified by the community during PEL Meetings #3 and #4. Walk audits were open and advertised to the public, and included a mix of stakeholders including Waimea residents, businesses, non-profit organizations, representatives of elected officials, and staff from State and County agencies. The audits were led by experts in Complete Streets and Vision Zero, Mike Packard of SSFM and Peter Koonce, a technical consultant from Portland, Oregon. There were 18 participants for the morning walk audit and 11 participants for the afternoon walk audit.

The walk audit included portions of Mamalahoa Highway, Lindsey Road, and Opelo Road, as well as a portion of the Waimea Stream Trail. A presentation was given over lunch between the morning and afternoon walk audits. The presentation provided background on best practices and possible solutions for multimodal safety and mobility in Waimea. Attendees were encouraged to ask questions and make comments.

The project team recorded comments and input from the community participants and compiled them into a table of observations. The comments received were used to inform the development of draft concepts that were presented at PEL Meeting #5 held on May 29, 2019.

The walk audit route map is shown in **Figure 26**.

Figure 26. Walk Audit Route Map



6.2 Community Groups Consulted

6.2.1 South Kohala Traffic Safety Committee

The South Kohala Traffic Safety Committee (SKTSC) is an independent citizen group that meets with County, State, and Federal agencies to address traffic safety issues in the South Kohala District of Hawaii Island. The SKTSC stays informed of matters related to traffic safety in the district and shares this information with the community at large.

The SKTSC was a strong and regular participant in the PEL process. They helped advertise the PEL Meetings and discussed topics during their regular meetings.

6.2.2 Waimea Hawaiian Homesteaders' Association

The Waimea Hawaiian Homesteaders' Asscociation is a 501(c)3 non-profit organization that was founded in 1952 by the first homesteaders in the region. The Waimea Hawaiian Homestead has a population of approximately 14,000 people. The community is composed of land used for residential, agricultural, and pastoral purposes, as designated by the Hawaiian Homes Commission Act.

SSFM met with the Waimea Hawaiian Homesteaders' Association on May 14, 2019 to discuss the bypass alternatives and to answer questions. The group is opposed to the bypass going through their lands. They were assured that none of the bypass options considered would go through their lands. The bypass would be a separate project and is not analyzed in this EA.

6.2.3 PATH Hawaii

PATH Hawaii is a community-based, grassroots 501(c)(3) non-profit public access advocacy organization serving Hawaii County. PATH works with communities to improve and create opportunities for bikes and pedestrians. Their mission is to safely connect people and places on Hawaii Island with pathways and bikeways. They attended PEL Meetings and made regular input.

6.2.4 Blue Zones Project

Blue Zones Project is a community-wide well-being improvement initiative that helps make healthy choices easier for everyone in Hawaii. Blue Zones project focuses on comprehensively changing a community's environment so that individuals can make healthy choices, such as walking or biking. Representatives from Blue Zones attended PEL Meetings and made valuable input.

6.2.5 Landowner – Parker Ranch

Parker Ranch is the largest landowner in the project vicinity. Parker Ranch is currently developing the Waimea Town Plan. Representatives from Parker Ranch attended PEL Meetings and participated in breakout groups.

6.2.6 Parker School

The primary entrance to Parker School is at the intersection of Lindsey Road and Kawaihae Road where the roundabout is proposed. The Chief Operating Officer for Parker School attended PEL Meetings and participated in the Walk Audit.

6.2.7 Residents along Mamalahoa Highway

As part of the pre-assessment consultation process, as discussed in **Section 6.3**, several comments were received from residents along Mamalahoa Highway between Waimea School and Kaomoloa Road with concerns about the proposed improvements. SSFM, in coordination with Representative David Tarnas' office, held a virtual meeting with concerned residents on September 28, 2020.

6.2.8 Waimea Elementary School

During the virtual meeting discussed in **Section 6.2.7**, it was mentioned that Waimea Elementary School is planning to revise their drop-off/pick-up location and may be purchasing the property between the U.S. Post Office and the school with access from Lindsey Road. SSFM coordinated with the Principal of Waimea Elementary School and confirmed that the current primary drop-off/pick-up location is the parking lot by the library, but parents and busses also use the parking lot by the cafeteria. If funding becomes available, the drop-off/pick-up location will be moved to the property between the U.S. Post Office and the school.

6.2.9 Greenwood Center LLC

During the virtual meeting discussed in **Section 6.2.7**, it was mentioned that a developer had plans for the property across Mamalahoa Highway from Waimea Elementary School. SSFM coordinated with the developer, Greenwood Center LLC, to discuss roadway improvements made by the developer in coordination with the County of Hawaii Department of Public Works and Planning Department. These included construction of a sidewalk with three driveways fronting the property and modifications to roadway striping to provide a dedicated storage lane for left turns into and out of the center driveway.

6.3 Pre-Assessment Consultation for the Draft Environmental Assessment

The following State of Hawaii agencies (**Section 6.3.1**), County of Hawaii agencies (**Section 6.3.2**), elected officials (**Section 6.3.3**), non-governmental organizations (**Section 6.3.4**), and other interested parties

(**Section 6.3.5**) were consulted prior to the preparation of the Draft EA. All written comments received during the early consultation period of the Draft EA and the responses are included in **Appendix G**.

6.3.1 State of Hawaii Agencies

The following State of Hawaii agencies were consulted prior to the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*).

Department of Accounting and General Services *
Department of Business, Economic Development & Tourism
Department of Business, Economic Development & Tourism, Office of Planning
Department of Education *
Department of Hawaiian Home Lands *
Department of Health, Clean Water Branch
Department of Health, Clean Air Branch
Department of Health, Indoor and Radiological Health Branch *
Department of Health, Office of Environmental Quality Control
Department of Land and Natural Resources, Land Division *
Department of Land and Natural Resources, Engineering Division *
Department of Land and Natural Resources, Land Division – Hawaii District *
Department of Land and Natural Resources, State Historic Preservation Division
Office of Hawaiian Affairs

6.3.2 County of Hawaii Agencies

The following County of Hawaii Agencies were consulted prior to the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*).

Department of Environmental Management *
Department of Parks and Recreation
Department of Research and Development
Department of Water Supply
Planning Department
Civil Defense Agency
Department of Public Works *
Mass Transit Agency
Police Department
Fire Department

6.3.3 Elected Officials

The following elected officials were consulted prior to the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*).

Mayor Harry Kim, Office of the Mayor
Senator Lorraine R. Inouye, State Senate District 4
Representative David A. Tarnas, State House District 7
Council Member Valerie T. Poindexter, Hawaii County Council District 1

Council Member Tim Richards III, Hawaii County Council District 9

6.3.4 Non-Governmental Organizations

The following non-governmental organizations were consulted prior to the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*).

South Kohala Traffic Safety Committee
Waimea Hawaiian Homesteaders' Association
PATH Hawaii
Blue Zones Project
Waimea Community Association
Waimea Preservation Association
Parker Ranch
Parker School

6.3.5 Other Interested Parties

The following interested parties were consulted prior to the preparation of the Draft EA. Those who formally replied are indicated by an asterisk (*).

Nell Achtmeyer
Julia Alos
Sally Ancheta
Dana Asis
Nani Barretto
Dr. Billy Bergin *
Carol Buck
John Buck
Andrew Choy
Tina Clothier
Patti Cook
Steve Cotton
Don Cox
Annette Cromwell *
Lisa DeSantis
Debbie Diehl *
Mike Donoho
Jim Dupont
Leningrad Elarionoff
Janice English
Barbara Feliciano
G.T. Foulkes
Anika Glass
David and Dallas Gomes
David and Terri Greenwell
David Gross
Robyn Hafner
Judy Halford
Howard Hall
Pat Hall
Betty Hannah
Roger Harris
Susan Harris
Whitney Harvey
Pete Hendricks
Wayne Higaki
David Higgins
Roger Hirako
James Hustace
Carol Ignacio
Gens Johnson
Maxine Kahaulelio
Susan Kim
David Kirk
Steve Kittell
James Kong
Llewellyn Kumulae
Clemson Lam *
Janet Lam
Betty Lau
Leonard Librizzi
Randy Luck
Jan Marrack
Tim McCullough
Gunner Mench
Melvin Miranda
Sonny Miranda
Jonathan Mitchell
Colin Miura
Bill Moore
Keith Neal *
Dodie Neves
Joyce O'Connor
Avi Oki
Val Overlan
Frankie Pang
Diane Paulson
Eliza Pond
Juanita Ritz
Ric Rocker
Chris Romeo
Liliu Ross
Susy Ruddle
Jada Rufo
William Sanborn

Barbara Schaefer
Meilan Sharpe
Julia Simmons
Bill Simonsa
Ruth Smith
Gary and Dorothy Souza
Aaron Stene *
Paul Strauss
Fran Tabor
Jojo Tanimoto *
Jen Valera
Michael Vasquez
Franz Weber
Roger Wehrsig
Kerry Wells
Lunn White
Chad Wiggins
Margaret Wilie

6.4 Public Review of the Draft Environmental Assessment

The Draft EA was published in OEQC's *The Environmental Notice* on March 8, 2021, which started the 30-day public review period. Notice of Availability of the Draft EA was distributed to the same State of Hawaii agencies, County of Hawaii agencies, elected officials, non-governmental organizations, and other interested parties identified in **Section 6.3** with one update for Hawaii County Council District 1: Council Member Heather Kimball. In addition, printed copies of the Draft EA were submitted to the Hilo Public Library and Thelma Parker Memorial Public and School Library for public review. Comments were received from the following:

- State of Hawaii Department of Accounting and General Services
- State of Hawaii Department of Land and Natural Resources, Land Division
- Department of Land and Natural Resources, Engineering Division
- Department of Land and Natural Resources, Land Division – Hawaii District
- Department of Hawaiian Home Lands
- County of Hawaii Fire Department
- County of Hawaii Police Department
- Hawaii Preparatory Academy
- Laurie and Charles Heath
- Graham Paul Knopp, Ph.D.

Copies of the comment letters received and responses to the letters are provided in **Appendix H**.

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APPENDIX A

Roadway Plans

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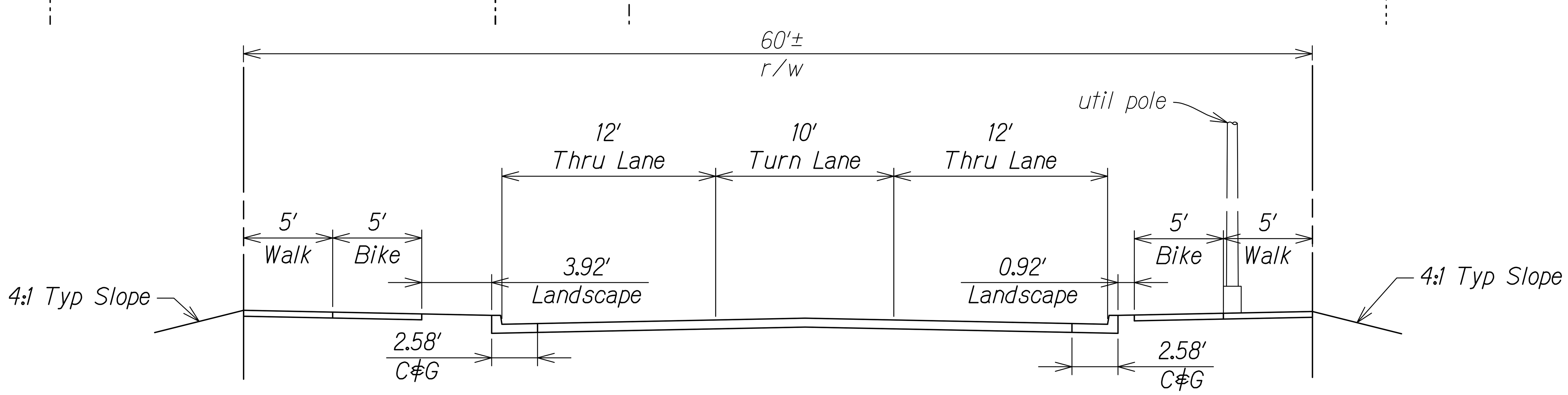
LEGEND:
Grass or Landscape Cover
Bike Lane (Asphalt w/ Conc Headers)
Concrete
Construction Easement
Bikeway Crossing Marking See Det This Sht
Green Stripe
6" White Edge Stripe
2'
5'
6'
BIKEWAY CROSSING DETAIL
Scale: Not to Scale
FED. ROAD DIST. NO. | STATE | FED.-AID PROJ. NO. | FISCAL YEAR | SHEET NO. | TOTAL SHEETS
HAWAII | HAW. | XXX-XXXX(XX) | 20XX | 1 | X
TRUE NORTH
SCALE : 1" = 20'
TMK: (3) 6-5-002:043
Okuno, Dale
Loren, Marcelle Franchoise Trst
TMK: (3) 6-5-002:042
Niu Pia Land Company, Ltd
TMK: (3) 6-5-002:177
Opelo Plaza II LLC
Contemporary Restaurant Corp
Realign Exst WL 5' from Face of Curb for CB & Tree Installation, Typ
TMK: (3) 6-5-007:008
State of Hawaii
Opelo Rd (County)
Constr Esmt, Typ
r/w, typ
Relocate Exst Signs, Typ
Adjust Exst MH to Remain, Typ
New RRFB
Bikeway Wayfinding Signs
To Waikui
Kawaihae Rd ℄
855+00
KAWAIHAE RD (STATE)
Kawaihae Rd ℄
To Lindsey Rd
M.L. ℄ Sta. 858+50
60'±
r/w
New Gateway Sign
Adjust Exst WVs to Remain, Typ
Exst Util to be Removed
Remove All "No Parking" Signs, Typ
TMK: (3) 6-5-003:028
Hamada, Y Ohana LLC
Adjust Exst Pole, Typ
Relocate Exst FH, Typ
TMK: (3) 6-5-009:036
Dean, Dennis & Yolanda
TMK: (3) 6-5-009:088
Grant, Barbara TR
TMK: (3) 6-5-009:034
Cacoulidis, Michael & Bernadette
TMK: (3) 6-5-009:033
Nekoba, Gladys M TR
TMK: (3) 6-5-009:032
Kaneshiro, Melvin & Arnold
Santos, Karen
Rogriguera, Sharyn
Waimea Apartments
PLAN
Scale: 1" = 20'
60'±
r/w
util pole
12' Thru Lane
10' Turn Lane
12' Thru Lane
5' Walk
5' Bike
3.92' Landscape
0.92' Landscape
5' Bike
5' Walk
4:1 Typ Slope
4:1 Typ Slope
2.58' C&G
2.58' C&G
TYPICAL SECTION
Not to Scale
NOTE:
New R9-7 signs shall be installed at intervals along both sides of travelway.
GRAPHIC SCALE:
20' 10' 0 20' 40'
Scale: 1" = 20'
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
ROADWAY PLAN
WAIMEA MULTIMODAL IMPROVEMENTS
Federal-Aid Project No. XXX-XXXX(XX)
Scale: As Noted
Date: Oct, 2020
SHEET No. 1 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	2	X

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det Sht 1

PLAN
Scale: 1" = 20'



TYPICAL SECTION
Not to Scale

NOTE:

New R9-7 signs shall be installed at intervals along both sides of travelway.

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)

Scale: As Noted Date: Oct, 2020

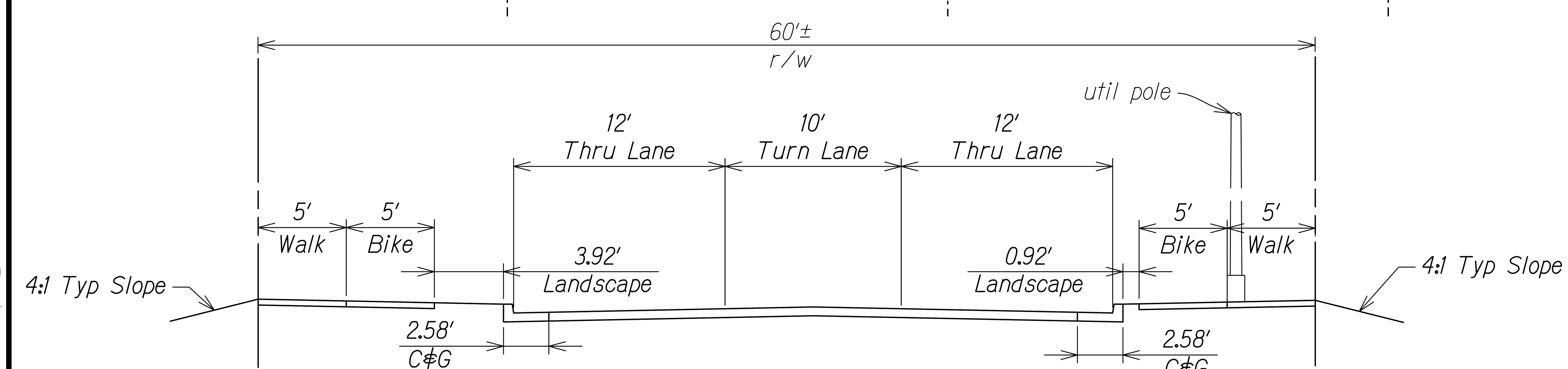
SHEET No. 2 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	3	X

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det Sht 1

PLAN
Scale: 1" = 20'



TYPICAL SECTION
Not to Scale

NOTE:

New R9-7 signs shall be installed at intervals along both sides of travelway.

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)

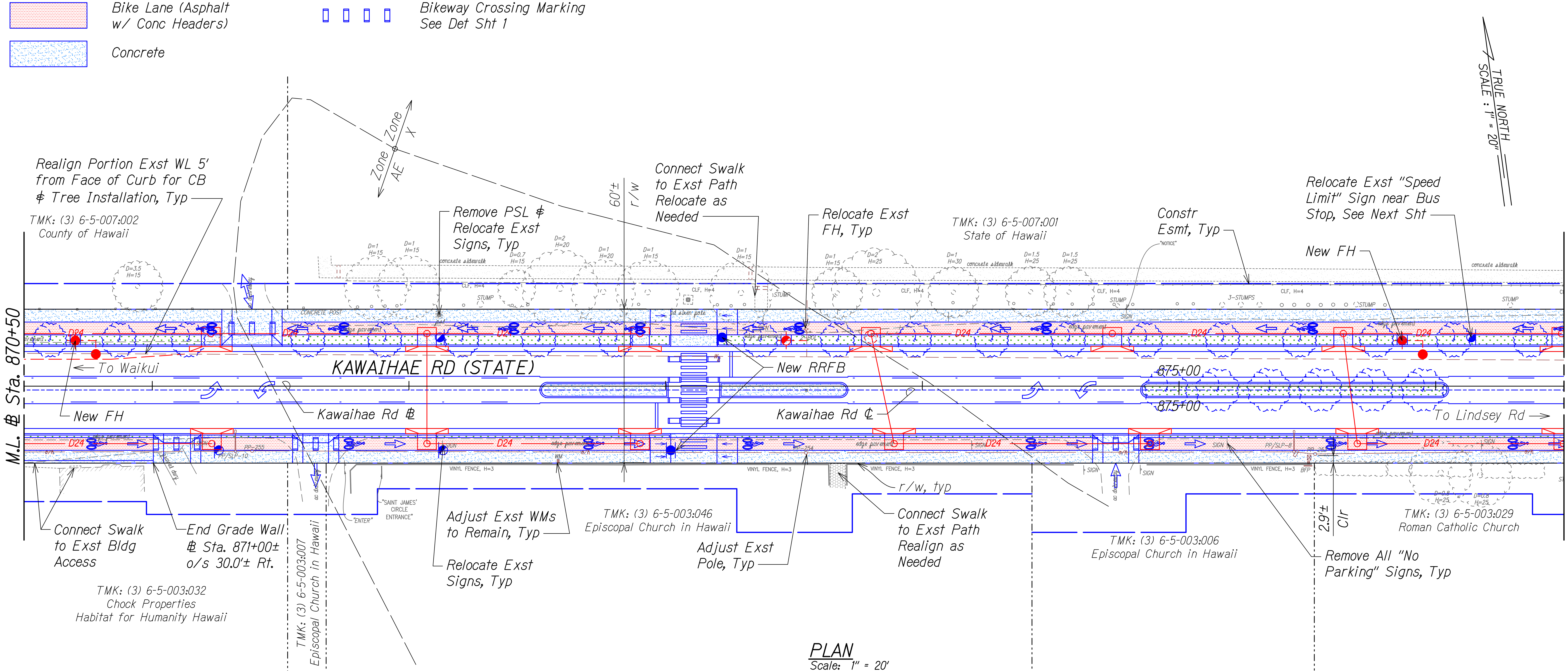
Scale: As Noted Date: Oct, 2020

SHEET No. 3 OF 10 SHEETS

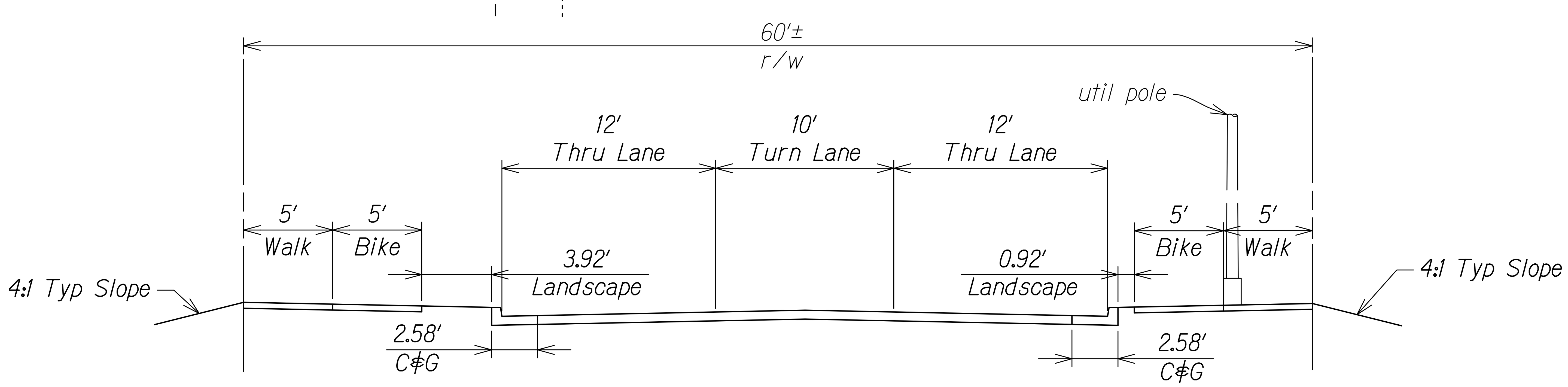
FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	4	X

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det Sht 1



PLAN
Scale: 1" = 20'



TYPICAL SECTION
Not to Scale

NOTE:
New R9-7 signs shall be installed at intervals along both sides of travelway.

GRAPHIC SCALE:
20' 10' 0 20' 40'
Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

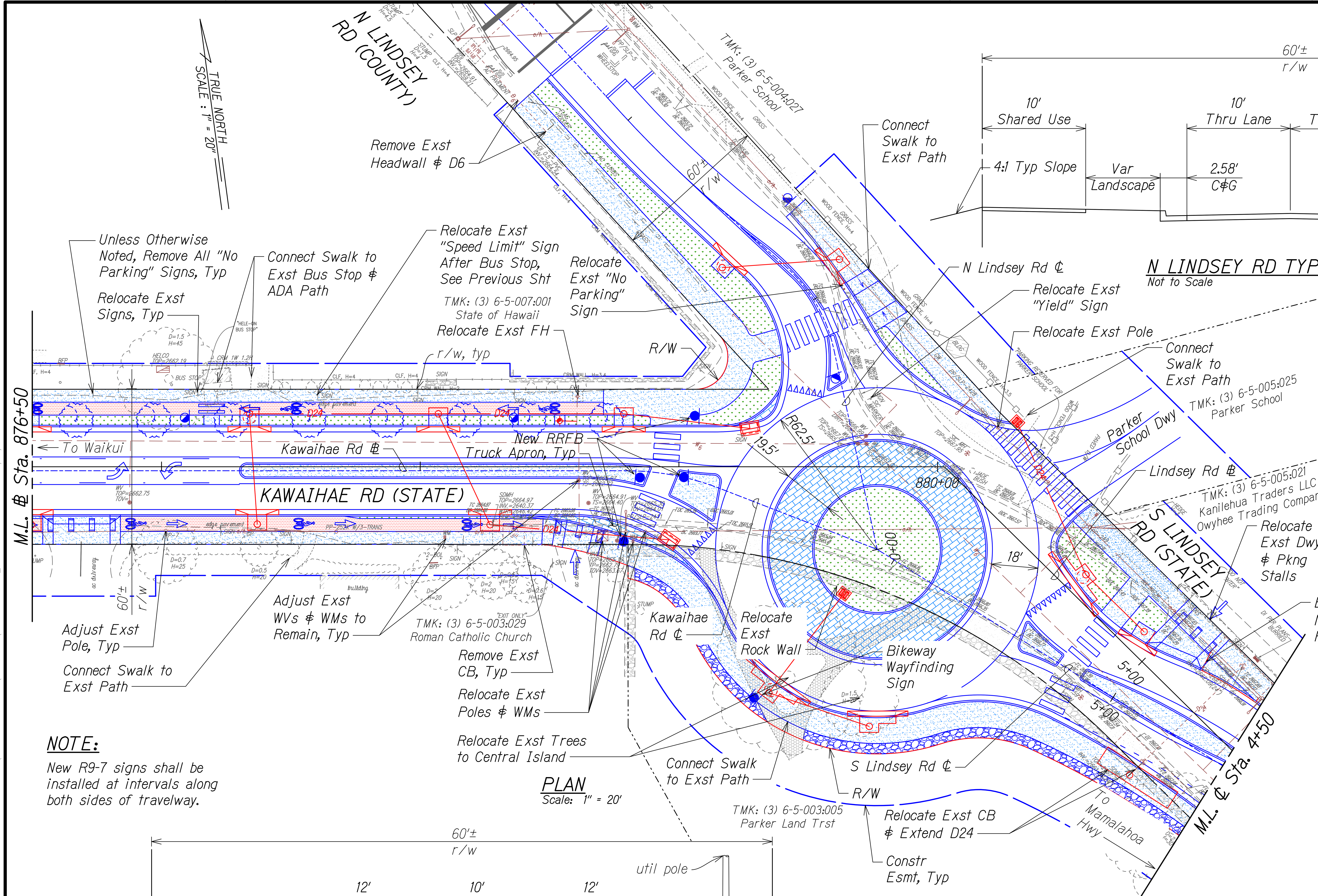
ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)
Scale: As Noted   Date: Oct, 2020

SHEET No. 4 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	5	X



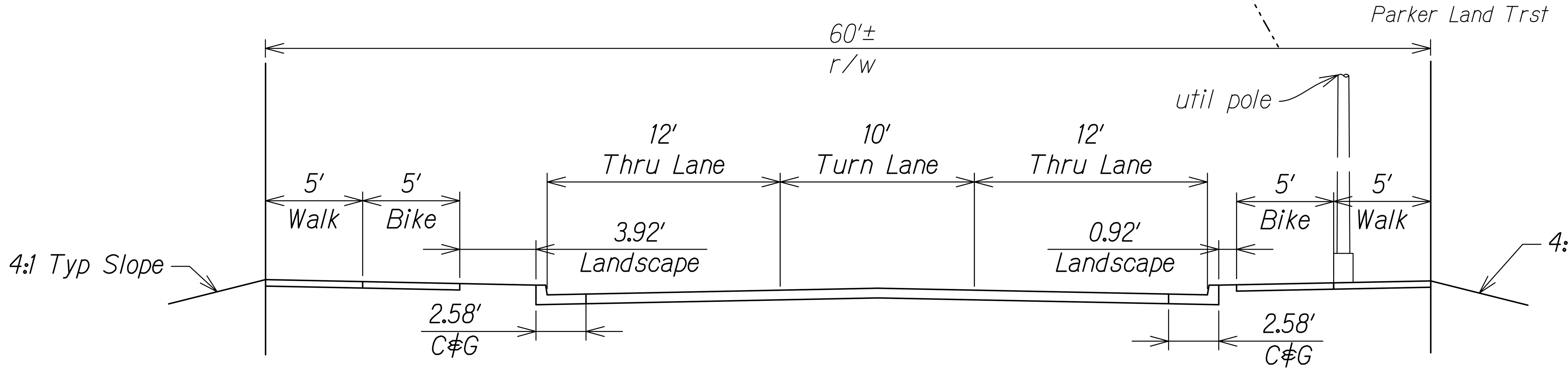
PLAN
Scale: 1" = 20'

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- New R/W
- Construction Easement
- Bikeway Crossing Marking See Det Sht 1

NOTE:

New R9-7 signs shall be installed at intervals along both sides of travelway.



KAWAIHAE TYPICAL SECTION
Not to Scale

GRAPHIC SCALE:
20' 10' 0 20' 40'
Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

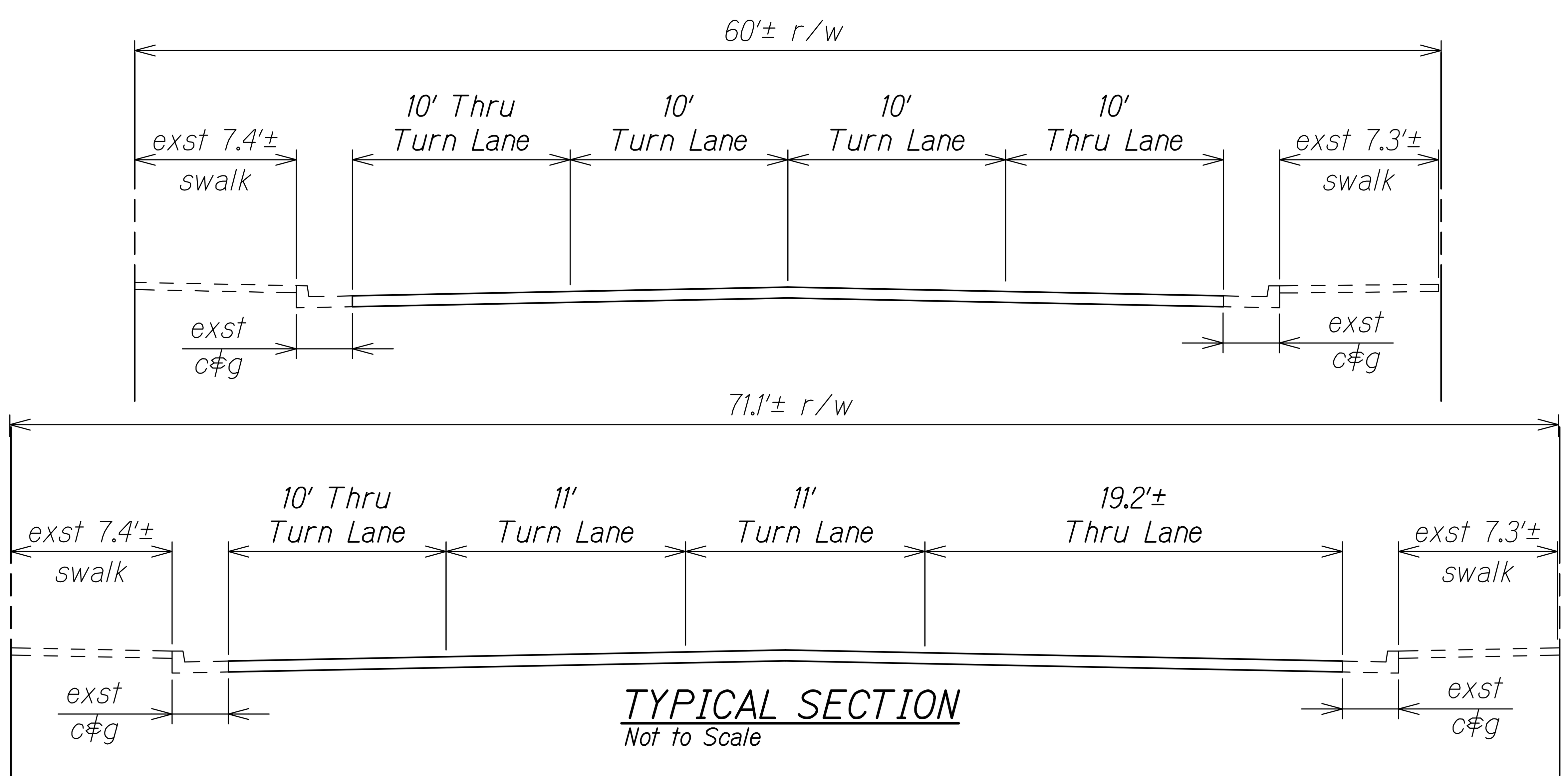
WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)
Scale: As Noted Date: Oct, 2020

SHEET No. 5 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	6	X

PLAN
Scale: 1" = 20'



TYPICAL SECTION
Not to Scale

LEGEND:

Grass or Landscape Cover

Concrete

New R/W

Construction Easement

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)

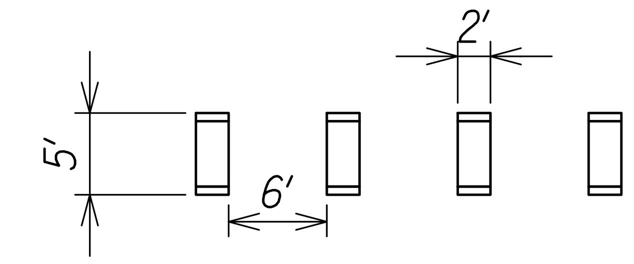
Scale: As Noted Date: Oct, 2020

SHEET No. 6 OF 10 SHEETS

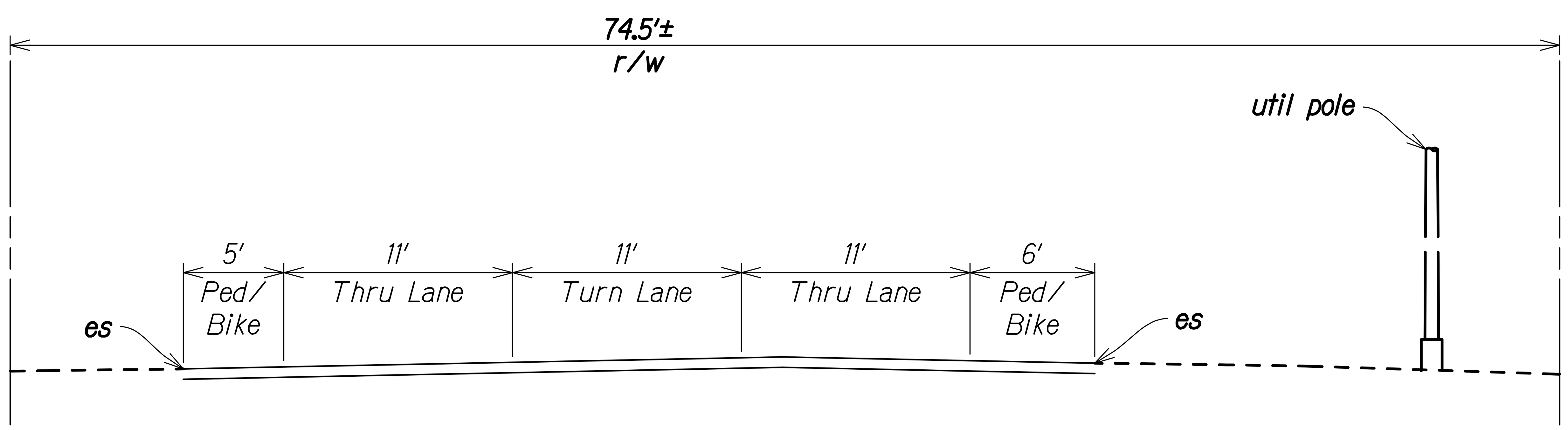
FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	7	X

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det This Sht



BIKEWAY CROSSING DETAIL
Scale: Not to Scale



TYPICAL SECTION
Not to Scale

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

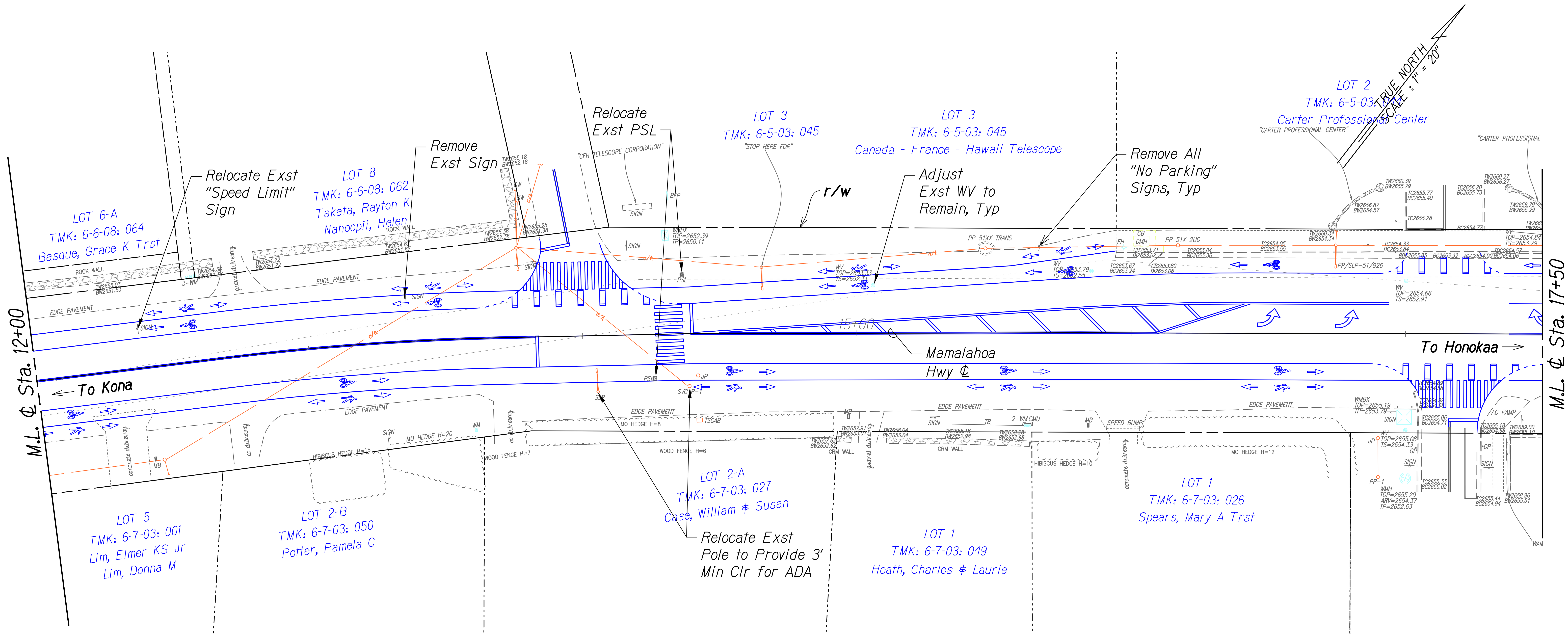
WAIMEA MULTIMODAL IMPROVEMENTS

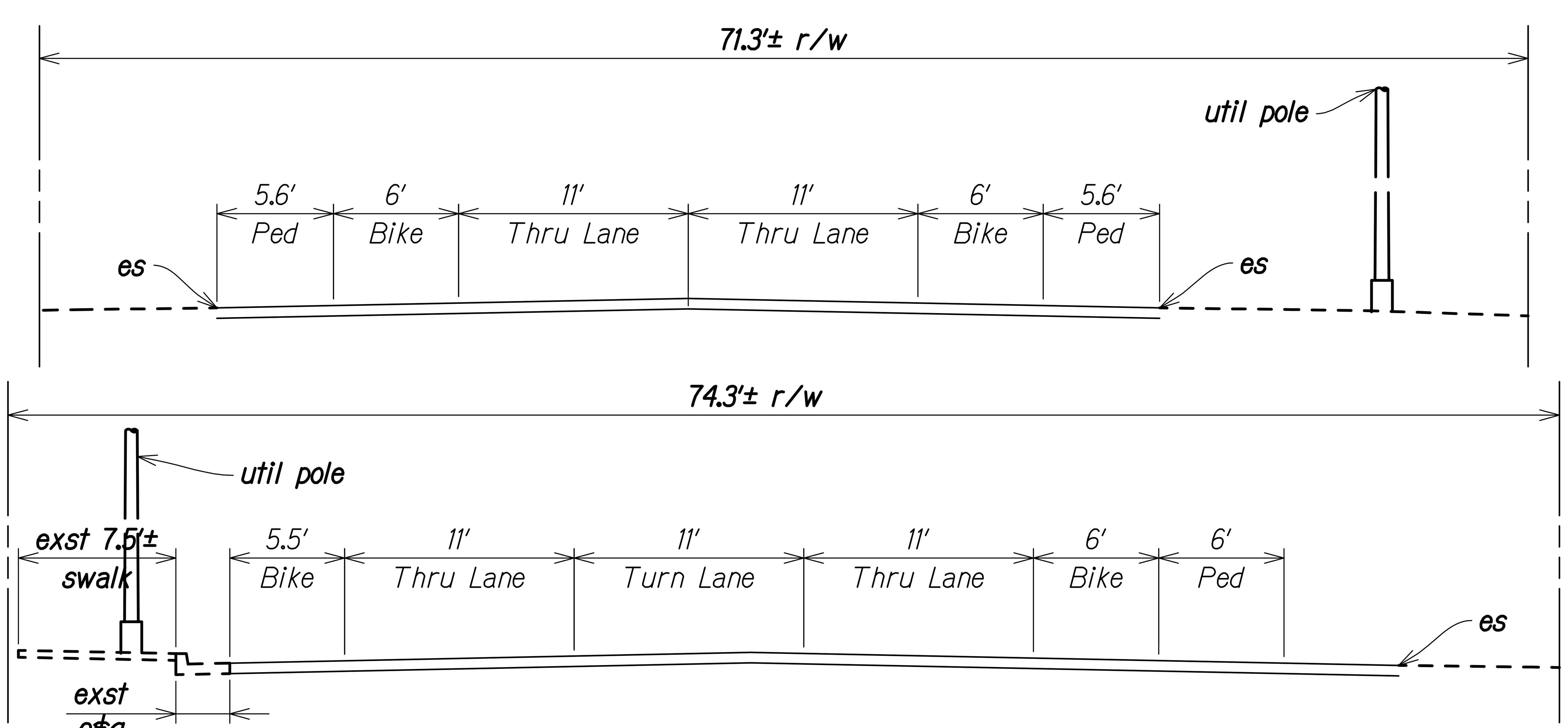
Federal-Aid Project No. XXX-XXXX(XX)

Scale: **AS NOTED** Date: Oct, 2020

SHEET No. 7 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	8	X





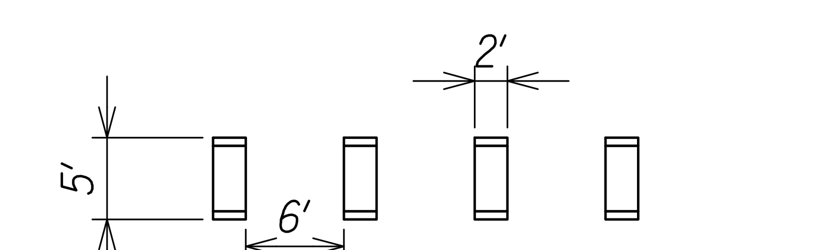
TYPICAL SECTION
Not to Scale

LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det This Sht

GRAPHIC SCALE:
20' 10' 0 20' 40'

Scale: 1" = 20'



BIKEWAY CROSSING DETAIL
Scale: Not to Scale

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)

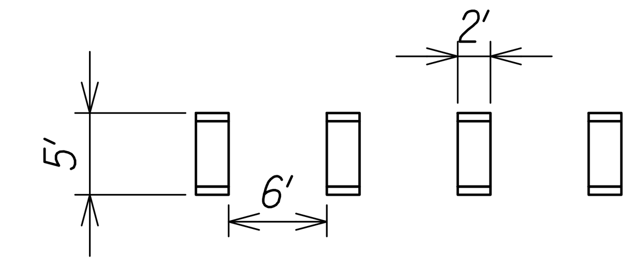
Scale: **AS NOTED** Date: Oct, 2020

SHEET No. 8 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	9	X

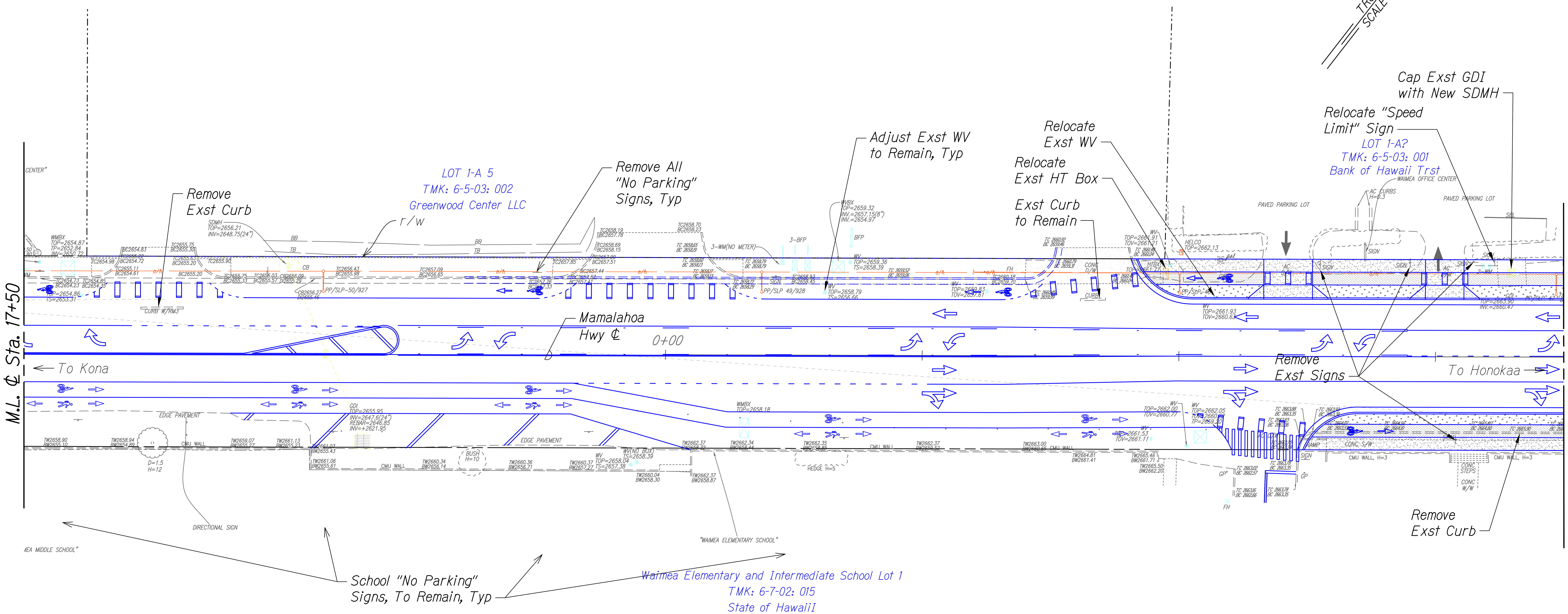
LEGEND:

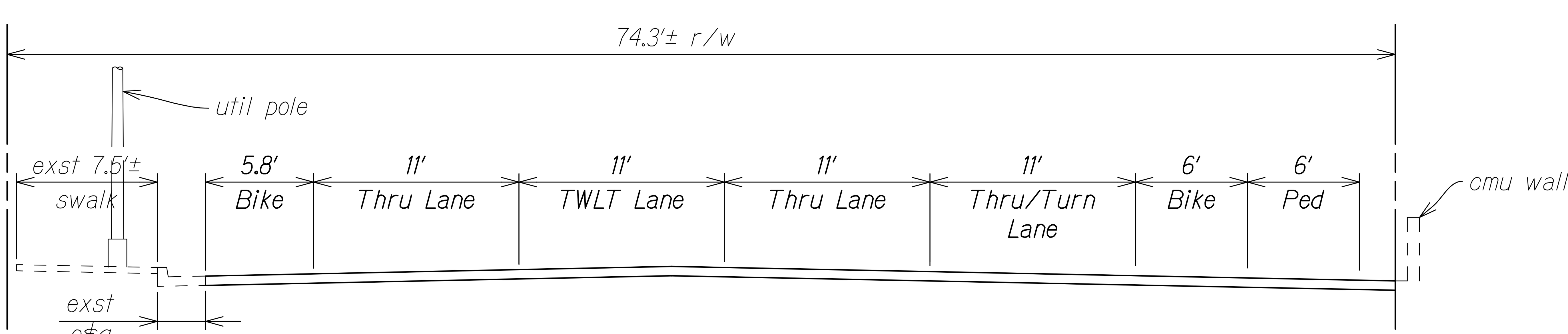
- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det This Sht



BIKEWAY CROSSING DETAIL

Scale: Not to Scale





TYPICAL SECTION

Not to Scale

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE

04/30/22
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

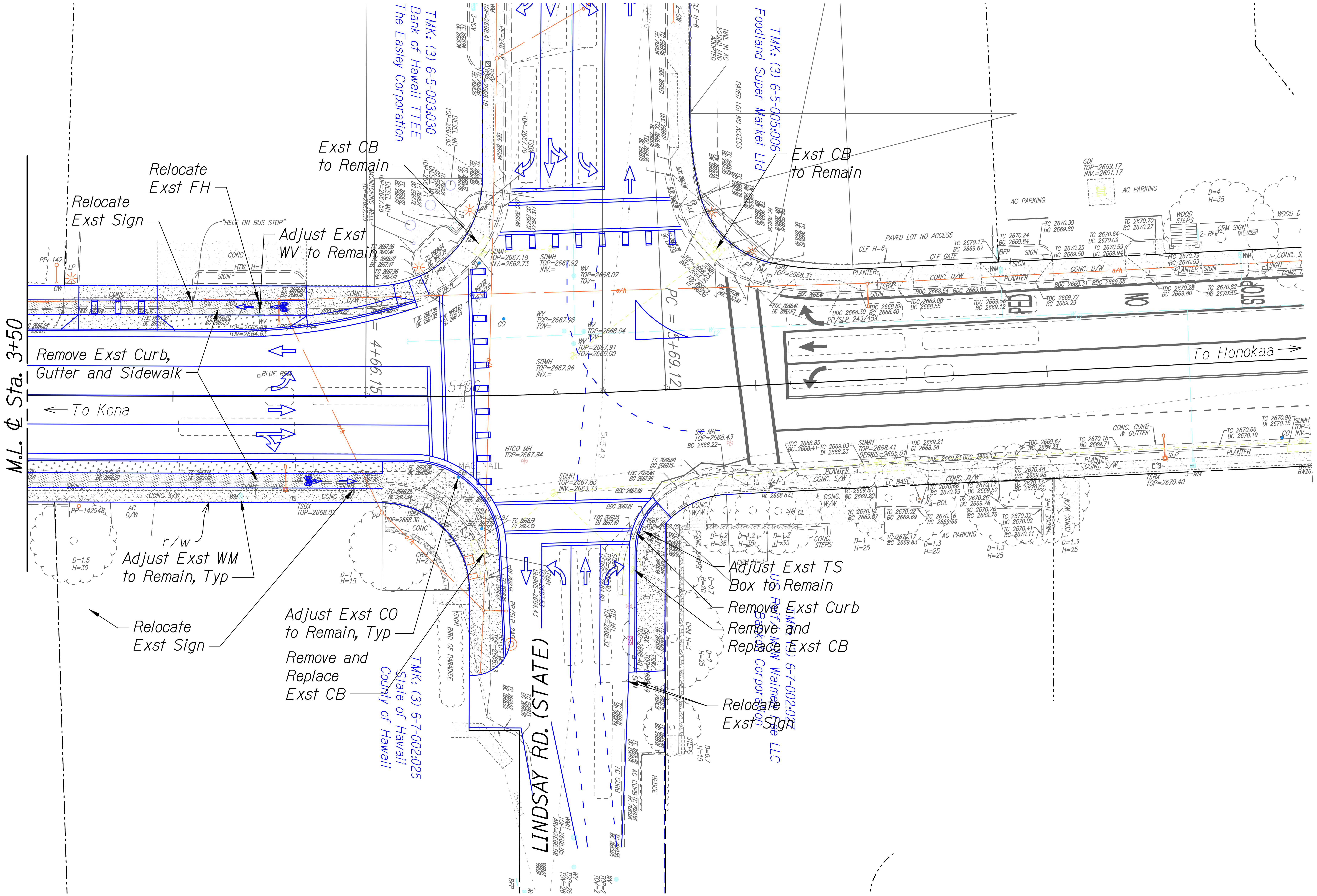
Federal-Aid Project No. XXX-XXXX(XX)

Scale: 1"=20' Date: Oct, 2020

SHEET No. 9 OF 10 SHEETS

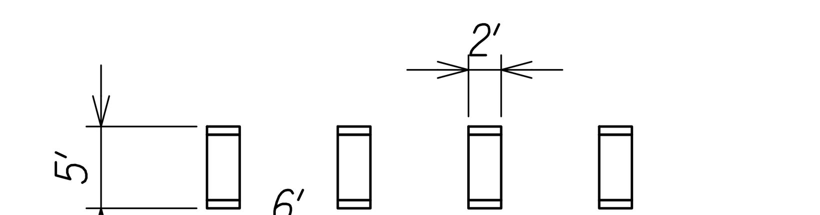
FED. ROAD DIST. NO.	STATE	FED.-AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	XXX-XXXX(XX)	20XX	10	X

TRUE NORTH
SCALE : 1" = 20'



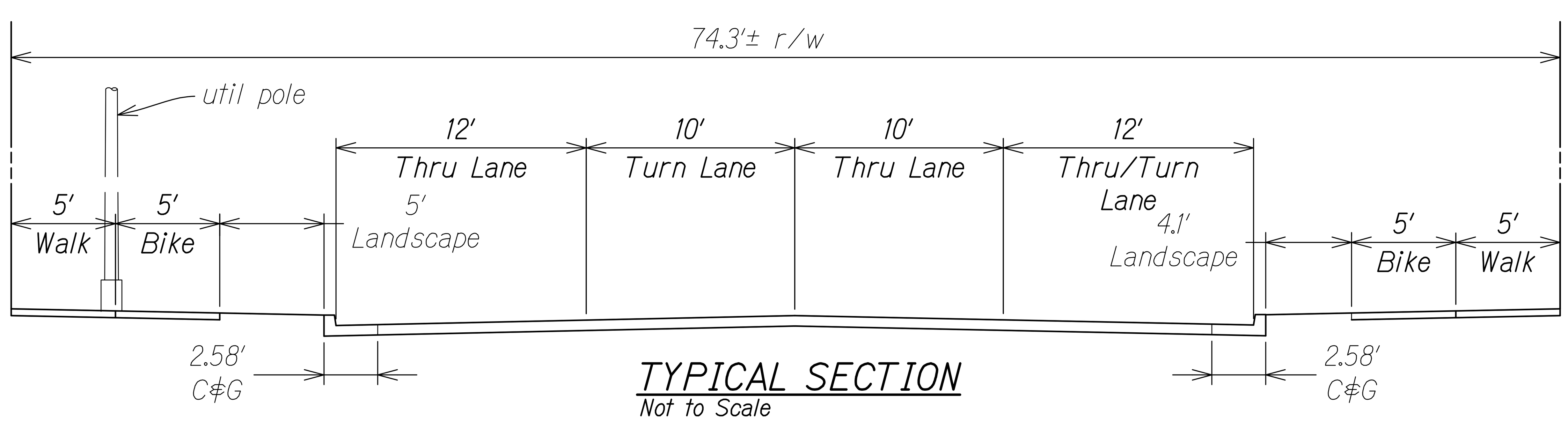
LEGEND:

- Grass or Landscape Cover
- Bike Lane (Asphalt w/ Conc Headers)
- Concrete
- Construction Easement
- Bikeway Crossing Marking See Det This Sht



BIKEWAY CROSSING DETAIL

Scale: Not to Scale



TYPICAL SECTION

Not to Scale

GRAPHIC SCALE:

20' 10' 0 20' 40'

Scale: 1" = 20'

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE

04/30/22
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN

WAIMEA MULTIMODAL IMPROVEMENTS

Federal-Aid Project No. XXX-XXXX(XX)

Scale: AS NOTED Date: Oct, 2020

SHEET No. 10 OF 10 SHEETS

APPENDIX B

Traffic Mobility Assessment Report

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Waimea Roadway Improvement Project:

Mobility Assessment Report

Prepared for:
SSFM International

October 14, 2020

SD16-0195

FEHR PEERS

Table of Contents

Appendices

List of Figures

List of Tables

1. Executive Summary

This report documents the assessment of the anticipated effects associated with the implementation of multimodal improvements proposed along sections of Kawaihae Road, Lindsey Road, and Mamalahoa Highway in the community of Waimea, including

- Sidewalks, raised/separated bikeways, and landscaping with street trees along Kawaihae Road and Mamalahoa Highway;
- An enhanced crosswalk with a Rectangular Rapid Flash Beacon (RRFB) and raised median island on the east leg of the Kawaihae Road/Opelo Road intersection;
- Relocating existing crosswalks and demarcating new crosswalks on Kawaihae Road;
- A new center two-way left-turn lane along two segments: 1) Kawaihae Road between Opelo Road and Lindsey Road, and 2) Mamalahoa Highway between Waimea Elementary School and Lindsey Road;
- A single-lane roundabout with splitter islands and marked crosswalks at Kawaihae Road/Lindsey Road; and
- Signal timing and lane configuration modifications at the Lindsey Road/Mamalahoa Highway intersection. Signal timing improvements include a leading pedestrian interval (LPI) to enhance safety for bicyclists and pedestrians by giving them a "head start" across the intersection before vehicle drivers receive a green light.

The effect of these improvements was analyzed under both existing (2018) conditions, based on collected traffic count data, and future (2036) conditions. Future volumes were estimated assuming an annual growth rate of 0.5% and established in consultation with Hawaii Department of Transportation (HDOT) staff. The key findings of the multimodal analysis under both existing and future conditions are summarized below.

Non-Auto Travel

Pedestrian comfort scores on roadway segments are expected to improve from scores of 4 (i.e., the least comfortable level) to generally scores of 3 with implementation of the proposed project. In addition, selected intersections will be significantly enhanced with the addition of signage, striping, warning beacons and reduced crossing widths. Achieving even greater levels of pedestrian comfort on segments would require substantial additional right-of-way or degradation of operations and safety for other modes. All segments are expected to provide a very good bicycle comfort score of 1 (i.e., the most comfortable level) under Future Plus Project conditions. Improvements in comfort are also expected for bicycles at all intersections.

Vehicle Level of Service

The body of the report evaluates in detail the level of service for isolated intersections and roadway segments under existing and future conditions with and without the project. For the intersection of Lindsey Road/Mamalahoa Highway, delays are projected to increase with implementation of the project under all evaluated scenarios. The increase in intersection delay is due in part to the inclusion of LPIs and in part to the reconfiguration of the westbound departure leg to increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety. However, the overall effect of the project is best measured in travel time through the study corridor, as summarized in the next section. Furthermore, at the intersection of Kawaihae Road/Lindsey Road as well as the roadway segment of Kawaihae Road eastbound between Opelo Road and Lindsey Road, delays will *decrease* with the project under all evaluated scenarios.

Vehicle Travel Times

Under existing conditions, implementation of the project will not change AM peak hour travel times through the study corridor in the eastbound direction, but it will slightly increase AM peak hour travel times in the westbound direction (by 16 seconds). In the PM peak hour, the project improvements result in *approximately 20 seconds of travel time savings in each direction*, indicating that the project would be able to offer immediate relief to the period of worst congestion. These results are summarized on **Figure ES-1**.

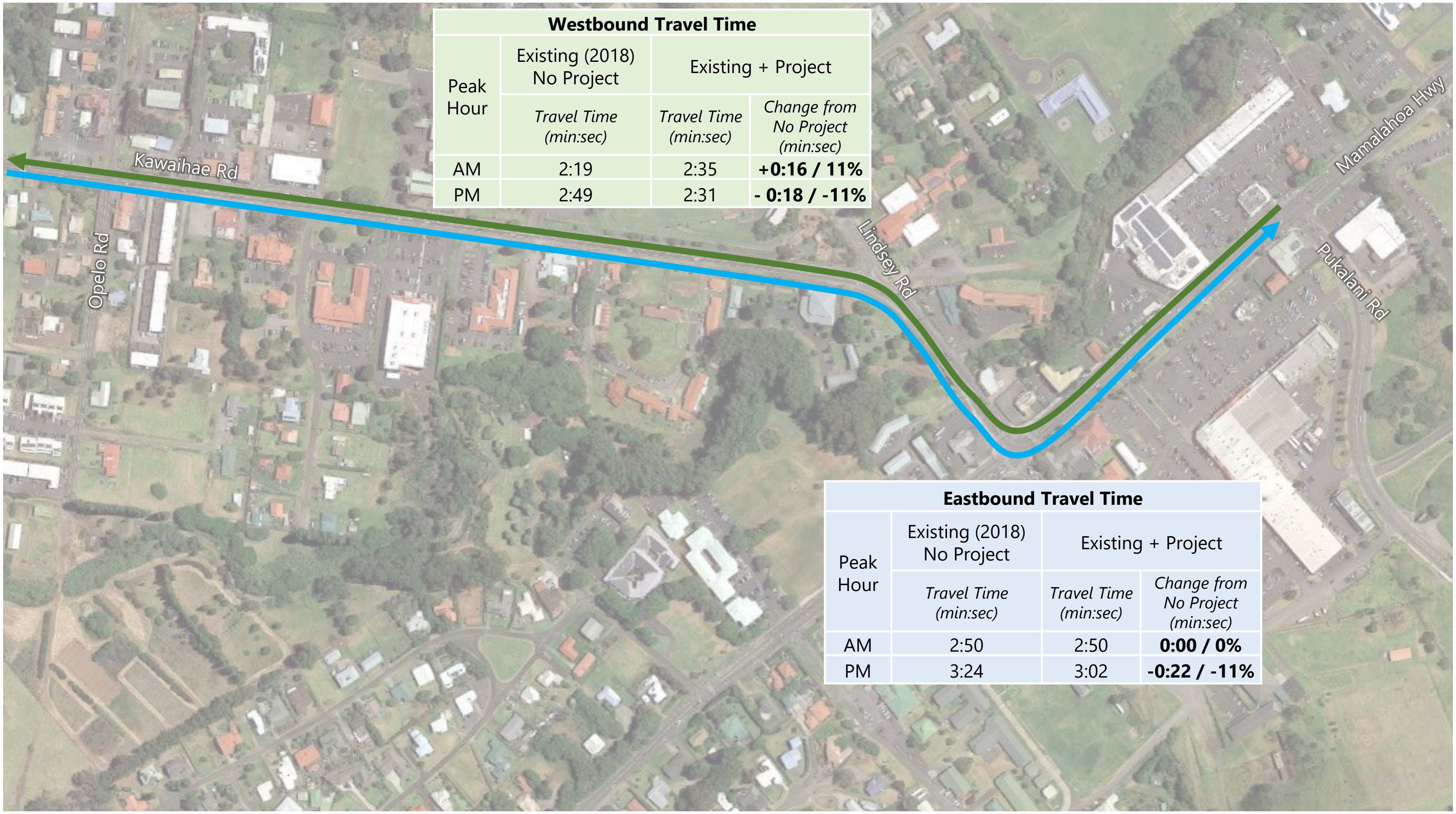
Under future conditions, implementation of the project is projected to provide *approximately 30 seconds of travel time savings* for both directions in the PM peak hour compared to Future No Project conditions. In addition, *approximately 40 seconds of travel time savings* is projected for traffic in the eastbound direction in the AM peak hour. In the westbound direction in the AM peak hour, travel time is projected to increase by 30 seconds. This increase in one direction in one peak hour is caused in large part by modified departure lane configurations and the introduction of LPIs at Lindsey Road/Mamalahoa Highway to enhance safety for pedestrians and bicyclists, as described above. This local increase in delay experienced at the intersection in the AM peak hour will result in slightly longer travel times through the study area; however, in the PM peak hour the increased delay at the signalized intersection is more than offset by the decreased delays along the Kawaihae Road section due to the additional capacity and reduction in left-turn conflicts provided by the two-way left-turn lane. These results are summarized on **Figure ES-2**.

Safety

Based on data obtained from HDOT, 53 collisions occurred within the study area from year 2012 through 2014. The project will improve multimodal safety in Waimea in multiple ways by:

- Providing separate and designated paths of travel for pedestrians, bicyclists, and automobiles
- Slowing travel speeds at Kawaihae Road/Lindsey Road via the roundabout
- Implementing LPIs at the Lindsey Road/Mamalahoa Highway intersection
- Increasing the frequency of demarcated pedestrian crossings to minimize illegal crossings between intersections

- Enhanced pedestrian crossings at select locations including the roundabout
- Eliminating 59 vehicle conflict points throughout the study area.



Westbound Travel Time

Peak Hour	Existing (2018) No Project	Existing + Project	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:19	2:35	**+0:16 / 11%**
PM	2:49	2:31	**- 0:18 / -11%**

Eastbound Travel Time

Peak Hour	Existing (2018) No Project	Existing + Project	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:50	2:50	**0:00 / 0%**
PM	3:24	3:02	**-0:22 / -11%**

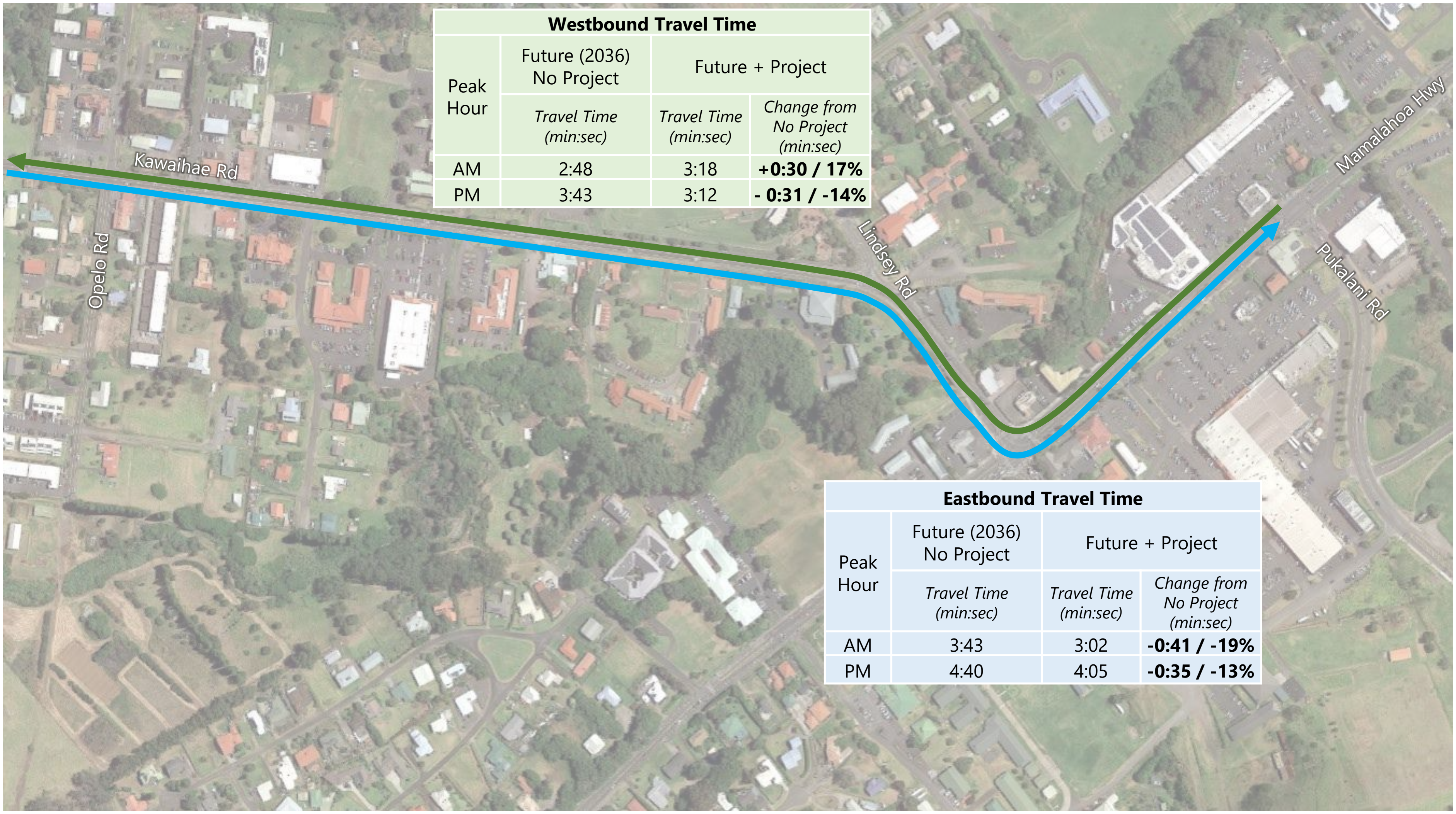
Project = + + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

Eastbound Direction

Westbound Direction

Figure ES-1

Travel Times – Existing (2018) Conditions



Westbound Travel Time

Peak Hour	Future (2036) No Project	Future + Project	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:48	3:18	**+0:30 / 17%**
PM	3:43	3:12	**- 0:31 / -14%**

Eastbound Travel Time

Peak Hour	Future (2036) No Project	Future + Project	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	3:43	3:02	**-0:41 / -19%**
PM	4:40	4:05	**-0:35 / -13%**

Project = + + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

Eastbound Direction

Westbound Direction

Figure ES-2

Travel Times – Future (2036) Conditions

2. Project Description

A set of multimodal improvements is proposed in the Waimea community on the island of Hawaii to enhance safety and efficiency for all travelers through the community. The specific improvements proposed for sections of Kawaihae Road, Lindsey Road, and Mamalahoa Highway include:

- Sidewalks, raised/separated bikeways, and landscaping with street trees along Kawaihae Road from approximately 200 feet west of Opelo Road to Lindsey Road;
- An enhanced crosswalk with a Rectangular Rapid Flash Beacon (RRFB) and raised median island on the east leg of Kawaihae Road/Opelo Road;
- New demarcated crosswalks on Kawaihae Road located:
    - west of Parker Square,
    - east of Longs Drugs (relocated from the existing location), and
    - east of Habitat for Humanity (relocated from the existing location);
- A center two-way left-turn lane along Kawaihae Road between Opelo Road and Lindsey Road;
- Sidewalks, raised/separated bikeways, and landscaping with street trees along Mamalahoa Highway from approximately 300 feet west of Lindsey Road to Lindsey Road;
- A center two-way left-turn lane along Mamalahoa Highway between Waimea Elementary School and Lindsey Road;
- A single-lane roundabout with splitter islands and marked crosswalks at Kawaihae Road/Lindsey Road; and
- Signal timing and lane configuration modifications at the Lindsey Road/Mamalahoa Highway intersection.
    - Signal timing improvements include a leading pedestrian interval (LPI). An LPI is a period during which all vehicles have a red light, and the pedestrian phase is provided with at least three (3) seconds for pedestrians to start crossing. Under this option, bicycle signals would not be installed, and instead signage of “Bikes Use Pedestrian Signal” would instruct bicyclists to travel with pedestrians. The LPI treatment was chosen because it balances added safety for bicycles and pedestrians without substantially degrading vehicle operations. Details of other alternatives considered at this location are provided in **Appendix A**.
    - Lane configuration modifications include an extended eastbound right-turn pocket on Lindsey Road and a reconfiguration of the westbound departure leg on Lindsey Road to provide only one departure lane. This reconfiguration will increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety.

The proposed roundabout includes a one-lane circulating roadway with an inscribed diameter of approximately 125 feet and yield controlled on all approaches. A raised/separated bikeway and sidewalk continue through the roundabout providing continuous bicycle and pedestrian connections.

The study area is illustrated on **Figure 1**, and the specific improvements proposed for sections of Kawaihae Road, Lindsey Road, and Mamalahoa Highway are illustrated on **Figure 2**. The improvements are expected to be constructed in 2022.

3. Methodology

3.1 Non-Auto Travel

Non-auto travel refers to modes including walking and biking. Effects of potential changes to the quality and extent of new pedestrian and bicycle facilities can be evaluated using a set of physical and operations measures that affect a user's comfort level.

Pedestrian and bicycle comfort analysis was conducted using the **Tables 1 through 4**, which were used in the preparation of the *Draft Oahu Pedestrian Master Plan* (2019) prepared by Fehr & Peers under the direction of the City & County of Honolulu Department of Transportation Services (DTS) and from complete streets efforts in Honolulu. This approach uses the best available quantitative and qualitative method used by a jurisdiction in Hawaii for intersections and roadway segments. It should be noted that these tables determine the comfort score using a weakest link approach. This means that if one variable (for example, usable pedestrian zone) has a comfort score of 4, then the entire segment would receive a comfort score of 4. "No effect" signifies that there is no further decrease in comfort for that variable.

Intersections that were unsignalized did not consider the "Accessibility" variable and assumed that all lefts were permitted. Because a user's comfort level is generally affected by the static set of measures identified in **Tables 1 through 4**, future no project conditions for these modes will be unchanged from existing conditions such that the comfort scores are the same.

Study Intersection

Project Extents

Figure 1

Study Area

Figure 2

Waimea Roadway Improvements: Kawaihae Road at Opelo Road

Figure 2 continued

Waimea Roadway Improvements: Kawaihae Road and Lindsey Road

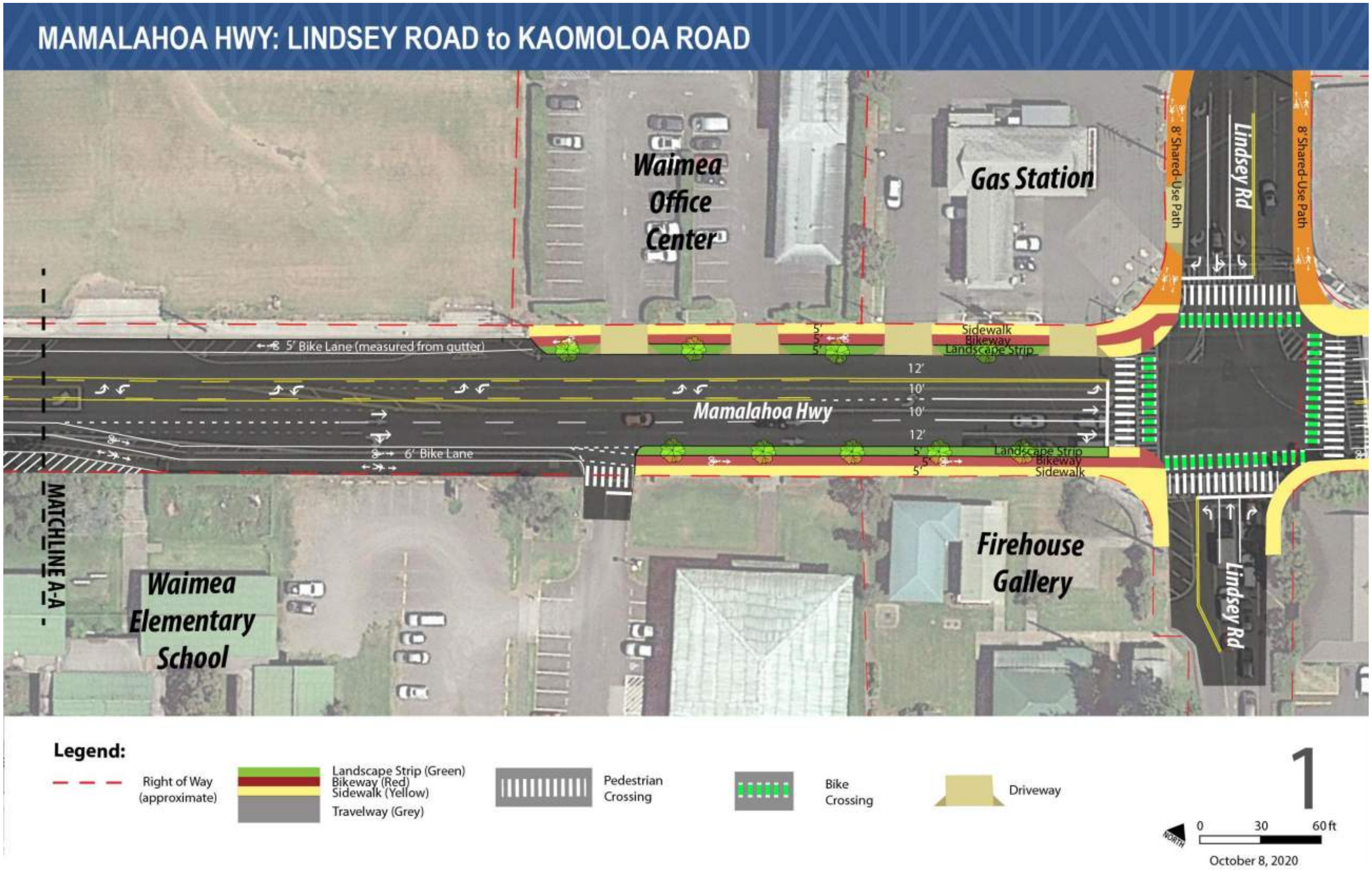


Figure 2 continued

Waimea Roadway Improvements: Mamalahoa Highway from Lindsey Road to Waimea Elementary School

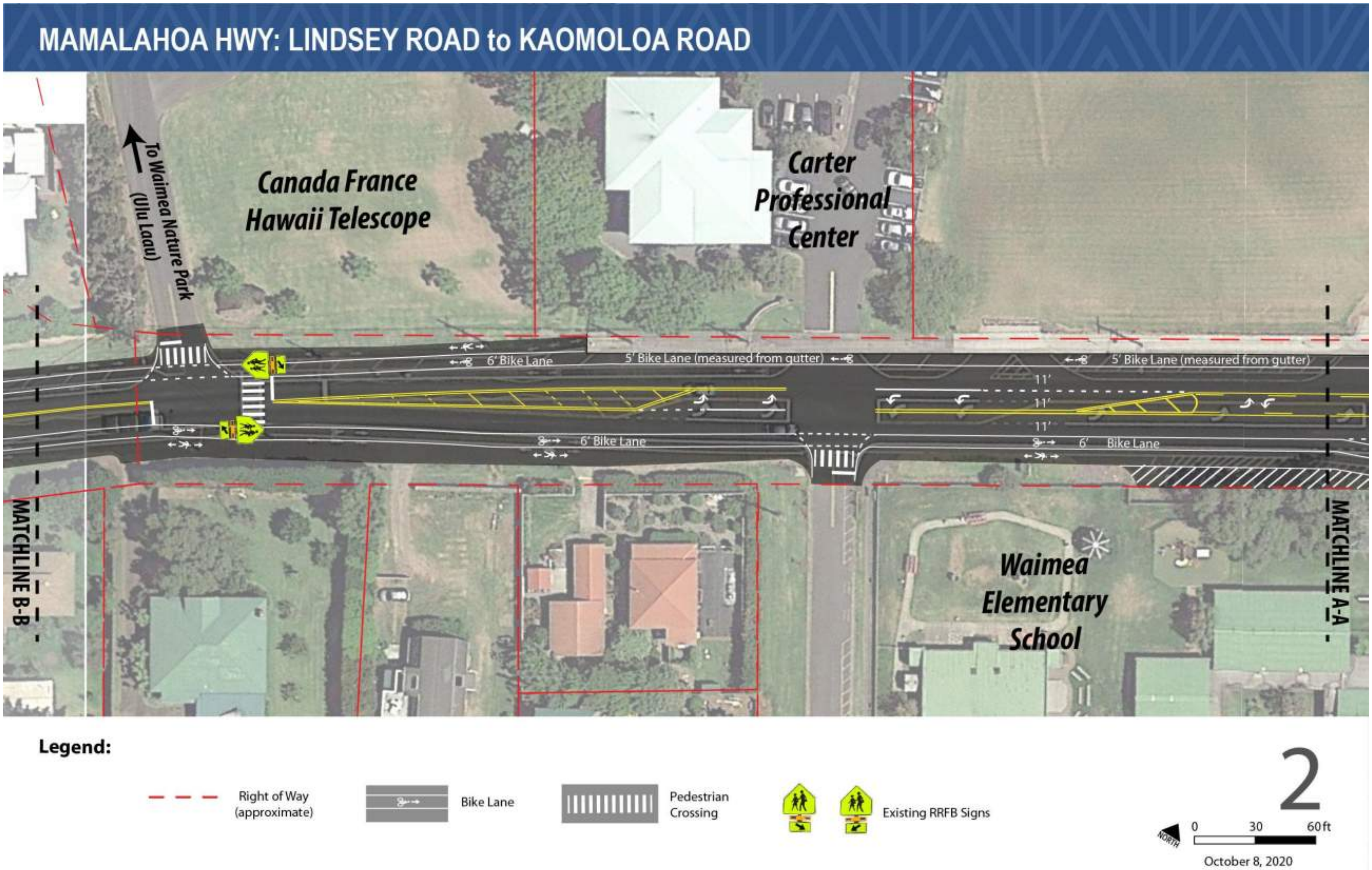


Figure 2 continued

Waimea Roadway Improvements: Mamalahoa Highway from Waimea Elementary School to Ulu Laau Lane

MAMALAHOA HWY: LINDSEY ROAD to KAOMOLOA ROAD

Legend:

Table 1: Pedestrian Segments Within Walking Distance of Schools/Park

Criteria	High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
Usable Pedestrian Zone	5-10 ft	(No Effect)	5-10 feet obstructed OR <5 ft	None
Visual Interest	(No Effect)	(No Effect)	(No Effect)	(No Effect)
Sidewalk Quality	Excellent/New or Fair	(No Effect)	Poor	(No Effect)
Sidewalk Accessibility	Driveways are Outside Sidewalk Path	(No Effect)	Driveways are Into Sidewalk Path	(No Effect)
Landscape Buffer & Street Trees	>0 ft with Tree Canopy	Tree Canopy Only (No Furniture Zone)	No Tree Canopy	(No Effect)
Number of Lanes	2-3 lanes OR 4 lanes with Traffic Calming Feature	4-5 lanes	6-7 lanes	8+ Lanes
Posted Speed	<= 25mph OR Traffic Calming Feature Present	26-30 mph	31-35 mph	>= 36 mph
Lighting	Ped-Scale or Roadway	(No Effect)	(No Effect)	No Lighting
Heavy Vehicle	Not a Freight Route	(No Effect)	Freight Route with Buffer (Roadway Buffer or Furniture Zone >4 ft)	Freight Route with No Buffer
Crosswalk Frequency	<= 300 ft	300-800 ft	>= 800 ft	(No Effect)

Source: *Draft Oahu Pedestrian Master Plan* (prepared by Fehr & Peers, 2019).

Table 2: Pedestrian Intersections (Signalized or Unsignalized) Within Walking Distance of Schools/Park

Criteria	High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
Crossing Distance	2-3 lanes OR 4 lanes with Traffic Calming Feature	4-5 lanes	6-7 lanes	8+ Lanes
Pedestrian Signal Accessibility	APS (Auditory Push Button) and Separated	APS and Same Pole with Audible Message	Two-Inch (Non APS) OR No Countdown	Non-Compliant Push Buttons
Accessibility	Directional Curb Ramps	Diagonal Curb Ramps	(No Effect)	No Curb Ramps
Right-Turn Slip Lanes	No Slip Lane	Signalized Slip Lane	(No Effect)	Yield or Uncontrolled Slip Lane
Pedestrian Scramble or Protected Lefts	Scramble OR All Protected OR LPI With No RTOR	One Approach Protected	All Permitted	(No Effect)

Source: *Draft Oahu Pedestrian Master Plan* (prepared by Fehr & Peers, 2019).

Table 3: Bicycle Segments

<table>
<tr><th colspan="3"></th><th>High Comfort (Score = 1)</th><th>Medium Comfort (Score = 2)</th><th>Low Comfort (Score = 3)</th><th>Critical Barriers (Score = 4)</th></tr>
<tr><td rowspan="11">Facility Type</td><td colspan="2">Bike Path</td><td colspan="4">All Bike Paths are Score 1</td></tr>
<tr><td rowspan="2">Protected Bike Lanes</td><td>Buffer Type</td><td>Solid/Raised</td><td colspan="3">Painted with Vertical Elements[1]</td></tr>
<tr><td>Speed Limit</td><td>30 MPH or less</td><td>35 MPH</td><td colspan="2">40 MPH or more</td></tr>
<tr><td rowspan="4">Bike Lanes
Includes standard or buffered bike lanes</td><td>Speed Limit</td><td>25 MPH or less</td><td>30 MPH</td><td>35 MPH</td><td>40 MPH or more</td></tr>
<tr><td>Bike lane blockage</td><td colspan="2">Rare</td><td colspan="2">Frequent</td></tr>
<tr><td>Total # of travel lanes</td><td colspan="2">3 or less</td><td colspan="2">4 or more</td></tr>
<tr><td>ADT</td><td>5,000 or less</td><td>5,001 – 9,000</td><td>9,001 – 15,000</td><td>15,001 or more</td></tr>
<tr><td rowspan="3">Bike Route
OR
No Bike Facility</td><td>Speed Limit</td><td>25 MPH or less</td><td>30 MPH</td><td colspan="2">35 MPH or more</td></tr>
<tr><td>Total # of travel lanes</td><td colspan="2">3 or less</td><td>4-5</td><td>6 or more</td></tr>
<tr><td>ADT</td><td colspan="2">3,000 or less</td><td>3,001 – 6,000</td><td>6,001 or more</td></tr>
</table>

Source: Previously presented in *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019. Adapted from *Mekuria, Furth, and Nixon, 2012* and project experience

Notes:

[1] Such as soft-hit posts, landscape planters, and other vertical elements that provide additional protection but do not provide a continuous raised barrier

Table 4: Bicycle Intersections

			High Comfort (Score = 1)	Medium Comfort (Score = 2)	Low Comfort (Score = 3)	Critical Barriers (Score = 4)
Facility Type	**Protected Bike Lanes at Signalized Intersections**	Separation	Separate phasing[1] with barrier[2]	Barrier[2] and good sightlines but permitted turns (RT<150 vph) during bicycle phase	Barrier[2] and good sightlines but permitted turns (RT>150 vph) during bicycle phase OR No barrier[3] (RT<150 vph)	No barrier[3] (RT>150 vph)
		Bicycle Left-Turn	Protected Intersection	Painted Treatment[4]	Break in barrier for bikes to merge into mixed traffic	
		Conflicting Left-Turn Treatments	Protected		Permitted	
	Protected Bike Lanes at Stop or Un-Controlled Intersections	Approach Geometry	(no effect)	Barrier with permitted turns (RT<150 vph)	Through bike lane and right-turn lane OR mixing zone with <150 vph	Through bike lane and right-turn lane OR mixing zone with >150 vph
	Pocket Bike Lane *Separate bike lane provided to the left of one or more exclusive right turn-lanes*	Number of right-turn lanes	0	1		2 or more
		Length of right turn lane	150' or less		151' or more	
		Turning speed	Less than 15 MPH		20 MPH	25 MPH or more
		Characteristics	Turn lane has a steep taper and bike lane continues straight		Turn lane does not have a steep taper and/or bike lane shifts left to accommodate turn lane	
	Bicycles in Mixed Traffic *Either street has no bike lanes or bike lane is dropped*	Number of right-turn lanes	0 - 1			2 or more
		Length of right turn lane	75' or less		76' - 150'	151' or more
		Turning speed	Less than 15 MPH			20 MPH or more

Source: Previously presented in *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019. Adapted from *Mekuria, Furth, and Nixon, 2012* and project experience

Notes:

[1] Either with protected right-turn phase or dedicated bicycle only phase that does not overlap with permitted turning autos or opposing auto movements.

[2] Barrier would be a solid, raised element (such as curb or landscape-buffer) or a protected intersection that remains up until the intersection

[3] For example, mixing zone or striped bike lane with right-turn pocket

[4] For example, two-stage turn box or bike box

3.2 Vehicle Level of Service

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6), published by the Transportation Research Board in 2016. The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six (6) levels are defined; from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents “at-capacity” operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The methodologies for signalized intersections, unsignalized intersections, and roadway segments are described below.

3.2.1 Signalized Intersections

The method described in Chapter 19: Signalized Intersections of the HCM 6 was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection’s operation based on average control delay per vehicle. Control delay alone is used to characterize LOS for the entire intersection or an approach. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using Vissim 11 analysis software and is correlated to a LOS designation as shown in **Table 5**. Vissim best reflects the potential operational issues associated with the relatively closely-spaced intersections comparing different traffic control devices (i.e., a signal and roundabout) and is more accurate for studying roundabouts than other analysis tools such as Synchro and SimTraffic.

3.2.2 Unsignalized Intersections

The operations of the unsignalized study intersections were evaluated using the method contained in Chapter 20: Two-Way Stop-Controlled Intersections of the HCM 6. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At two-way or side-street-controlled (SSSC) intersections, the average control delay is calculated for each minor-street stopped movement and the major-street left turns; not for the intersection as a whole. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented for SSSC. The average control delay for unsignalized intersections is calculated using Vissim 11 analysis software and is correlated to a LOS designation as shown in **Table 6**.

Table 5: Signalized Intersection Level of Service Definitions

Level of Service	Description	Delay (sec/veh)
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2016.

Table 6: Unsignalized Intersection Level of Service Definitions

Level of Service	Description	Delay (sec/veh)
A	Little or no delay.	≤ 10.0
B	Short traffic delay.	> 10.0 to 15.0
C	Average traffic delays.	> 15.0 to 25.0
D	Long traffic delays.	> 25.0 to 35.0
E	Very long traffic delays.	> 35.0 to 50.0
F	Extreme traffic delays with capacity exceeded.	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2016.

3.2.3 Roadway Segments

HCM 6 evaluates roadway segment operations depending on the class of facility. For street segments along corridors with signalized intersections, the calculation described in Chapter 18: Urban Street Segments would apply. On these segments, delay caused by mid-block turns and delay at the downstream intersection are the key contributors to reducing average speed relative to the free-flow speed. This method, which measures the percent of free-flow speed (PFFS), was used for the segments of Mamalahoa Highway between Waimea Elementary School and Lindsey Road.

All other roadway segments are two-lane highways, where movements on the highway are uncontrolled, and the methodologies described in Chapter 15: Two-Lane Highways were applied instead. These facilities are further broken down into three classifications that are evaluated by different metrics based on their context in the roadway network. Class I highways are defined as facilities that operate as major intercity routes, and accordingly motorists expect to travel at relatively high speeds. The operations on this type of facility are evaluated based on average travel speed and percent-time spent following (PTSF) another vehicle, which represents the freedom to maneuver and the convenience of travel on the study segment. Class II highways are defined as facilities that provide access to Class I facilities or that pass through rugged or winding terrain, such that motorists do not necessarily expect to travel at high speeds. On these facilities, operations are defined only by PTSF. Class I and Class II highways are not present within the study area, and therefore these methods were not applied for this analysis.

Lastly, Class III highways are defined as facilities that pass through moderately developed areas, such that local traffic mixes with through traffic. The operations on this type of facility are based on PFFS, since motorists do not expect to travel quickly but would like to make steady progress at or near the speed limit. This method was applied to the street segment of Kawaihae Road between Opelo Road and Lindsey Road.

A summary of the LOS designation for the two relevant metrics is shown in **Table 7**.

Because the roadway segment analysis required capacity calculations and delay calculations for intersections not included in the Vissim 11 network, the roadway segment delays and vehicle-to-capacity inputs were based on Synchro 10 outputs.

Table 7: Roadway Segment Level of Service Definitions

Level of Service	Urban Street Segment: PFFS	Class III Highways: PFFS
A	> 80%	> 91.7%
B	> 67% to 80%	> 83.3% to 91.7%
C	> 50% to 67%	> 75% to 83.3%
D	> 40% to 50%	> 66.7% to 75.0%
E	> 30% to 40%	≤ 66.7%
F	≤ 30% or V/C > 1	V/C > 1

Source: *Highway Capacity Manual*, Transportation Research Board, 2016.
Notes:
PFFS = Percent Free-Flow Speed
V/C = Vehicle-to-Capacity ratio

3.3 Vehicle Travel Times

In addition to the level of service calculations for each facility, an evaluation of operations throughout the network was performed using average travel time calculations from the Vissim software. Travel times were calculated along an eastbound path from Kawaihae Road just east of Puu Opelu Road to Mamalahoa Highway just west of Pukalani Road, and along a westbound path from Mamalahoa Highway just west of Pukalani Road to Kawaihae Road just east of Kapena Place. The endpoints of each path were chosen to capture the queueing along approaches to each study intersection and to identify the effect of the proposed two-way left-turn lanes.

It is important to note that the travel times are based on typical conditions. Due to the limited number of routes through Waimea, the roadway network is highly sensitive to road closures that may occur for construction or maintenance activities as well as for emergencies, including collisions, weather-related (including flooding or fires), spills, or other unforeseen events. Accordingly, roadway operations will be substantially different when there is such a breakdown in the overall network.

3.4 Safety

An evaluation of the baseline safety conditions was performed by reviewing historic collision data. Then, as a proxy for understanding how the project will change safety conditions in the study area, the change in the number of conflict points along the study roadways with the project were enumerated. For example, where a two-way left-turn lane is implemented at a driveway that forms a T-intersection, there are two (2) conflicts that are eliminated: one being a conflict for left-turning vehicles into the driveway, which will be made via a separate lane from through traffic in the same direction on the major roadway, and the other being a conflict for left-turning vehicle out of the driveway, which will be made using the two-way left-turn lane as a refuge before finding an appropriate gap to merge into the major roadway travel lane. This reduction of two conflicts per driveway, per side of the roadway was multiplied by the number of driveways along each roadway segment where the project proposes to implement a two-way left-turn lane.

At Kawaihae Road/Opelo Road, the project will provide an exclusive left-turn lane for the eastbound approach. This improvement will eliminate one (1) conflict for the intersection: the conflict between eastbound left-turning traffic and eastbound through traffic. Finally, the proposed roundabout will eliminate four (4) vehicle conflicts compared to the existing side-street stop-control at Kawaihae Road/Lindsey Road.

4. Existing (2018) Conditions

This section describes the existing conditions within the study area.

4.1 Existing No Project Conditions

4.1.1 Non-Auto Travel

Following the methodology described in **Section 3.1**, the results of the comfort analyses for existing conditions without the project are presented in **Table 8**. Detailed analysis including the variables for each segment and intersection is provided in **Appendix B**.

Table 8: Baseline Conditions – Pedestrian and Bicycle Comfort Scores on Segments and Intersections

Segment/Intersection	Existing No Project Pedestrian Comfort Score	Existing No Project Bicycle Comfort Score
Segment 1: Kawaihae Rd Between Opelo Rd and Lindsey Rd	4	4
Segment 2: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy	4	4
Segment 3: Mamalahoa Hwy West of Lindsey Rd	4	4
Intersection 1: Opelo Rd/Kawaihae Rd	4	4
Intersection 2: Kawaihae Rd/Lindsey Rd	4	3
Intersection 3: Lindsey Rd/Mamalahoa Hwy	4	4

Source: Previously presented in *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019.

As shown, the baseline pedestrian and bicycle comfort scores are very poor in the study area with most scores of 4, and a score of 3 at only Kawaihae Road/Lindsey Road.

It is also noted that these results assume legal behavior at the Lindsey Road/Mamalahoa Highway intersection, where the southbound right-turn is allowed to turn on red after coming to a stop. However, vehicles making this turn have been observed to proceed through the intersection as though a channelized free right-turn were provided. This driving behavior is unsafe for pedestrians because vehicles are not properly stopping and yielding for pedestrians that have the right-of-way crossing the north leg of Mamalahoa Highway.

4.1.2 Vehicle Level of Service

Intersection counts were collected for automobiles, bicycles, and pedestrians in 15-minute intervals at the Mamalahoa Highway/Lindsey Road intersection. The counts were conducted on Wednesday, November 14, 2018, during the weekday morning (6:00 AM to 9:00 AM) and weekday afternoon (2:00 PM to 6:00 PM) periods. This information and the existing lane configurations and traffic control devices were used to analyze operations at each intersection. Detailed counts are provided in Appendix A of the *Existing Conditions Evaluation* dated January 21, 2019. The existing lane configurations were modelled in Vissim 11 microsimulation software, and operations were calibrated to reflect driver behavior and queueing consistent with field observations

Following the methodology described in **Section 3.2**, the resulting level of service at each intersection is presented below in **Table 9**, and the resulting level of service along each roadway segment is presented below in **Table 10** for existing conditions. Detailed intersection analysis, including queueing results, is provided in **Appendix C**, and detailed roadway segment analysis is included in **Appendix D**.

Table 9: Existing (2018) Conditions – Intersection Level of Service (LOS)

Intersection	Traffic Control[1]	Peak Hour	Existing	
			Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd/Lindsey Rd	SSSC	AM	17.6	C (WBT)
		PM	27.8	D (EBL)
Lindsey Rd/Mamalahoa Hwy	Signal	AM	33.0	C
		PM	34.6	C

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

Table 10: Existing (2018) Conditions – Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Existing (2018) No Project LOS
Eastbound/Northbound			
Kawaihae Rd: Between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	D
		PM	D
Westbound/Southbound			
Kawaihae Rd: Between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	D
		PM	D
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	A
		PM	A

Source: Fehr & Peers, 2020.

It is also noted that these results assume legal behavior at the Lindsey Road/Mamalahoa Highway intersection, where the southbound right-turn is allowed to turn on red after coming to a stop. However, as noted above in **Section 4.1.1**, vehicles making this turn have been observed to proceed through the intersection as though a channelized free right-turn were provided. Taking this behavior into account would result in improved operations over what is presented in **Tables 9, 10, and 11** due to decreased delays for this movement; however, this driving behavior is unsafe for pedestrians because vehicles are not properly stopping and yielding for pedestrians that have the right-of-way crossing the north leg of Mamalahoa Highway.

4.1.3 Vehicle Travel Times

The travel times through the corridor are summarized below in **Table 11**. Detailed results are provided in **Appendix E**.

Table 11: Existing Conditions – Study Area Travel Times

Direction / Path	Peak Hour	Travel Time (min:sec)
Eastbound / Kawaihae Road to Mamalahoa Highway	AM	2:50
	PM	3:24
Westbound / Mamalahoa Highway to Kawaihae Road	AM	2:19
	PM	2:49

Source: Fehr & Peers, 2020.

4.1.4 Safety

Baseline safety conditions were evaluated using historic collision data. Detailed collision information for the major roadways that pass through the study area was obtained from the Hawaii Department of Transportation (HDOT) for year 2012 through 2014. These segments include the following:

- Kawaihae Road (from Queen Kaahumanu Highway to Lindsey Road)
- Lindsey Road (from Kawaihae Road to Mamalahoa Highway), and
- Mamalahoa Highway (from Saddle Road to Mud Lane)

While some of the sections of these roadways are outside the immediate study area, this information provided a comprehensive look at collision patterns in and around the Waimea area.

All of the reported collisions are mapped on **Figure 3**, and include 98 total, with 53 occurring within the immediate vicinity of the study area. Of the three years under study, 2012 included the highest number of collisions (22) within the immediate study area.

As shown on **Figure 3**, collisions are distributed across the roadway segments with a concentration of conflicts occurring at two key "hot spot" locations with more than five (5) collisions in the three-year period:

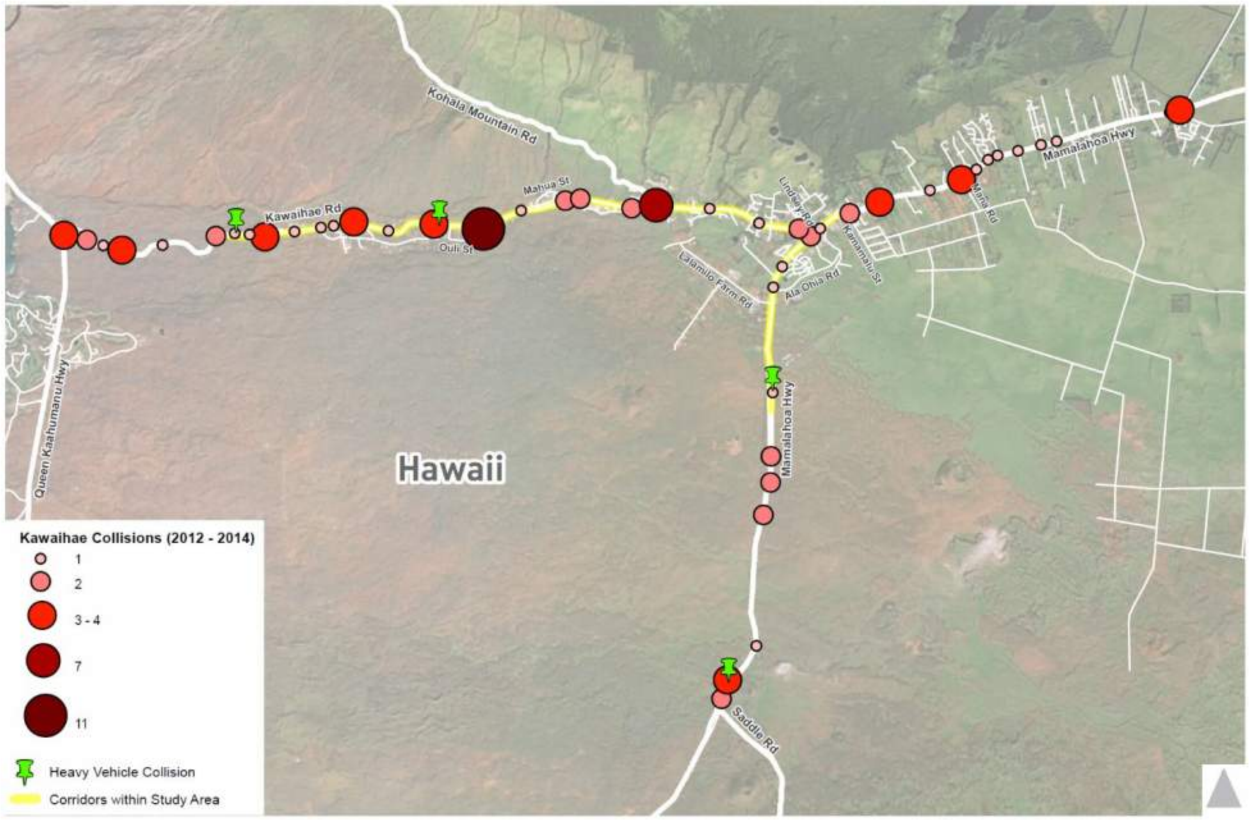
- Kawaihae Road approximately ½-mile east of Ouli Street (on a curved section) – 11 collisions
- Kawaihae Road at the Kohala Mountain Road intersection (near Waiaka Bridge) – 7 collisions

No industry criterion has been uniformly established to determine an excessive number of collisions, but one or two collisions per year at a location is typically not identified as a problem location unless the collision severity in terms of injuries or fatalities occurs frequently.

At the two hot spot locations, the collision factors were reviewed for each individual collision from the detailed police reports to identify any recurring patterns or causes. Near Waiaka Bridge where Kawaihae Road includes an abrupt curve compared to the rest of the roadway, the presence of rain appeared to be a factor in most of the collisions. Vehicles were reported running off the road, crossing the centerline, and swerving to avoid an obstacle. Drivers were also inattentive, misjudged conditions, or failed to yield.

East of Ouli Road on the curve of Kawaihae Road, it is not possible to determine a consistent or primary collision factor based on the available information. Most drivers appeared to fail to maintain travel in their lane or crossed the centerline apparently due to a variety of factors including speeding, inattention, or alcohol. Regardless, the frequency of collisions at both locations with a notable change in roadway alignment is likely a contributing factor to these incidents.

Figure 3 – Collision Data (2012 to 2014)



Source: HDOT

The number of heavy vehicle collisions was also investigated and a total of three collisions of this type occurred within the study area: two at separate locations on Kawaihae Road between the western study boundary, and one on Mamalahoa Highway just south of the airport access road.

Lastly, the number of collisions resulting in fatalities was identified as part of the data review. The only fatal collision within the study area between 2012 and 2014 actually involved a large truck and was a single vehicle accident that occurred at the western study area boundary just west of Waiemi Place. While the collision data by itself does not show a systemic problem related to heavy vehicle traffic and corridor safety, it is important to note that the data includes only reported collisions. Unreported collisions and "near misses" can also factor into safety assessments for corridors.

4.2 Existing Plus Project Conditions

4.2.1 Non-Auto Travel

As part of the bicycle and pedestrian improvements proposed for the project area, a raised/separated bikeway and enhanced sidewalk are proposed for portions of Kawaihae Road, Lindsey Road, and Mamalahoa Highway. To determine the potential benefits related to these improvements, a comfort analysis was conducted for both pedestrian and bicyclist users of the upgraded facilities. Under Existing Plus Project conditions, all analyzed roadways were considered to be freight routes. Intersections that were unsignalized did not consider the "Accessibility" variable and assumed that all lefts were permitted.

The results of the comfort analyses for the proposed bicycle and pedestrian improvements are presented in **Tables 12 and 13**. Detailed analysis including the variables for each segment and intersection is provided in **Appendix B**. For some segments and intersections, engineering judgement was used to provide a score for the proposed condition that is reflective of the expected comfort of the facility in the context of Waimea. These locations are discussed below.

As shown in **Table 12**, all pedestrian facilities will have improved comfort scores under plus project conditions. According to the methodology, the comfort score associated with the intersection at Opelo Road/Kawaihae Road would not change as there are still uncontrolled turning movements that could potentially conflict with pedestrians crossing either side of Opelo Road. However, due to the addition of an RRFB across the east leg of Kawaihae Road and an RRFB's potential effect to slow all traffic at the intersection, it is expected that the perceived comfort score at the intersection would decrease to a 3.

Table 12: Pedestrian Segments and Intersections Comfort Score

Segment/Intersection	Existing No Project Comfort Score	Existing Plus Project Comfort Score
Segment 1: Kawaihae Rd Between Opelo Rd and Lindsey Rd	4	3
Segment 2: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy	4	3
Segment 3: Mamalahoa Hwy West of Lindsey Rd	4	3
Intersection 1: Opelo Rd/Kawaihae Rd	4	3*
Intersection 3: Lindsey Rd/Mamalahoa Hwy	4	2

Source: Previously presented in *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019.
Notes:
* This intersection receives a comfort score of 3 due to the addition of an RRFB on its east leg.

All bicycle segments are expected to be very comfortable under plus project conditions. Improvements in comfort are also expected for all bicycle intersections.

Table 13: Bicycle Segments and Intersections Comfort Score

Segment/Intersection	Existing No Project Comfort Score	Existing Plus Project Comfort Score
Segment 1: Kawaihae Rd Between Opelo Rd and Lindsey Rd	4	1
Segment 2: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy	4	1
Segment 3: Mamalahoa Hwy West of Lindsey Rd	4	1
Intersection 1: Opelo Rd/Kawaihae Rd	4	2
Intersection 3: Lindsey Rd/Mamalahoa Hwy	4	3

Source: Previously presented in *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019.

The pedestrian and bicycle comfort scores for the proposed roundabout were also evaluated. Due to limitations of the methodology, the pedestrian intersection analysis for roundabouts initially results in a poor comfort score of 4, as all legs are considered to have yield-controlled slip lanes. The methodology does not distinguish between yield control and no control, and only identifies an increase in comfort if vehicle traffic is required to stop at a stop sign, traffic signal, or pedestrian enhancement like a RRFB.

However, a roundabout is different in that pedestrians only need to wait for a gap in traffic in one direction, pedestrians only need to cross one lane of traffic, and vehicle travel speed entering the intersection is reduced through deflection of the approach lane next to the raised splitter island. Therefore, a roundabout provides an enhanced pedestrian environment, as compared to the existing conditions at the Kawaihae Rd/Lindsey Rd intersection, and accordingly a decreased comfort score is estimated to improve to 3. If RRFBs were added at the pedestrian/bicycle crossings at the roundabout, it is expected that the comfort score could be decreased.

4.2.2 Vehicle Level of Service

The proposed improvements were added to the Vissim network for existing conditions, consisting of a two-way-left-turn-lane along Kawaihae Road, a roundabout at Kawaihae Road/Lindsey Road, and modifications to the lane configurations and signal timing at Lindsey Road/Mamalahoa Highway. Volume adjustments were made to account for additional permitted movements into and out of the Parker School Driveway under Existing Plus Project conditions. This scenario is used to determine the effect of hypothetically implementing the project immediately. Intersection LOS results are summarized below in **Table 14**, and roadway segment LOS results are summarized in **Table 15**. Furthermore, queueing without and with the project is visualized on **Figures 4 and 5**. Detailed intersection analysis, including queueing results, is provided in **Appendix C**, and detailed roadway segment analysis is included in **Appendix D**.

Table 14: Existing (2018) Conditions – Intersection Level of Service (LOS)

Intersection	Traffic Control[1]	Peak Hour	Existing No Project		Existing Plus Project	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd/Lindsey Rd	SSSC / Roundabout	AM	17.6	C (WBT)	7.4	A
		PM	27.8	D (EBL)	8.9	A
Lindsey Rd/Mamalahoa Hwy	Signal	AM	33.0	C	38.3	D
		PM	34.6	C	39.6	D

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

As shown in **Table 14**, the proposed roundabout will improve operations at Kawaihae Road/Lindsey Road, while overall intersection delays at Lindsey Road/Mamalahoa Highway are projected to increase slightly by approximately five (5) seconds. Queues under the project scenario with implementation of LPIs are generally similar to the no project conditions, but the eastbound approach to Lindsey Road/Mamalahoa Highway will increase by approximately 550 feet in the PM peak hour.

A detailed review of the operations results indicates that the eastbound volume served at Lindsey Road/ Mamalahoa Highway improves from 91.2% without the project to 98.5% with the project (see **Appendix C**). This is due to the substantially improved operations offered by the proposed roundabout and the two-way left-turn lane along Kawaiahae Road, which increase the throughput of the corridor. This higher volume served, while *an overall operational improvement*, effectively increases the eastbound demand at the Lindsey Road/Mamalahoa Highway intersection, resulting in longer queueing and increased delays for the eastbound approach. The southbound approach also experiences an increase in delay due in part to the inclusion of LPIs and in part to the reconfiguration of the westbound departure leg to increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety.

Table 15 shows that eastbound operations along Kawaihae Road will improve with the project. All other segments maintain the same LOS with implementation of the project.

Table 15: Existing (2018) Conditions – Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Existing No Project LOS	Existing Plus Project LOS
Eastbound/Northbound				
Kawaihae Rd: Between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	D	D
		PM	D	D
Westbound/Southbound				
Kawaihae Rd: Between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	D	D
		PM	D	D
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	A	A
		PM	A	A

Source: Fehr & Peers, 2020.
Notes:
* Although the plus project conditions show a lower roadway segment LOS than without the project (experienced by the southbound through and right-turn movements), this is caused by modified signal timings and the introduction of LPIs at Lindsey Rd/Mamalahoa Hwy, a safety enhancement for pedestrians and bicyclists. It should be noted that the overall travel time throughout the corridor only experiences a slight increase under existing plus project conditions (see **Table 16**).

Project = + + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

Average Queue

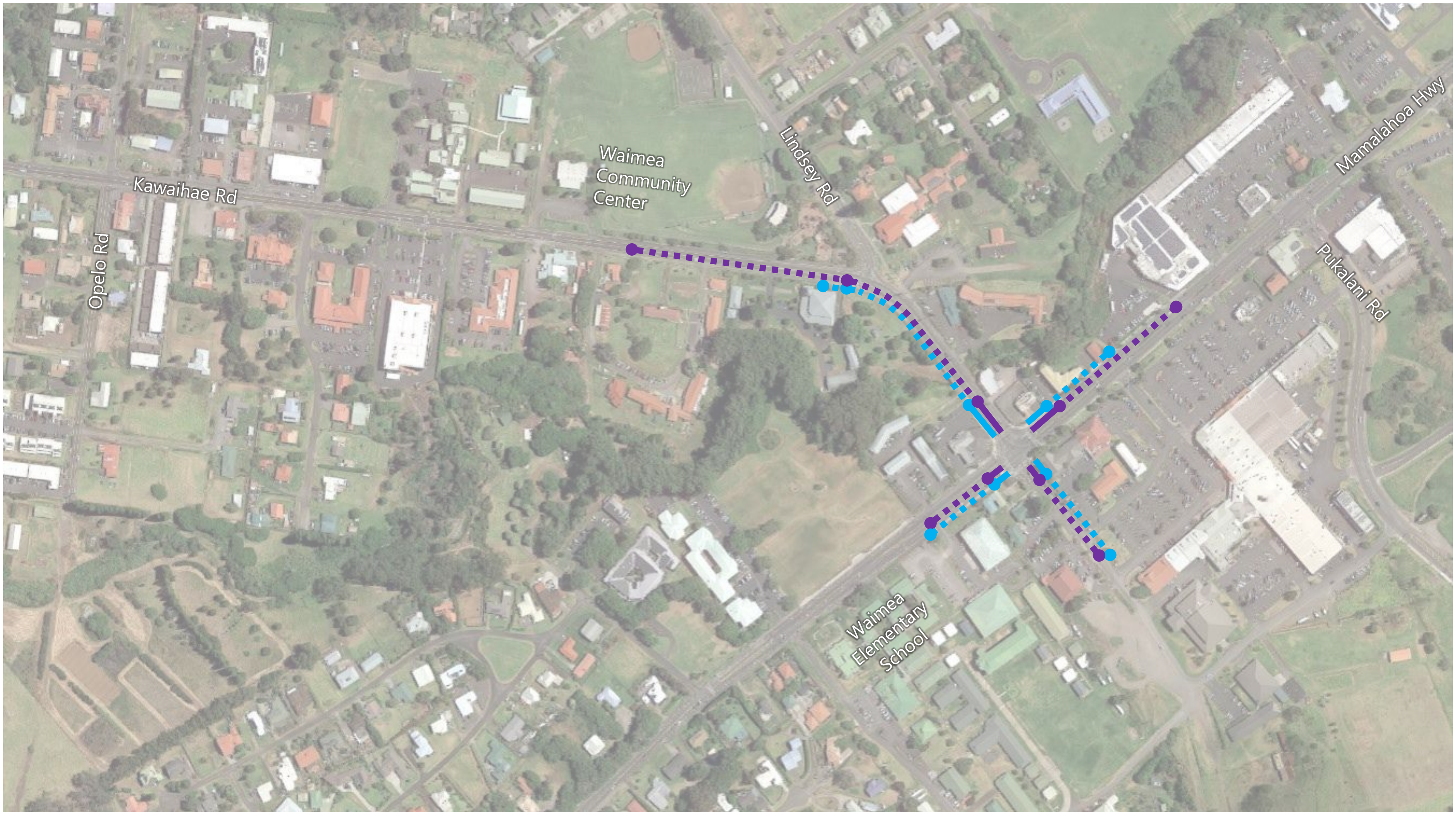
Maximum Queue

Existing (2018) No Project

Existing + Project

Figure 4

Queue Lengths – Existing (2018) AM Peak Hour



Project = + + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

Average Queue

Maximum Queue

Existing (2018) No Project

Existing + Project

Figure 5

Queue Lengths – Existing (2018) PM Peak Hour

4.2.3 Vehicle Travel Times

The travel times through the corridor are summarized below in **Table 16**. Detailed results are provided in **Appendix E**. As shown, with implementation of the project, AM peak hour travel times are project to have no change in the eastbound direction and a small increase (of 16 seconds) in the westbound direction. The increase in travel time in this direction and peak hour is due to LPIs and the departure lane reconfiguration as described above. In the PM peak hour, however, the local increase in delay at the intersection is outweighed by the decreased delays along the Kawaihae Road section due to the two-way left-turn lane. As a result, the project improvements are projected to provide *approximately 20 seconds of travel time savings in each direction*, indicating that the project would be able to offer immediate relief to the period of worst congestion.

Table 16: Existing (2018) Conditions – Study Area Travel Times

Direction / Path	Peak Hour	Travel Time (min:sec)		Change in Travel Time (min:sec / % change)
		Existing No Project	Existing Plus Project	
Eastbound / Kawaihae Road to Mamalahoa Highway	AM	2:50	2:50	+0:00 / 0%
	PM	3:24	3:02	-0:22 / -11%
Westbound / Mamalahoa Highway to Kawaihae Road	AM	2:19	2:35	+0:16 / 11%
	PM	2:49	2:31	-0:18 / -11%

Source: Fehr & Peers, 2020.

4.2.4 Safety

The reduction in conflicts with project implementation along each study segment are summarized in **Table 17**. This decrease in conflicts will improve multimodal safety in Waimea.

Table 17: Conflict Reductions by Study Segment

Intersection Type	Change in Vehicle Conflicts with Project Implementation
Segment 1: Kawaihae Rd Between Opelo Rd and Lindsey Rd (including the Opelo Rd intersection)	-53
Segment 2: Lindsey Rd Between Kawaihae Rd and Mamalahoa Hwy (including the Kawaihae Rd intersection)	-6
Segment 3: Mamalahoa Hwy West of Lindsey Rd	0
Total	**-59**

Source: Fehr & Peers, 2020.

5. Future (2036) Conditions

5.1 Future No Project

5.1.1 Non-Auto Travel

The pedestrian and bicycle comfort scores do not depend on vehicle volumes, and therefore, without any other planned roadway improvements in the area, the baseline conditions presented in **Table 8** for existing conditions also apply to future no project conditions.

5.1.2 Future Traffic Volumes

Existing (2018) volumes were increased by a total of 9.5% to estimate traffic volumes at the point when the roundabout and signal would experience excessive delays and vehicle queuing and where the intersections would no longer have sufficient capacity during the peak commute periods. The year at which these volumes are reached will depend on when traffic returns to 2018 conditions following the ongoing COVID-19 pandemic, as well as how quickly additional development occurs within the greater Waimea and surrounding areas.

Based on the Hawaii Regional Long-Range Land Transportation Plan (LRLTP) prepared by HDOT, a growth factor of approximately 1.3% per year is projected from 2007 to 2035. Assuming this annual rate of growth and without taking account for reductions in traffic due to the pandemic and various economic downturns, traffic volumes would reach a 9.5% overall increase from 2018 counts in the year 2025. However, this growth rate is now considered to be overly optimistic given the limited amount of planned development in the Waimea area, the precipitous drop in tourism and economic activity due to the pandemic, and the potential long recovery time for conditions to return to pre-COVID-19 levels. To provide some perspective, it took 51 months for employment to recover to pre-Great Recession levels after 18 months of a major downturn according to the Economic Policy Institute.[1] Even if the post-pandemic recovery is faster overall, other issues associated with air travel and tourism to Hawaii are expected to moderate traffic growth. Accordingly, an annual growth rate of 0.5% is considered to be more reasonable to reflect future growth for purposes of analyzing this project. With this annual growth rate and without taking account for reductions in 2018 traffic counts due to the pandemic, traffic volumes would reach a 9.5% overall increase by the year 2036.

It is noted that, as of July 2020, observed daily traffic at the reported count station along Saddle Road to the south of Waimea are approximately 35% below 2019 annual average daily traffic levels.[2] If traffic volumes take some time to return to their 2019 levels, as recent technical memoranda suggest,[3] it is

[1] https://www.epi.org/publication/why-is-recovery-taking-so-long-and-who-is-to-blame/
[2] https://hidot.hawaii.gov/highways/covid-19-traffic-volume-comparison/
[3] *Counts and Studies during a Pandemic*, ITE 2020; *Automotive's new reality*, KPMG 2020

reasonable to expect that it will take even longer to reach the 9.5% overall increase in volumes over 2018 traffic counts than is projected for the purposes of this analysis.

5.1.3 Vehicle Level of Service

After applying this growth in vehicle volumes and following the methodology described in **Section 3.2**, the resulting level of service at each intersection is presented below in **Table 18**, and the resulting level of service along each roadway segment is presented below in **Table 19** for future conditions. Furthermore, queueing both without and with the project is visualized on **Figures 6 and 7**. Detailed intersection analysis, including queueing results, is provided in **Appendix C**, and detailed roadway segment analysis is included in **Appendix D**.

Table 18: Future (2036) Conditions – Intersection Level of Service (LOS)

Intersection	Traffic Control[1]	Peak Hour	Future No Project	
			Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd/Lindsey Rd	SSSC	AM	**51.8**	**F** (SBL)
		PM	**> 100**	**F** (SBL)
Lindsey Rd/Mamalahoa Hwy	Signal	AM	41.9	D
		PM	44.7	D

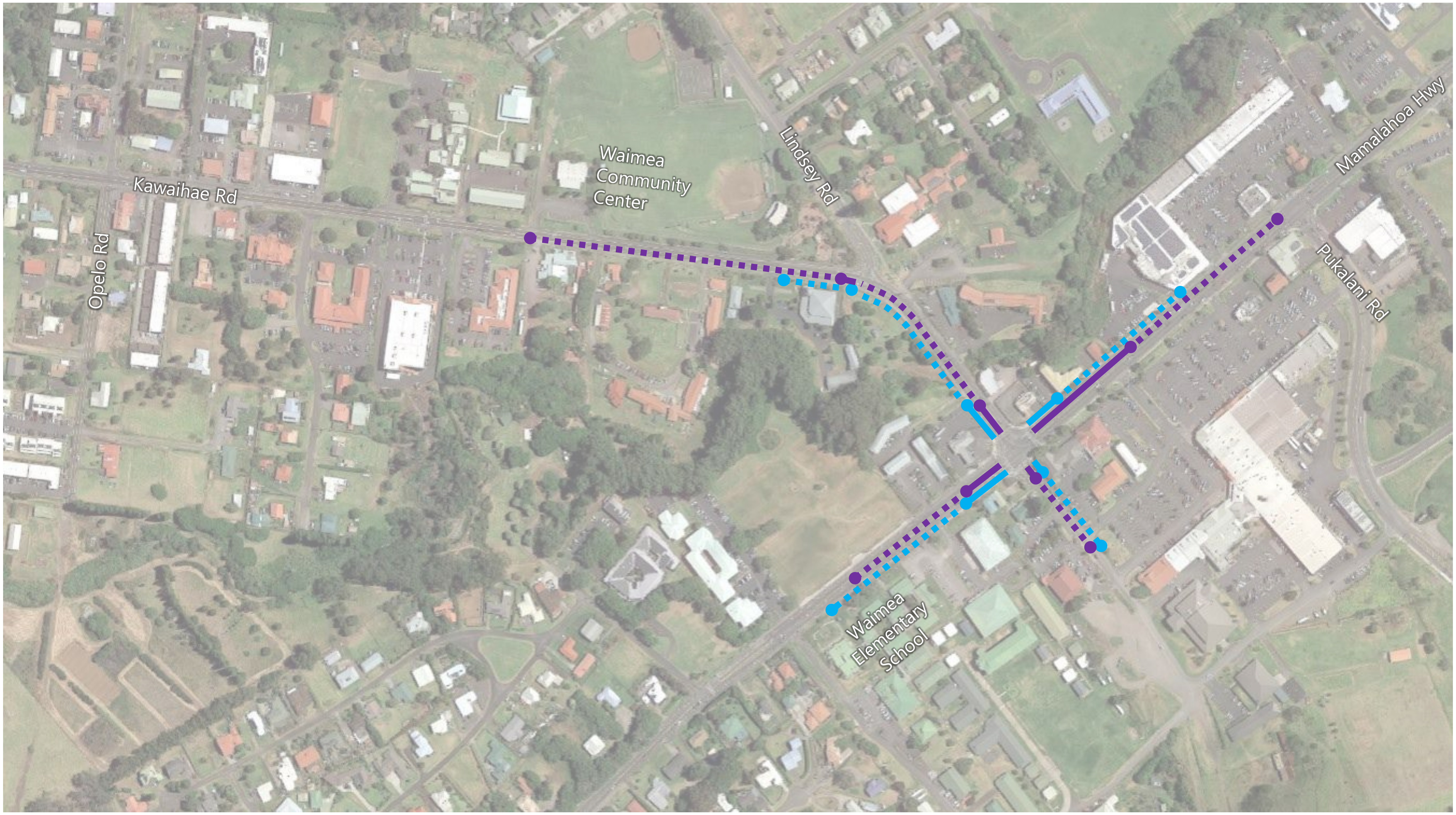
Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

In addition to the worst-movement delay degrading to LOS F operations, the eastbound left-turn queueing from the Lindsey Road/Mamalahoa Highway signalized intersection is expected to exceed the available turn pocket storage, blocking eastbound through traffic from reaching the downstream intersection of Lindsey Road/Mamalahoa Highway. Otherwise average queues are projected to remain relatively short, but the maximum queues on the eastbound approach to Lindsey Road/Mamalahoa Highway will extend past the intersection with Kawaihae Road during both peak hours, and will extend nearly to the Waimea Community Center in the PM peak hour.

Table 19: Future (2036) Conditions – Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Future No Project LOS
Eastbound/Northbound			
Kawaihae Rd: Between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	D
		PM	**E**
Westbound/Southbound			
Kawaihae Rd: Between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	**E**
		PM	**E**
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	A
		PM	A

Source: Fehr & Peers, 2020.



Project = + + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

Average Queue

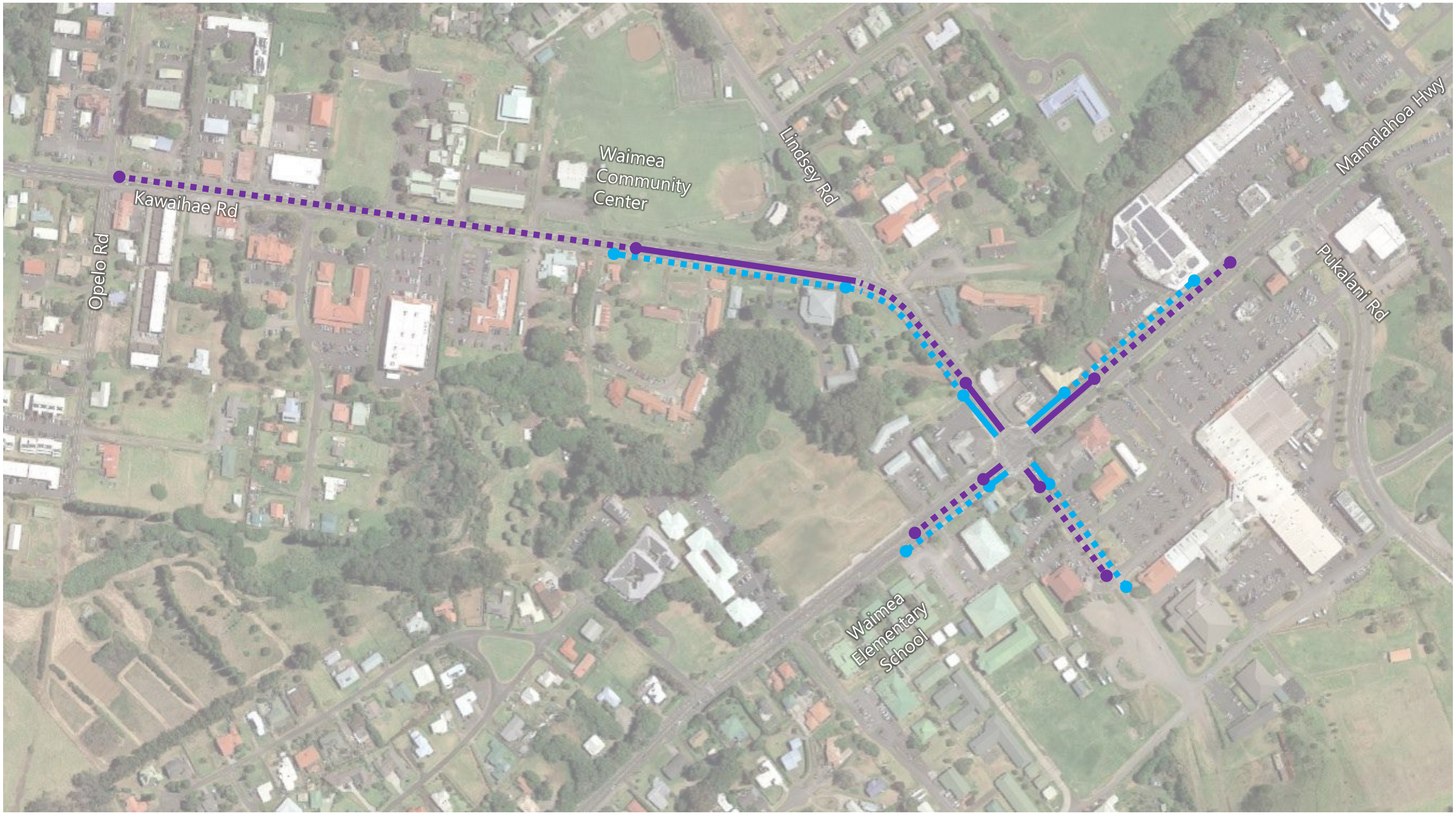
Maximum Queue

Future (2036) No Project

Future + Project

Figure 6

Queue Lengths – Future (2036) AM Peak Hour



Project = [roundabout symbol] + [two-way left-turn lane symbol] + Leading Pedestrian Intervals at Lindsey Rd/Mamalahoa Hwy

- Average Queue
- Maximum Queue
- Future (2036) No Project
- Future + Project

Figure 7

Queue Lengths – Future (2036) PM Peak Hour

5.1.4 Vehicle Travel Times

The travel times through the corridor are summarized in **Table 20**. Travel times along the study corridors are projected to increase to up to 4.5 minutes if no improvements are made. Detailed results are provided in **Appendix E**.

Table 20: Future (2036) Conditions – Study Area Travel Times

Direction / Path	Peak Hour	Travel Time (min:sec)
Eastbound / Kawaihae Road to Mamalahoa Highway	AM	3:43
	PM	4:40
Westbound / Mamalahoa Highway to Kawaihae Road	AM	2:48
	PM	3:43

Source: Fehr & Peers, 2020.

5.1.5 Safety

It is not possible to determine the number of collisions that would occur in the future. However, it is reasonable to assume that the collision rate will not change, and instead the number of collisions could be expected to increase along with increases in traffic volume. At best, future no project conditions can be assumed to be similar to existing no project conditions.

5.2 Future Plus Project

5.2.1 Non-Auto Travel

Similar to future no project conditions, the pedestrian and bicycle comfort scores presented in **Tables 12 and 13** for Existing Plus Project conditions also apply to Future Plus Project conditions.

5.2.2 Vehicle Level of Service

The forecasted future volumes were also applied to the plus project Vissim network, and the resulting intersection LOS is summarized in **Table 21**, while the roadway segment LOS in presented in **Table 22**. Detailed intersection analysis, including queueing results, is provided in **Appendix C**, and detailed roadway segment analysis is included in **Appendix D**.

Table 21: Future (2036) Conditions – Intersection Level of Service (LOS)

Intersection	Traffic Control[1]	Peak Hour	Future No Project		Future Plus Project	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)[2]	LOS[3]
Kawaihae Rd/Lindsey Rd	SSSC / Roundabout	AM	**51.8**	**F** (SBL)	12.6	B
		PM	**> 100**	**F** (SBL)	28.8	D
Lindsey Rd/Mamalahoa Hwy	Signal	AM	41.9	D	**58.4**	**E**
		PM	44.7	D	51.5	D

Source: Fehr & Peers, 2020.
Notes:
[1]SSSC = Side-Street Stop Control
[2]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. Worst movement delay reported for side-street stop-controlled intersections, with the worst movement specified in parentheses.
[3]LOS calculations performed using the *Highway Capacity Manual (HCM) 6th Edition* method.

As shown in **Table 21**, operations are substantially improved at Kawaihae Road/Lindsey Road, but average delays at Lindsey Road/Mamalahoa Highway increase by nearly 17 seconds in the AM peak hour and nearly seven (7) seconds in PM peak hour. Similar to the findings under existing conditions, a detailed review of the future projected operations results indicates that the eastbound volume served at Lindsey Road/Mamalahoa Highway improves from 77.7% without the project to 96.4% with the project (see **Appendix C**). This is due to the substantially improved operations offered by the proposed roundabout and the two-way left-turn lane along Kawaihae Road, which increase the throughput of the corridor. This higher volume served, while *an overall operational improvement*, effectively increases the eastbound demand at the Lindsey Road/Mamalahoa Highway intersection, resulting in longer queueing (of approximately 1,450 feet) and increased delays for the eastbound approach. The southbound approach also experiences an increase in delay due in part to the inclusion of LPIs and in part to the reconfiguration of the westbound departure leg to increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety.

Table 22 shows that eastbound operations along Kawaihae Road will improve with the project. All other segments maintain the same LOS with implementation of the project.

Table 22: Future (2036) Conditions – Roadway Segment Level of Service (LOS)

Roadway Segment	Classification	Peak Hour	Future No Project LOS	Future Plus Project LOS
Eastbound/Northbound				
Kawaihae Rd: Between Opelo Rd and Lindsey Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	D	D
		PM	**E**	**E**
Westbound/Southbound				
Kawaihae Rd: Between Lindsey Rd and Opelo Rd	Two-Lane Highway Class III	AM	**E**	D
		PM	**E**	D
Mamalahoa Hwy: West of Lindsey Rd	Urban Street Segment	AM	A	A
		PM	A	A

Source: Fehr & Peers, 2020.

5.2.3 Vehicle Travel Times

As shown in **Table 23**, implementation of the project is projected to provide *approximately 30 seconds of travel time savings* for both directions in the PM peak hour, and *approximately 40 seconds of travel time savings* in the eastbound direction in the AM peak hour. However, in the westbound direction in the AM peak hour, travel times increase by 30 seconds due to LPIs and the departure lane reconfiguration at Lindsey Road/Mamalahoa Highway as described above. In other scenarios these local delays at the intersection are more than outweighed by the decreased delays along the Kawaihae Road section due to the two-way left-turn lane. Detailed results are provided in **Appendix E**.

Table 23: Future (2036) Conditions – Study Area Travel Times

Direction / Path	Peak Hour	Travel Time (min:sec)		Change in Travel Time (min:sec / % change)
		Future No Project	Future Plus Project	
Eastbound / Kawaihae Road to Mamalahoa Highway	AM	3:43	3:02	-0:41 / -19%
	PM	4:40	4:05	-0:35 / -13%
Westbound / Mamalahoa Highway to Kawaihae Road	AM	2:48	3:18	+0:30 / 17%
	PM	3:43	3:12	-0:31 / -14%

Source: Fehr & Peers, 2020.

5.2.4 Safety

The number of conflict points reductions with project implementation under future conditions will be the same as that given in **Table 14** for existing conditions.

Appendix A: Alternatives at Lindsey Road/Mamalahoa Highway

Memorandum

Date: October 13, 2020

To: Cheryl Soon and Jared Chang, SSFM

From: Cecily Taylor and Sohrab Rashid

Subject: Waimea Multimodal Improvements Project – Evaluation Findings for Intersection Options at Mamalahoa Highway and Lindsey Road

SD16-0195

Executive Summary

This memorandum evaluates six (6) operational options for improvements at the Lindsey Road/ Mamalahoa Highway intersection to be implemented along with multimodal improvements in the Waimea community. The option that is expected to best balance pedestrian and bicyclist safety with vehicle operations was the optimization of signal timings, restriping of the westbound departure leg with one lane (instead of two), and implementing a leading pedestrian interval (LPI) on all crossings. An LPI is a period during which all vehicles have a red light, and the pedestrian phase is provided with at least three (3) seconds for pedestrians to start crossing in advance of a green signal for vehicles. A more robust safety enhancement would be fully protected pedestrian and bicycle phasing, but this was found to cause substantial worsening of vehicle operations. Details of all considered options are provided in the remainder of this technical memorandum.

Introduction

A set of multimodal improvements is proposed in the Waimea community on the island of Hawaii to enhance safety and efficiency for all travelers through the community. The specific improvements proposed for sections of Kawaihae Road, Lindsey Road, and Mamalahoa Highway include:

- Sidewalks, raised/separated bikeways, landscaping with street trees, and marked crosswalks along Kawaihae Road from approximately 200 feet west of Opelo Road to Lindsey Road;
- An enhanced crosswalk with a Rectangular Rapid Flash Beacon (RRFB) and raised median island on the east leg of Kawaihae Road/Opelo Road;

- A center two-way way left-turn lane along Kawaihae Road between Opelo Road and Lindsey Road;
- Sidewalks, raised/separated bikeways, landscaping with street trees, and marked crosswalks along Mamalahoa Highway from approximately 300 feet west of Lindsey Road to Lindsey Road;
- An enhanced crosswalk with a RRFB and raised median island on the north leg of Mamalahoa Highway/Ulu Laau Lane, where RRFB currently exists.
- A center two-way way left-turn lane along Mamalahoa Highway between Waimea Elementary School and Lindsey Road;
- A single-lane roundabout with splitter islands and marked crosswalks at Kawaihae Road/ Lindsey Road; and
- Signal timing and lane configuration modifications at the Lindsey Road/Mamalahoa Highway intersection. Lane configuration modifications include an extended eastbound right-turn pocket on Lindsey Road and a reconfiguration of the westbound departure leg on Lindsey Road to provide only one departure lane. This reconfiguration will increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety.

The proposed roundabout is a one-lane facility with an inscribed diameter of approximately 125 feet and yield controlled on all approaches. A raised/separated bikeway and sidewalk continue through the roundabout providing continuous bicycle and pedestrian connections.

Methodology

The proposed improvements were analyzed using Vissim 11 microsimulation software. This tool best reflects the potential operational issues associated with the relatively closely-spaced intersections with different traffic control devices (i.e., a signal and roundabout). Vissim 11 also allows for the most flexibility and innovation with adjusting traffic signal timings.

The existing lane configurations were first analyzed for Existing Conditions using volumes from counts collected in 2018 to calibrate driver behavior and queueing based on field observations. The proposed improvements were then added to the Vissim network. The improvements include: 1) a two-way-left-turn-lane along Kawaihae Road; 2) a roundabout at Kawaihae Road/Lindsey Road; 3) modifications to the lane configurations and signal timing at Lindsey Road/Mamalahoa Highway; and 4) dedicated spaces for bicycle and pedestrian circulation between and at intersections. Volume adjustments were made to account for additional permitted movements into and out of the Parker School Driveway under Existing Plus Project conditions.

Traffic Operations Results

Existing (2018) No Project Conditions

Under existing conditions it takes approximately 2.5 to 3.5 minutes to travel on Mamalahoa Highway and Lindsey Road between just east of Opelo Road and Pukalani Road along the study corridor. While average queues throughout the peak hours are relatively minimal, the maximum queues in the AM peak hour on the eastbound approach to Lindsey Road/Mamalahoa Highway reach nearly to the intersection with Kawaihae Road, and in the PM peak hour they extend past this intersection. These results are visualized in comparison to Plus Project conditions on the attached figures, described below.

Future (2036) No Project Conditions

Existing (2018) volumes were increased by a total of 9.5% to estimate future traffic volumes at the point when the roundabout and signal would experience excessive delays and vehicle queuing, where the intersections would no longer have sufficient capacity during the peak commute periods. The year at which these volumes are reached will depend on when traffic returns to 2018 conditions following the ongoing COVID-19 pandemic. Future volumes will also depend on how quickly additional development occurs within the greater Waimea and surrounding areas. For purposes of this study, the future study year when the 9.5% increase over 2018 would occur is estimated to be 2036.

Travel times along the study corridors are projected to increase to up to 4.5 minutes if no improvements are made. Average queues are projected to remain relatively short, but the maximum queues on the eastbound approach to Lindsey Road/Mamalahoa Highway will extend past the intersection with Kawaihae Road during both peak hours, and will extend nearly to the Waimea Community Center in the PM peak hour. These results are visualized in comparison to Plus Project conditions, described below.

In addition to the worst-movement delay degrading to LOS F operations, the eastbound left-turn queueing from the Lindsey Road/Mamalahoa Highway signalized intersection is expected to exceed the available turn pocket storage, blocking eastbound through traffic from reaching the downstream intersection of Lindsey Road/Mamalahoa Highway. These results are provided in a detailed table along with Plus Project results, described below.

Lindsey Road/Mamalahoa Highway Improvement Options Considered

In addition to providing enhanced and dedicated spaces for bicycle and pedestrian circulation along Kawaihae Road and Mamalahoa Highway, the following enhancements were evaluated at the intersection of Lindsey Road/Mamalahoa Highway:

Option A: A safety feature option was evaluated at the Lindsey Road/Mamalahoa Highway signalized intersection called **leading pedestrian interval (LPI).** An LPI is a period during which all vehicles have a red light, and the pedestrian phase is provided with at least three (3) seconds for pedestrians to start crossing. Under this option, bicycle signals would not be installed, and instead signage of "Bikes Use Pedestrian Signal" would instruct bicyclists to travel with pedestrians. While not as robust of a safety feature as a fully protected pedestrian and bicycle phase, an LPI is beneficial to pedestrian safety by allowing pedestrians to get further into the intersection before a permitted turn would occur, increasing pedestrian visibility to drivers. The LPI treatment was tested under the scenario of existing lane configurations and split signal phasing at the Lindsey Road/Mamalahoa Highway signalized intersection.

Option B: A pedestrian safety enhancement option evaluated was **protected bicycle and pedestrian crossing phases**. This would minimize the exposure of active travelers with conflicting vehicle movements. A protected crossing is required when bicycle signals are implemented (*Interim Approval for Optional Use of a Bicycle Signal Face*, MUTCD IA-16 2013[1]), and a protected pedestrian phase would also minimize confusion among drivers and other road users. A protected crossing means that no conflicting vehicle movements are permitted during that phase.

At the Lindsey Road/Mamalahoa Highway signalized intersection, a protected crossing would be achieved via a red right-turn arrow during the pedestrian crossing and right-turn-on-red movements would be prohibited. It is noted that to apply this treatment to the northbound approach on Mamalahoa Highway, the outside shared through/right-turn lane would be converted to an exclusive right-turn lane.

Option C: An **alternative signal timing** was evaluated to improve operations by changing the east-west signal phasing from **split phased to protected, concurrent, left-turn phasing**. This phasing is typically more efficient from an operational perspective. To accomplish this change, eastbound through traffic on Lindsey Road would need to be shifted to share what is currently the exclusive eastbound right-turn pocket. By moving eastbound through traffic to this lane, the eastbound left-turn lanes would be able to operate with protected phasing instead of split phasing, such that the westbound left-turn phase could run concurrently with the eastbound left-turn phase, and the westbound through phase could run concurrently with the eastbound

[1] https://mutcd.fhwa.dot.gov/resources/interim_approval/ia16/

through phase. With this change, the eastbound approach could no longer accommodate a protected pedestrian crossing due to limited right-of-way that prevents the provision of an exclusive right-turn lane.

Combine with above Option D: Another safety option tested at this intersection for future conditions is a **"double-served" eastbound left-turn** (i.e., a second eastbound left-turn phase) within the signal's cycle. The signal would function by calling the eastbound left-turn phase, switching to the westbound through phase, then calling the eastbound left-turn phase again before switching to the north and south approach phases. This double-served left-turn would allow the eastbound approach to advance twice during each signal cycle, minimizing the occurrence of queueing back to and through the proposed roundabout. This atypical signal phasing has been implemented at locations throughout California such as in San Diego, San Jose, Irvine, and Fullerton.

Option E and F (Considered but Rejected): Other intersection safety improvement options that were considered include a **dual right-turn lane for the heavy southbound right-turn movement**, and a **fully protected intersection with refuge islands at each corner** for bicyclists and pedestrians. However, if was found that both these options would require substantial right-of-way acquisition at and in advance of the intersection that would substantially and negatively impact existing occupied buildings and parcel access.

Existing (2018) Plus Project Conditions

As shown on **Figure 1**, implementing the project with the LPI feature (Option A) at Lindsey Road/Mamalahoa Highway would provide *approximately 20 seconds of travel time savings in each direction* in the PM peak hour, indicating that the project would be able to offer immediate relief to the period of worst congestion. Travel times in the AM peak hour would be largely unchanged, and overall average vehicle delays at Lindsey Road/Mamalahoa Highway are projected to increase slightly by approximately five (5) seconds. As shown on **Figures 2 and 3**, queues under the project scenario with implementation of LPIs are generally similar to the no project conditions, but the eastbound approach to Lindsey Road/Mamalahoa Highway will increase by approximately 550 feet.

With implementation of the more robust protected crossing phases (Option C), the project still achieves 25 seconds of travel time savings (a 12% decrease) in the eastbound direction in the PM peak hour (see **Figure 1**). However, the safety feature otherwise increases travel times by up to 41 seconds, and increases average delays at the Lindsey Road/Mamalahoa Highway intersection by up to approximately 22 seconds. As shown on **Figures 2 and 3**, queues under the project scenario with implementation of protected pedestrian and bicycle crossings are generally longer than the scenario with LPIs.

Future (2036) Plus Project Conditions

As shown on **Figure 4**, under future conditions the implementation of the project with LPIs (Option A) provide up to approximately 40 seconds of travel time savings, The only increase in travel time occurs in the westbound direction in the AM peak hour, which is due in part to the inclusion of LPIs and in part to the reconfiguration of the westbound departure lanes to increase southbound right-turn driver compliance of stopping on red, which in turn will substantially enhance pedestrian safety. Average delays at the Lindsey Road/Mamalahoa Highway intersection increase slightly by up to nearly 17 seconds. This is due to the delays described above as well as the substantially improved operations offered by the proposed roundabout and the two-way left-turn lane along Kawaihae Road, which increase the throughput of eastbound traffic. A detailed review of the operations results indicate that the eastbound volume served at Lindsey Road/Mamalahoa Highway improves from 77.7% without the project to 96.4% with the project and the LPI feature. This higher volume served, while an overall operational improvement, effectively increases the demand at the Lindsey Road/Mamalahoa Highway intersection, resulting in longer queueing and increased delays. However, the travel time results highlight that the local increase in delay at the intersection is more than outweighed by the decreased delay in travel along the Kawaihae Road section.

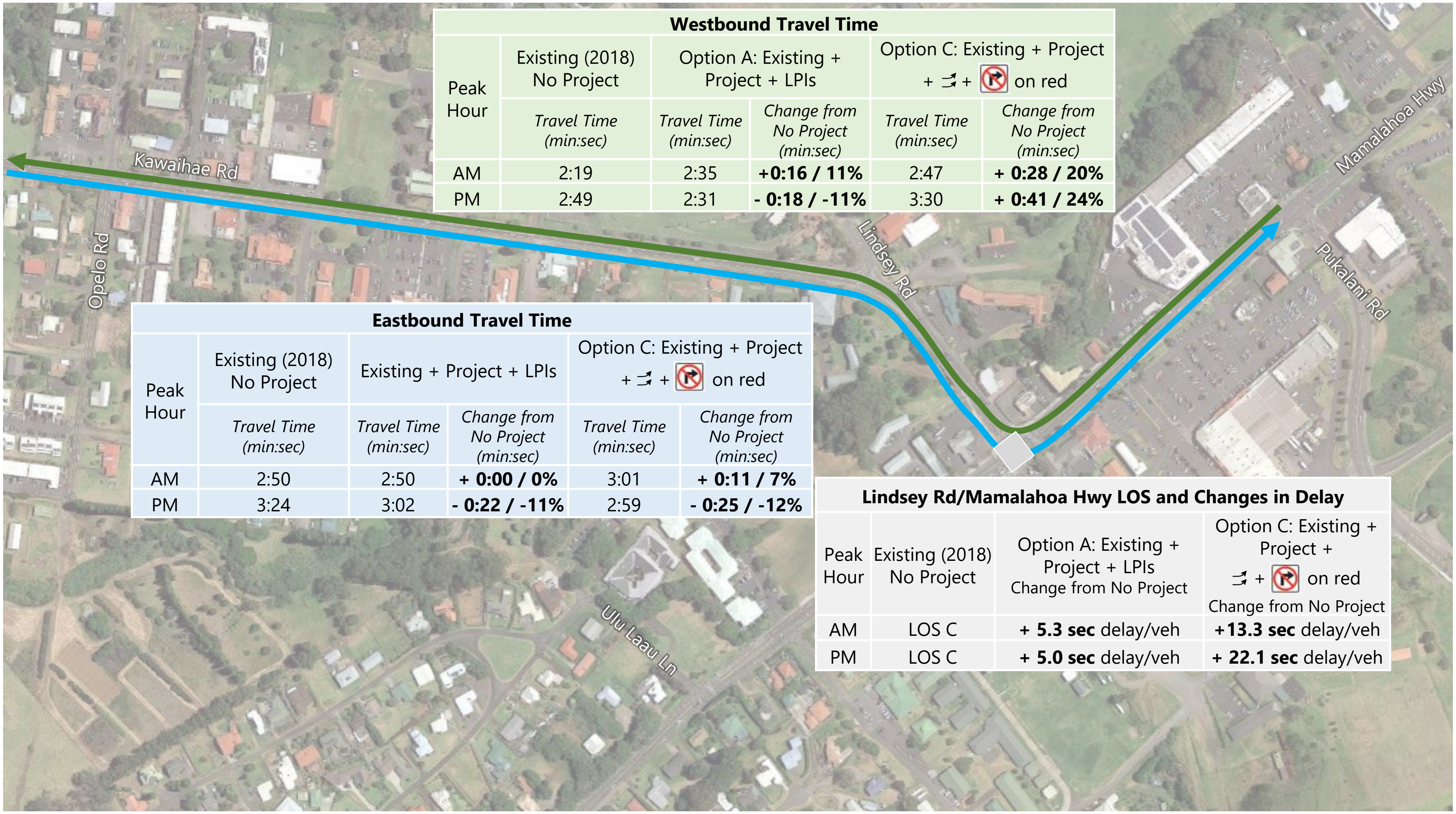
The specific effect of LPIs is summarized on **Figure 7**. As shown, implementing the project without any additional safety features at Lindsey Road/Mamalahoa Highway will substantially improve travel times through the study area, and will improve overall intersection operations. Implementing the LPI safety feature slightly offsets these operational benefits by increasing travel times by nearly 40 seconds in the westbound direction and up to approximately 30 seconds in the eastbound direction in the peak hours.

As shown on **Figure 4**, implementing the more robust protected crossings along with a double-served eastbound left-turn phase (Option D) also provides substantial eastbound travel time savings from approximately 40 seconds to more than one (1) minute. In the westbound direction, travel times are slightly longer by up to approximately 20 seconds. Average delays at the Lindsey Road/Mamalahoa Highway intersection increase substantially by up to nearly 50 seconds, and the intersection is projected to degrade to LOS F conditions. As shown on **Figures 5 and 6**, Option D results in the shortest average queues for the eastbound approach to the Lindsey Road/ Mamalahoa Highway signalized intersection. However, the protected pedestrian and bicycle crossing phases cause notable increases to average queueing lengths for the other approaches in the PM peak hour.

The effect of the double-served eastbound left-turn phase feature is summarized on **Figure 8** (Option D compared to Option B). As shown, the feature provides a mixed effect, with substantial eastbound travel time savings in the PM peak hour, but also a substantial westbound travel time increase during the same peak hour. Furthermore, the Lindsey Road/Mamalahoa Highway average delays increase by nearly 30 seconds. However, this trade-off achieves a reduction of nearly 300 feet for the eastbound approach to Lindsey Road/Mamalahoa Highway, while the southbound approach queue increases by nearly 200 feet.

Conclusion

The project Option A with **LPI treatment** appears to be optimal both for intersection operations and overall queueing, which also translates to the generally shortest travel times along the major paths through the study area along Mamalahoa Highway and Kawaihae Road.



Westbound Travel Time

Peak Hour	Existing (2018) No Project	Option A: Existing + Project + LPIs		Option C: Existing + Project + + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:19	2:35	**+0:16 / 11%**	2:47	**+ 0:28 / 20%**
PM	2:49	2:31	**- 0:18 / -11%**	3:30	**+ 0:41 / 24%**

Eastbound Travel Time

Peak Hour	Existing (2018) No Project	Existing + Project + LPIs		Option C: Existing + Project + + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:50	2:50	**+ 0:00 / 0%**	3:01	**+ 0:11 / 7%**
PM	3:24	3:02	**- 0:22 / -11%**	2:59	**- 0:25 / -12%**

Lindsey Rd/Mamalahoa Hwy LOS and Changes in Delay

Peak Hour	Existing (2018) No Project	Option A: Existing + Project + LPIs Change from No Project	Option C: Existing + Project + + on red Change from No Project
AM	LOS C	+ **5.3 sec** delay/veh	+**13.3 sec** delay/veh
PM	LOS C	+ **5.0 sec** delay/veh	+ **22.1 sec** delay/veh

Project = +

Lindsey Rd/Mamalahoa Hwy Alternatives:

LPIs = Leading Pedestrian Intervals

= reconfiguration and protected left-turn phasing

on red = protected pedestrian & bicycle signal timing

Eastbound Direction

Westbound Direction

Lindsey Rd/Mamalahoa Hwy Intersection

Figure 1

Key Operations – Existing (2018) Conditions

Average Queue
Maximum Queue
Existing (2018) No Project
Option A: Existing + Project + Leading Pedestrian Intervals
Option C: Existing + Project + Reconfiguration/Protected Left-turn Phasing + Protected Pedestrian/Bicycle Signal Timing

Project = +

Figure 2

Queue Lengths – Existing (2018) AM Peak Hour

Average Queue

Maximum Queue

Existing (2018) No Project

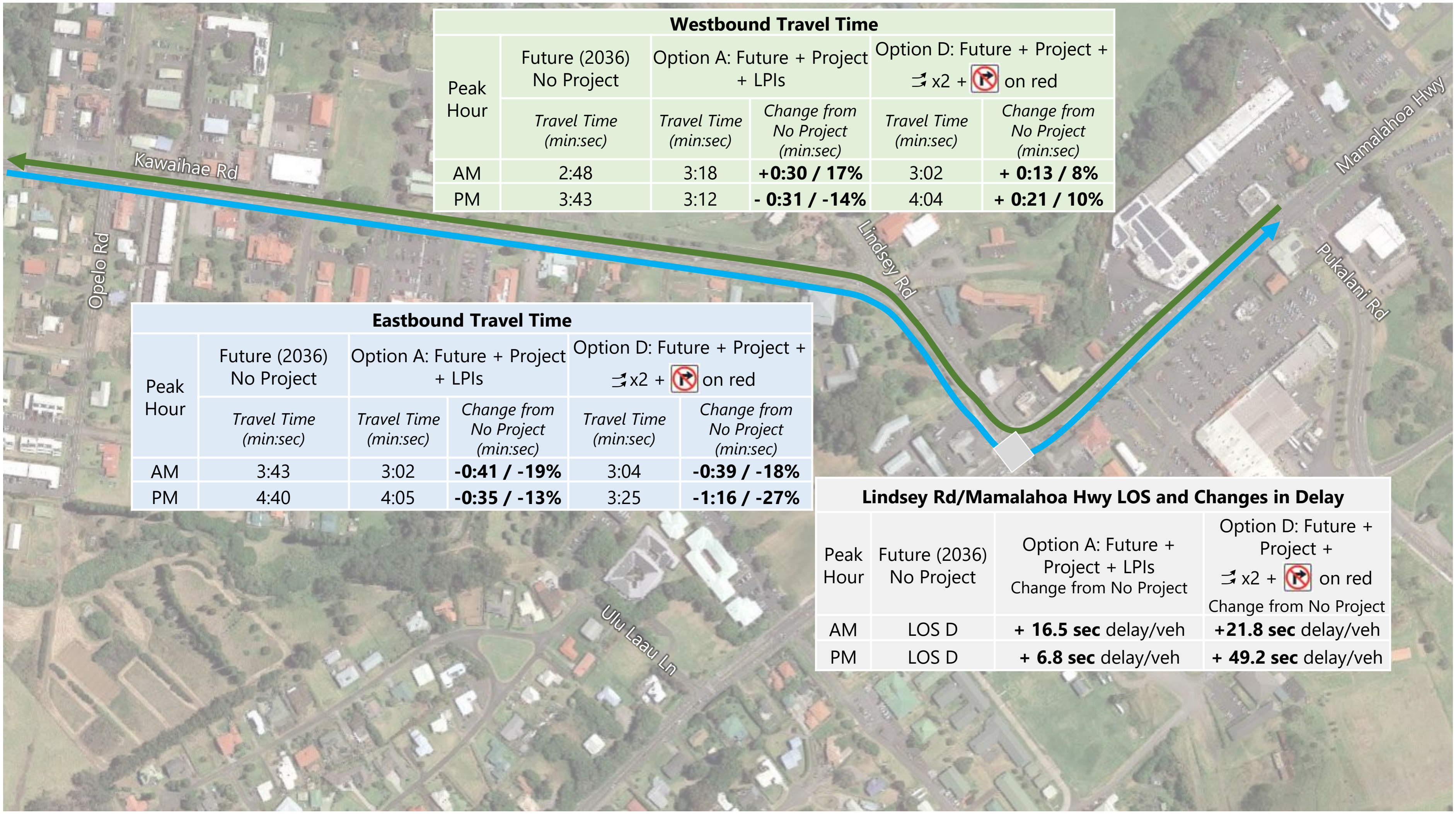
Option A: Existing + Project + Leading Pedestrian Intervals

Option C: Existing + Project + Reconfiguration/Protected Left-turn Phasing + Protected Pedestrian/Bicycle Signal Timing

Project = +

Figure 3

Queue Lengths – Existing (2018) PM Peak Hour



Westbound Travel Time

Peak Hour	Future (2036) No Project	Option A: Future + Project + LPIs		Option D: Future + Project + x2 + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	2:48	3:18	**+0:30 / 17%**	3:02	**+ 0:13 / 8%**
PM	3:43	3:12	**- 0:31 / -14%**	4:04	**+ 0:21 / 10%**

Eastbound Travel Time

Peak Hour	Future (2036) No Project	Option A: Future + Project + LPIs		Option D: Future + Project + x2 + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No Project (min:sec)*
AM	3:43	3:02	**-0:41 / -19%**	3:04	**-0:39 / -18%**
PM	4:40	4:05	**-0:35 / -13%**	3:25	**-1:16 / -27%**

Lindsey Rd/Mamalahoa Hwy LOS and Changes in Delay

Peak Hour	Future (2036) No Project	Option A: Future + Project + LPIs Change from No Project	Option D: Future + Project + x2 + on red Change from No Project
AM	LOS D	+ **16.5 sec** delay/veh	+**21.8 sec** delay/veh
PM	LOS D	+ **6.8 sec** delay/veh	+ **49.2 sec** delay/veh

Project = +

Lindsey Rd/Mamalahoa Hwy Alternatives:

LPIs = Leading Pedestrian Intervals

x2 = reconfiguration and protected, double-served eastbound left-turn phasing

on red = protected pedestrian & bicycle signal timing

Eastbound Direction

Westbound Direction

Lindsey Rd/Mamalahoa Hwy Intersection

Figure 4

Key Operations – Future (2036) Conditions

Average Queue

Maximum Queue

Existing (2018) No Project

Option A: Existing + Project + Leading Pedestrian Intervals

Option D: Existing + Project + Reconfiguration/Protected and Double-Served Eastbound Left-turn Phasing + Protected Pedestrian/Bicycle Signal Timing

Project = +

Figure 5

Queue Lengths – Future (2036) AM Peak Hour

Average Queue

Maximum Queue

Existing (2018) No Project

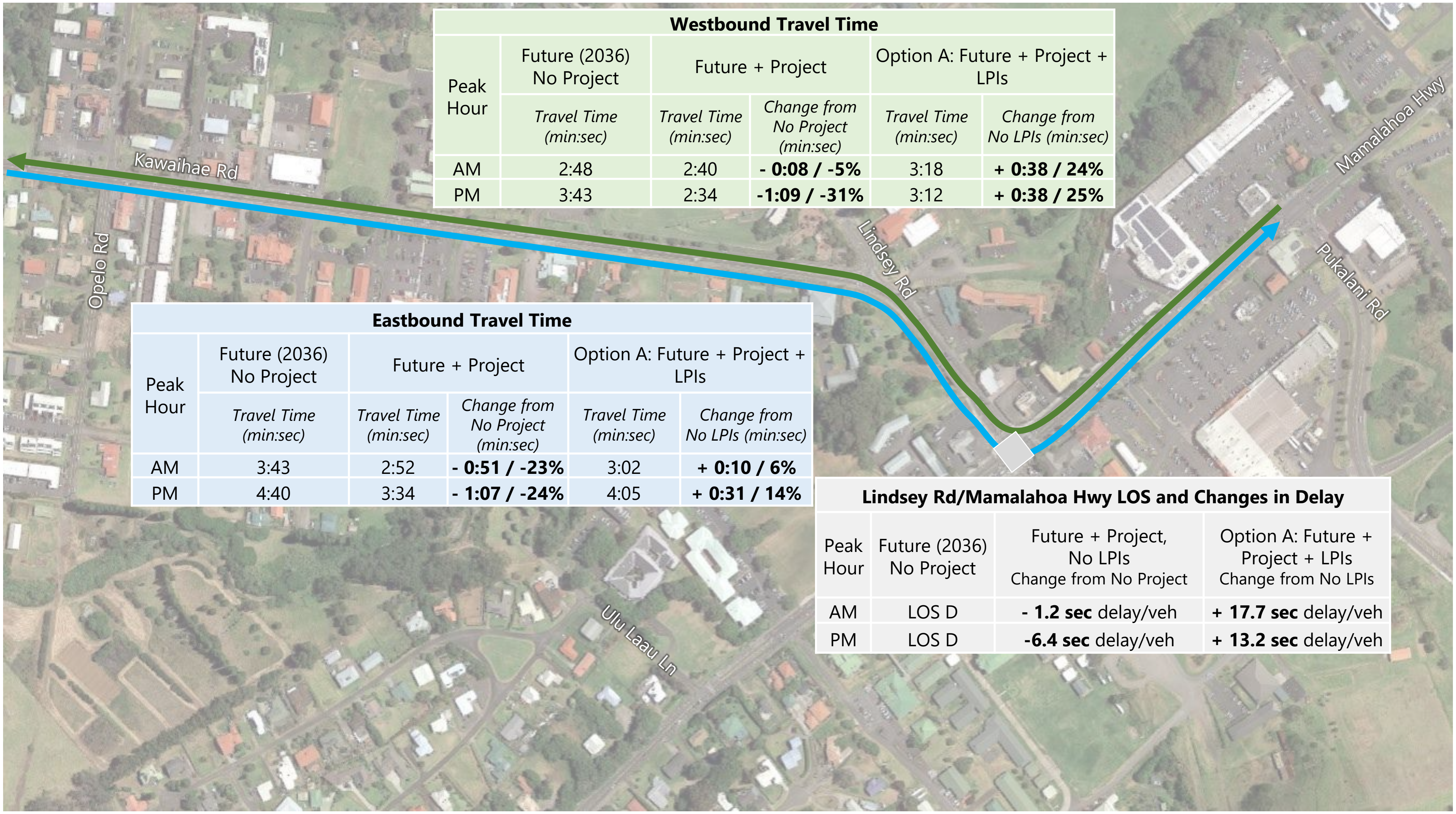
Option A: Existing + Project + Leading Pedestrian Intervals

Option D: Existing + Project + Reconfiguration/Protected and Double-Served Eastbound Left-turn Phasing + Protected Pedestrian/Bicycle Signal Timing

Project = +

Figure 6

Queue Lengths – Future (2036) PM Peak Hour



Westbound Travel Time

Peak Hour	Future (2036) No Project	Future + Project		Option A: Future + Project + LPIs	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No LPIs (min:sec)*
AM	2:48	2:40	**- 0:08 / -5%**	3:18	**+ 0:38 / 24%**
PM	3:43	2:34	**-1:09 / -31%**	3:12	**+ 0:38 / 25%**

Eastbound Travel Time

Peak Hour	Future (2036) No Project	Future + Project		Option A: Future + Project + LPIs	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No LPIs (min:sec)*
AM	3:43	2:52	**- 0:51 / -23%**	3:02	**+ 0:10 / 6%**
PM	4:40	3:34	**- 1:07 / -24%**	4:05	**+ 0:31 / 14%**

Lindsey Rd/Mamalahoa Hwy LOS and Changes in Delay

Peak Hour	Future (2036) No Project	Future + Project, No LPIs Change from No Project	Option A: Future + Project + LPIs Change from No LPIs
AM	LOS D	**- 1.2 sec** delay/veh	**+ 17.7 sec** delay/veh
PM	LOS D	**-6.4 sec** delay/veh	**+ 13.2 sec** delay/veh

Project = +

LPIs = Leading Pedestrian Intervals

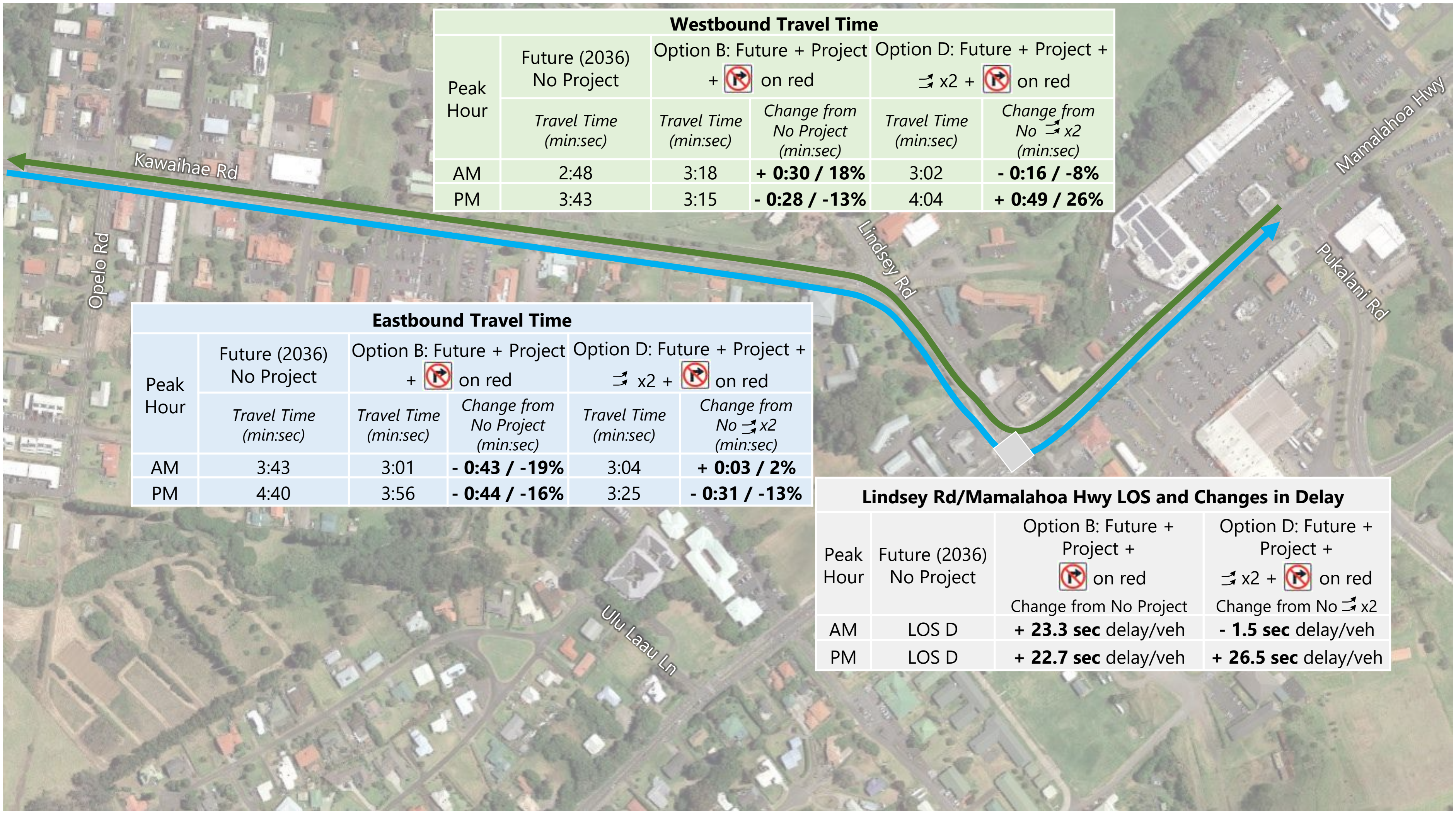
Eastbound Direction

Westbound Direction

Lindsey Rd/Mamalahoa Hwy Intersection

Figure 7

Effect of LPIs at Lindsey Rd/Mamalahoa Hwy – Future (2036) Conditions



Westbound Travel Time

Peak Hour	Future (2036) No Project	Option B: Future + Project + on red		Option D: Future + Project + x2 + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No x2 (min:sec)*
AM	2:48	3:18	**+ 0:30 / 18%**	3:02	**- 0:16 / -8%**
PM	3:43	3:15	**- 0:28 / -13%**	4:04	**+ 0:49 / 26%**

Eastbound Travel Time

Peak Hour	Future (2036) No Project	Option B: Future + Project + on red		Option D: Future + Project + x2 + on red	
	Travel Time (min:sec)	*Travel Time (min:sec)*	*Change from No Project (min:sec)*	*Travel Time (min:sec)*	*Change from No x2 (min:sec)*
AM	3:43	3:01	**- 0:43 / -19%**	3:04	**+ 0:03 / 2%**
PM	4:40	3:56	**- 0:44 / -16%**	3:25	**- 0:31 / -13%**

Lindsey Rd/Mamalahoa Hwy LOS and Changes in Delay

Peak Hour	Future (2036) No Project	Option B: Future + Project + on red	Option D: Future + Project + x2 + on red
		Change from No Project	Change from No x2
AM	LOS D	+ **23.3 sec** delay/veh	- **1.5 sec** delay/veh
PM	LOS D	+ **22.7 sec** delay/veh	+ **26.5 sec** delay/veh

Project = +

x2 = reconfiguration and protected, double-served eastbound left-turn phasing

on red = protected pedestrian & bicycle signal timing

Eastbound Direction

Westbound Direction

Lindsey Rd/Mamalahoa Hwy Intersection

Figure 8

Effect of Dual-Served Left-Turn at Lindsey Rd/Mamalahoa Hwy – Future (2036) Conditions

Waimea Multimodal Improvements Peak Hour Intersection Operations - Updated Evaluation Findings

Intersection	Peak Hour	Existing (2018) Without Project Conditions			Option A: Existing Plus Project Conditions w/LPIs[1]			Option C: Existing Plus Project Conditions w/Pedestrian and Bicycle Signal Timing and protected EBL[2]			Future (2036) Without Project Conditions[3]		
		Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)
Kawaihae Rd/Lindsey Rd	AM	17.6	C (WBT)	EBL: 62	7.4	A	EB: 363	11.1	B	EB: 593	**51.8**	**F** (SBL)	EBL: **239*** / SBR: **790***
	PM	27.8	D (EBL)	EB: 118	8.9	A	EB: 671	9.4	A	EB: 758	**146.7**	**F** (SBL)	EBL: **283*** / EBT: 721** SBR: **908***
Mamalahoa Hwy/Lindsey Rd	AM	33.0	C	EBL: 454 / SBR: 411	38.3	D	EB: 379 / SBR: 571	46.3	D	EB: 477 / SBR: 750	41.9	D	EBL: 831 / SBR: 599
	PM	34.6	C	EBL: 750 / SBR: 402	39.6	D	EB: 1,311 / SBR: 554	**56.7**	**E**	EB: 1,398 / SBR: 974	44.7	D	EBL: 873 / SBR: 640

Intersection	Peak Hour	Future Plus Project Conditions w/o LPIs[1,3]			Option A: Future Plus Project Conditions w/LPIs[1,3]			Option B: Future Plus Project Conditions w/ Pedestrian and Bicycle Signal Timing[2,3]			Option D: Future Plus Project Conditions w/ Pedestrian and Bicycle Signal Timing and protected, double-		
		Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)	Delay[4] (sec/veh)	LOS	Major Queues (maximum[5], ft)
Kawaihae Rd/Lindsey Rd	AM	14.0	B	EB: 553	12.6	B	EB: 970	15.7	C	EB: 816	16.6	C	EB: 959
	PM	21.9	C	EB: 1,796	28.8	D	EB: 2,173	28.3	D	EB: 1,979	20.0	C	EB: 1,699
Mamalahoa Hwy/Lindsey Rd	AM	40.7	D	EBL: 535 / SBR: 643	**58.4**	**E**	EBL: 1,610 / SBR: 942	**65.2**	**E**	EBL: 1,456 / SBR: 1,060	**63.7**	**E**	EB: 1,599 / SBR: 887
	PM	38.3	D	EB: 2,436 / SBR: 511	51.5	D	EB: 2,813 / SBR: 762	**67.4**	**E**	EB: 2,619 / SBR: 938	**93.9**	**F**	EB: 2,339 / SBR: 1,122

Source: Fehr & Peers, 2020.

Notes:

[1] LPI=Leading Pedestrian Interval, a period of 3 seconds during which all vehicles have a red light and pedestrians can begin to cross.

[2] Pedestrian and bicycle signal timing consists of protected pedestrian crossings on all legs. This requires converting the northbound Mamalahoa approach to a through and exclusive right-turn lane. Under the protected EBL condition, a protected southern crossing (across Mamalahoa Hwy) cannot be accomodated.

[3] Future Year of 2036 assumes a 0.5% annual growth rate over 2018 traffic counts, and does not assume any change in projected growth due to the COVID-19 pandemic. If the average annual growth rate is higher at 1.0% the projected conditions would occur by year 2027.

[4] The average delay is reported for the signalized and roundabout intersections. Worst movement delay is reported for the side-street stop-controlled intersection.

[5] The maximum queue is determined for each peak hour simulation, then these values are averaged

* The maximum queue extends beyond available storage capacity

** Spill-back from the left-turn lane causes substantial queueing for the through movement

Table 1: Signalized Intersection Level of Service Criteria

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

Table 2: Unsignalized Intersection Level of Service Criteria

Level of Service	Description	Delay in Seconds
A	Little or no delay	≤ 10.0
B	Short traffic delay	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

Appendix B: Level of Comfort Detailed Results

TABLE A1 – PEDESTRIAN SEGMENTS EXISTING COMFORT SCORES

Segment #	Description	Usable Sidewalk Width	Sidewalk Quality	Sidewalk Accessibility	Landscape Buffer & Street Trees	No. of Lanes	Posted Speed	Lighting	Heavy Vehicle	Crosswalk Frequency	Ped Comfort Index
1	Kawaihae Rd - Opelo Rd to Lindsey Rd	None	N/A	N/A	Tree Canopy Only	2	25	None	Freight with No Buffer	>800'	4
2	Lindsey Rd - Kawaihae Rd to Mamalahoa Hwy	5-10'	Poor	Majority of Driveway Curbs Cut Into Sidewalk Path	No Tree Canopy	4	30	Roadway (one side only)	Freight with No Buffer	<= 300'	4
3	Mamalahoa Hwy - West of Lindsey Rd	<5'	Poor	Majority of Driveway Curbs Cut Into Sidewalk Path	Tree Canopy Only	4	25	Roadway (one side only)	Freight with No Buffer	300-800'	4

TABLE A2 – PEDESTRIAN SEGMENTS 2036 COMFORT SCORES

Segment #	Description	Usable Sidewalk Width	Sidewalk Quality	Sidewalk Accessibility	Landscape Buffer & Street Trees	No. of Lanes	Posted Speed	Lighting	Heavy Vehicle	Crosswalk Frequency	Ped Comfort Index
1	Kawaihae Rd - Opelo Rd to Lindsey Rd	5-10'	Excellent/New	Driveways are Outside Sidewalk Path	Tree Canopy Only	3	25	Roadway	Freight with Buffer	<= 300	3
2	Lindsey Rd - Kawaihae Rd to Mamalahoa Hwy	<5'	Excellent/New	Driveways are Outside Sidewalk Path	No Tree Canopy	4	30	Roadway (one side only)	Freight with Buffer	<= 300	3
3	Mamalahoa Hwy - West of Lindsey Rd	5-10'	Excellent/New	Driveways are Outside Sidewalk Path	Tree Canopy Only	4	25	Roadway (one side only)	Freight with Buffer	300-800	3

TABLE B1 – PEDESTRIAN INTERSECTIONS EXISTING COMFORT SCORES

Intersection #	Street 1	Street 2	# of Crossing Lanes[1]	Pedestrian Signal Accessibility	Curb Ramp Accessibility	Right Turn Slip Lane Type	Pedestrian Scramble or Protected Lefts	Ped Comfort Index
1	Opelo Rd	Kawaihae Rd	2 but no crosswalk	N/A	None	1 stop and 1 yield	N/A	4
2	Kawaihae Rd	Lindsey Rd	4 but no crosswalk	N/A	None	2 channelized yield and 1 uncontrolled slip lane	N/A	4
3	Lindsey Rd	Mamalahoa Hwy	5	Two-Inch (Non APS); Countdown Unknown	Diagonal	1 approach treated as uncontrolled slip lane	One Approach Protected Lefts	4

[1] Largest of all intersection legs with crossings

TABLE B2 – PEDESTRIAN INTERSECTIONS 2036 COMFORT SCORES

Intersection #	Street 1	Street 2	# of Crossing Lanes[1]	Pedestrian Signal Accessibility	Curb Ramp Accessibility	Right Turn Slip Lane Type	Pedestrian Scramble or Protected Lefts	Ped Comfort Index	
1	Opelo Rd	Kawaihae Rd	2	N/A	Directional	2 stop and 1 yield		3	Due to addition of RRFB on the east leg
2	Kawaihae Rd	Lindsey Rd	2	N/A	Directional	Yield Slip Lanes		3	Due to addition of the roundabout
3	Lindsey Rd	Mamalahoa Hwy	5	APS and Same Pole With Audible Message	Directional	No Slip Lanes	All Protected	2	

[1] Largest of all intersection legs with crossings

TABLE C1 – BICYCLE SEGMENTS EXISTING COMFORT SCORES

Segment #	Description	No. of Lanes	Speed	ADT[1]	Bicycle Facility	Bicycle Segment LTS
1	Kawaihae Rd - Opelo Rd to Lindsey Rd	2	25	22,400	None	4
2	Lindsey Rd - Kawaihae Rd to Mamalahoa Hwy	4	30	15,121	None	4
3	Mamalahoa Hwy - West of Lindsey Rd	4	25	7,440	None	4

[1] Based on the *Waimea Regional Transportation and Safety Study*, prepared by Fehr & Peers, 2019

TABLE C2 – BICYCLE SEGMENTS 2036 COMFORT SCORES

Segment #	Description	Buffer Type	Speed	Bicycle Segment LTS
1	Kawaihae Rd - Opelo Rd to Lindsey Rd	Solid/Raised	25	1
2	Lindsey Rd - Kawaihae Rd to Mamalahoa Hwy	Solid/Raised	30	1
3	Mamalahoa Hwy - West of Lindsey Rd	Solid/Raised	25	1

TABLE D1 – BICYCLE CROSSING COMFORT SCORES AT INTERSECTIONS SUMMARY

Intersection #	Street 1	Street 2	# of Right Turn Lanes	Right Turn Speed	Right Turn Pocket Length	Bicycle Facility	Bicycle Intersection LTS
1	Opelo Rd	Kawaihae Rd	1	Less than 15 MPH	>150	None	4
2	Kawaihae Rd	Lindsey Rd	1	Less than 15 MPH	100	None	3
3	Lindsey Rd	Mamalahoa Hwy	1	Less than 15 MPH	>150	None	4

[1] Approximated based on curb radius

TABLE D2 – BICYCLE INTERSECTIONS 2036 COMFORT SCORES

Intersection #	Street 1	Street 2	Bicycle Facility	Approach Geometry	Bicycle Intersection LTS
1	Opelo Rd	Kawaihae Rd	Protected Bike Lanes at Stop- or Un-Controlled Intersection	Barrier with permitted turns (RT<150 vph)	2
2	Kawaihae Rd	Lindsey Rd	Protected Bike Lanes at Stop- or Un-Controlled Intersection	Barrier with permitted turns (RT<150 vph)	2

Intersection #	Street 1	Street 2	Bicycle Facility	Separation	Bicycle Left-Turns	Conflicting Left-Turn Treatments	Bicycle Intersection LTS
3	Lindsey Rd	Mamalahoa Hwy	Protected Bike Lanes at Signalized Intersections	Barrier and good sightlines but permitted turns (RT>150 vph) during bicycle phase	Painted Treatment	Protected	3

Appendix C: Detailed Intersection Analysis

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	840	828	98.5%	1.7	0.7	A
	Through	40	39	96.3%	1.5	1.5	A
	Right Turn	30	30	99.0%	0.7	0.3	A
	Subtotal	910	896	98.4%	1.7	0.6	A
SB	Left Turn						
	Through	50	49	97.4%	15.1	6.4	C
	Right Turn	40	39	97.0%	2.6	0.6	A
	Subtotal	90	88	97.2%	9.8	4.4	A
EB	Left Turn	50	49	97.8%	8.7	1.9	A
	Through						
	Right Turn	694	698	100.5%	2.0	0.4	A
	Subtotal	744	747	100.3%	2.5	0.4	A
WB	Left Turn						
	Through	18	17	91.7%	**17.6**	4.9	**C**
	Right Turn	22	18	81.4%	7.6	1.5	A
	Subtotal	40	34	86.0%	12.3	2.3	B
Total		1,784	1,764	98.9%	2.6	0.5	A

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	223	222	99.7%	63.9	15.0	E
	Through	243	243	99.8%	33.6	7.7	C
	Right Turn	56	56	100.4%	14.9	4.9	B
	Subtotal	522	521	99.8%	45.0	10.4	D
SB	Left Turn	46	48	103.3%	25.9	7.0	C
	Through	236	242	102.6%	48.0	7.4	D
	Right Turn	571	561	98.2%	12.7	3.2	B
	Subtotal	853	850	99.7%	23.7	2.7	C
EB	Left Turn	467	466	99.7%	34.3	4.3	C
	Through	146	149	102.2%	37.7	5.5	D
	Right Turn	131	131	100.0%	20.2	5.6	C
	Subtotal	744	746	100.2%	32.4	4.2	C
WB	Left Turn	70	73	104.4%	47.1	6.0	D
	Through	116	111	96.0%	43.1	8.9	D
	Right Turn	17	17	97.1%	26.6	9.4	C
	Subtotal	203	201	99.0%	43.3	6.3	D
Total		2,322	2,318	99.8%	33.0	4.3	C

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Conditions
AM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	2	2	0	8	184	190	81	648	NO
	Through	560	0	0	0	0	15	10	0	23	NO
	Right Turn	560	1	1	0	2	109	49	57	230	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	3	0	2	4	51	8	42	63	NO
	Right Turn	100	2	2	0	8	184	190	81	648	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	1	0	1	2	62	13	43	79	NO
	Through										
	Right Turn	1,000	0	0	0	0	0	0	0	0	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	1	0	1	1	46	9	25	58	NO
	Right Turn	100	0	0	0	1	45	7	29	57	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Conditions
AM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	150	81	11	67	96	415	153	277	781	MAX
	Through	1,000	31	3	26	35	260	110	172	545	NO
	Right Turn	1,000	29	3	24	34	263	110	175	548	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	6	1	4	8	97	35	62	187	NO
	Through	930	85	7	72	92	409	82	291	529	NO
	Right Turn	930	83	7	71	91	411	82	293	531	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	90	6	81	98	454	108	312	642	NO
	Through	560	89	6	79	98	454	108	312	642	NO
	Right Turn	100	3	2	2	7	165	97	82	318	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	20	5	15	28	192	35	128	231	MAX
	Through	1,000	33	4	26	42	225	19	188	253	NO
	Right Turn	1,000	28	4	22	35	223	24	167	253	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Waimea Roadway Improvements
Existing Conditions
PM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	778	761	97.8%	8.7	10.6	A
	Through	40	35	88.3%	2.7	5.5	A
	Right Turn	4	5	130.0%	0.6	1.0	A
	Subtotal	822	802	97.5%	8.4	10.3	A
SB	Left Turn						
	Through	60	58	95.8%	17.4	16.8	C
	Right Turn	20	18	91.5%	6.4	7.8	A
	Subtotal	80	76	94.8%	14.2	11.4	B
EB	Left Turn	20	18	90.0%	**27.8**	40.1	**D**
	Through						
	Right Turn	910	834	91.6%	2.9	1.1	A
	Subtotal	930	852	91.6%	3.5	1.7	A
WB	Left Turn						
	Through	5	3	50.0%	6.6	7.6	A
	Right Turn	5	5	98.0%	6.4	2.3	A
	Subtotal	10	7	74.0%	7.9	3.6	A
Total		1,842	1,737	94.3%	6.2	5.6	A

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	156	154	98.7%	57.9	9.7	E
	Through	329	330	100.3%	38.0	5.1	D
	Right Turn	51	50	98.4%	18.8	8.2	B
	Subtotal	536	534	99.7%	42.0	5.0	D
SB	Left Turn	49	49	100.6%	29.0	7.9	C
	Through	239	239	99.8%	47.9	5.9	D
	Right Turn	515	511	99.3%	11.3	2.8	B
	Subtotal	803	799	99.5%	23.1	2.7	C
EB	Left Turn	600	550	91.7%	37.6	5.9	D
	Through	191	172	90.2%	38.2	4.9	D
	Right Turn	179	163	90.9%	25.9	5.5	C
	Subtotal	970	885	91.2%	35.7	4.9	D
WB	Left Turn	94	99	105.0%	53.5	7.5	D
	Through	151	147	97.4%	51.1	7.6	D
	Right Turn	44	43	96.8%	36.2	11.2	D
	Subtotal	289	288	99.8%	49.9	7.1	D
Total		2,598	2,507	96.5%	34.6	1.9	C

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Conditions
PM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	26	27	1	78	583	285	81	887	MAX
	Through	560	0	0	0	0	8	10	0	21	NO
	Right Turn	560	9	12	0	33	247	182	42	504	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	5	4	3	15	78	46	47	201	NO
	Right Turn	100	26	27	1	78	583	285	81	887	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	1	1	0	3	45	12	21	66	NO
	Through										
	Right Turn	1,000	1	1	0	3	118	163	0	493	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	0	0	0	1	26	6	21	42	NO
	Right Turn	100	0	0	0	1	26	5	23	40	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Conditions
PM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	150	57	9	46	79	282	40	199	322	MAX
	Through	1,000	49	5	41	58	289	41	201	347	NO
	Right Turn	1,000	49	5	40	58	292	41	204	350	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	8	2	5	11	91	20	50	119	NO
	Through	930	83	11	67	100	400	46	332	472	NO
	Right Turn	930	82	11	67	101	402	46	334	474	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	127	15	107	151	750	191	441	945	MAX
	Through	560	126	15	106	149	750	191	441	945	MAX
	Right Turn	100	10	6	2	21	366	242	88	894	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	38	6	30	49	330	41	285	398	MAX
	Through	1,000	61	6	53	74	368	46	299	425	NO
	Right Turn	1,000	58	6	49	71	365	45	300	426	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Waimea Roadway Improvements
Existing Plus Project Conditions
AM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	840	829	98.7%	5.7	1.3	A
	Through	40	37	93.5%	6.4	2.1	A
	Right Turn	30	30	98.7%	3.8	1.8	A
	Subtotal	910	896	98.5%	5.6	1.3	A
SB	Left Turn	5	6	114.0%	6.4	9.4	A
	Through	50	48	95.4%	14.2	7.5	B
	Right Turn	40	40	100.8%	12.6	5.8	B
	Subtotal	95	94	98.6%	13.8	5.3	B
EB	Left Turn	50	48	96.4%	8.9	3.0	A
	Through	25	25	101.6%	8.5	3.6	A
	Right Turn	694	692	99.7%	8.4	1.5	A
	Subtotal	769	766	99.6%	8.5	1.6	A
WB	Left Turn	20	16	78.5%	13.3	8.8	B
	Through	18	20	108.3%	13.0	6.7	B
	Right Turn	2	2	90.0%	3.8	6.6	A
	Subtotal	40	37	92.5%	12.5	4.8	B
Total		1,814	1,793	98.8%	7.4	1.0	A

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	223	220	98.8%	57.7	7.4	E
	Through	243	245	101.0%	34.3	6.7	C
	Right Turn	56	55	98.8%	20.6	3.9	C
	Subtotal	522	521	99.8%	42.7	5.1	D
SB	Left Turn	46	44	96.3%	59.4	15.6	E
	Through	236	244	103.5%	51.9	8.8	D
	Right Turn	571	561	98.3%	30.6	12.7	C
	Subtotal	853	850	99.6%	38.5	8.3	D
EB	Left Turn	487	472	97.0%	38.4	3.9	D
	Through	146	151	103.5%	37.5	6.2	D
	Right Turn	131	129	98.8%	9.4	1.8	A
	Subtotal	764	753	98.5%	33.2	3.7	C
WB	Left Turn	70	70	99.3%	48.4	8.1	D
	Through	116	112	96.3%	48.8	8.0	D
	Right Turn	17	17	101.2%	6.5	1.5	A
	Subtotal	203	198	97.7%	45.2	6.1	D
Total		2,342	2,322	99.1%	38.3	3.9	D

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Plus Project Conditions
AM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	7	3	2	11	323	103	139	532	NO
	Through	560	7	3	2	11	323	103	139	532	NO
	Right Turn	560	7	3	2	10	324	102	141	532	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	6	1	3	7	93	20	63	141	NO
	Right Turn	100	6	1	3	7	94	20	63	141	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	1,000	10	3	6	16	363	127	241	672	NO
	Through										
	Right Turn	1,000	10	3	6	16	363	127	241	672	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	2	0	1	2	51	24	22	111	NO
	Right Turn	100	2	0	1	2	51	24	22	111	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Plus Project Conditions
AM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	150	80	8	72	96	372	51	274	444	MAX
	Through	1,000	36	2	32	39	228	43	188	324	NO
	Right Turn	1,000	35	3	29	37	231	43	192	327	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	14	4	10	21	119	38	64	187	NO
	Through	930	142	27	119	212	568	127	384	851	NO
	Right Turn	930	143	26	120	212	571	127	387	854	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	88	6	73	95	379	81	289	529	NO
	Through	560	88	6	73	95	379	81	289	529	NO
	Right Turn	100	3	1	3	5	94	16	74	124	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	23	5	15	34	211	45	155	308	MAX
	Through	750	35	5	25	42	252	39	199	308	NO
	Right Turn	100	0	0	0	0	45	17	27	78	NO
	Second Right										

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	778	773	99.3%	3.7	0.9	A
	Through	40	36	88.8%	3.2	1.4	A
	Right Turn	4	4	107.5%	1.2	1.5	A
	Subtotal	822	813	98.9%	3.6	0.9	A
SB	Left Turn	1	1	100.0%	0.8	2.6	A
	Through	60	61	101.2%	8.1	2.7	A
	Right Turn	20	18	91.5%	8.5	7.2	A
	Subtotal	81	80	98.8%	8.0	2.3	A
EB	Left Turn	20	19	93.5%	11.6	6.0	B
	Through	5	4	86.0%	6.4	6.2	A
	Right Turn	910	901	99.0%	13.7	5.4	B
	Subtotal	935	924	98.8%	13.6	5.3	B
WB	Left Turn	4	3	77.5%	3.2	4.1	A
	Through	5	4	74.0%	4.0	7.2	A
	Right Turn	1	1	110.0%	1.1	1.6	A
	Subtotal	10	8	79.0%	6.2	6.6	A
Total		1,848	1,825	98.7%	8.9	2.9	A

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	156	160	102.2%	64.9	6.2	E
	Through	329	322	98.0%	42.2	7.5	D
	Right Turn	51	55	107.6%	28.4	7.3	C
	Subtotal	536	537	100.1%	47.8	3.7	D
SB	Left Turn	49	50	101.8%	65.3	11.2	E
	Through	239	239	99.9%	51.4	5.4	D
	Right Turn	515	509	98.8%	22.6	8.5	C
	Subtotal	803	798	99.3%	34.2	4.6	C
EB	Left Turn	604	604	100.0%	42.5	4.7	D
	Through	191	188	98.5%	40.0	3.0	D
	Right Turn	179	170	95.0%	10.0	1.3	B
	Subtotal	974	962	98.8%	36.5	3.3	D
WB	Left Turn	94	100	106.0%	59.8	10.9	E
	Through	151	144	95.1%	53.2	6.7	D
	Right Turn	44	43	97.3%	10.7	4.3	B
	Subtotal	289	286	99.0%	49.5	7.2	D
Total		2,602	2,582	99.2%	39.6	2.1	D

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Plus Project Conditions
PM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	2	1	1	4	189	54	109	292	NO
	Through	560	2	1	1	4	189	54	109	292	NO
	Right Turn	560	2	1	1	4	194	55	111	292	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	3	1	2	4	78	27	47	147	NO
	Right Turn	100	3	1	2	4	79	27	48	147	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	1,000	43	25	17	84	671	242	353	1,008	NO
	Through										
	Right Turn	1,000	43	25	17	84	671	242	353	1,008	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	0	0	0	0	22	5	20	37	NO
	Right Turn	100	0	0	0	0	22	5	20	37	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Existing Plus Project Conditions
PM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	150	59	6	49	70	276	50	180	373	MAX
	Through	1,000	54	5	46	66	265	30	229	313	NO
	Right Turn	1,000	54	6	47	66	269	30	232	317	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	18	3	14	26	134	37	87	203	NO
	Through	930	118	15	97	138	550	86	418	733	NO
	Right Turn	930	119	15	98	140	554	86	421	736	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	130	11	112	146	625	30	545	653	MAX
	Through	560	130	11	112	146	625	30	545	653	MAX
	Right Turn	100	6	1	5	7	116	35	84	203	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	44	8	30	60	314	63	236	456	MAX
	Through	750	52	6	45	61	339	70	258	455	NO
	Right Turn	100	1	0	1	2	53	17	26	75	NO
	Second Right										

Vissim Post-Processor **Waimea Roadway Improvements**
Average Results from 10 Runs **Future Conditions**
Volume and Delay by Movement **AM Peak Hour**

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	920	915	99.5%	10.1	7.7	B
	Through	50	47	93.4%	3.8	4.0	A
	Right Turn	40	38	94.3%	3.5	3.7	A
	Subtotal	1,010	999	99.0%	9.6	7.3	A
SB	Left Turn						
	Through	60	59	98.5%	**51.8**	38.0	**F**
	Right Turn	50	48	96.6%	8.7	4.2	A
	Subtotal	110	107	97.6%	33.7	24.0	D
EB	Left Turn	60	56	92.5%	34.7	24.0	D
	Through						
	Right Turn	770	749	97.2%	5.2	4.7	A
	Subtotal	830	804	96.9%	7.5	5.0	A
WB	Left Turn						
	Through	20	16	79.5%	30.9	18.9	D
	Right Turn	30	29	97.7%	13.0	7.0	B
	Subtotal	50	45	90.4%	18.1	7.6	C
Total		2,000	1,956	97.8%	10.4	6.2	B

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	250	246	98.5%	98.6	41.0	F
	Through	270	268	99.2%	45.5	13.9	D
	Right Turn	70	72	102.1%	30.7	23.5	C
	Subtotal	590	586	99.3%	67.6	28.0	E
SB	Left Turn	60	60	100.5%	27.0	8.0	C
	Through	260	263	101.0%	49.3	5.0	D
	Right Turn	630	624	99.1%	18.1	7.8	B
	Subtotal	950	947	99.7%	27.7	4.4	C
EB	Left Turn	520	508	97.8%	39.3	8.6	D
	Through	160	156	97.6%	37.3	9.8	D
	Right Turn	150	141	93.9%	22.1	4.7	C
	Subtotal	830	805	97.0%	35.9	7.5	D
WB	Left Turn	80	80	99.6%	50.3	8.9	D
	Through	130	129	99.5%	53.5	15.1	D
	Right Turn	20	19	97.0%	32.2	19.2	C
	Subtotal	230	229	99.3%	50.7	11.9	D
Total		2,600	2,567	98.7%	41.9	8.9	D

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Conditions
AM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	47	34	8	110	790	164	561	968	MAX
	Through	560	0	0	0	0	22	13	0	52	NO
	Right Turn	560	15	12	1	37	387	146	152	550	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	12	7	5	28	121	55	58	213	MAX
	Right Turn	100	47	34	8	110	790	164	561	968	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	10	11	1	39	239	275	50	706	MAX
	Through										
	Right Turn	1,000	6	10	0	31	233	300	0	951	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	2	1	1	5	68	29	43	120	NO
	Right Turn	100	2	1	1	4	66	29	42	118	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Conditions
AM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	150	160	64	86	310	644	182	313	799	AVG
	Through	1,000	61	31	40	148	491	173	278	783	NO
	Right Turn	1,000	60	32	39	148	494	173	281	786	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	10	1	8	12	102	17	81	123	NO
	Through	930	124	14	109	145	597	95	465	764	NO
	Right Turn	930	123	14	107	144	599	95	467	766	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	124	16	100	150	831	85	653	910	MAX
	Through	560	123	16	100	149	831	85	653	910	MAX
	Right Turn	100	10	7	2	21	461	321	84	900	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	25	4	20	31	268	45	204	336	MAX
	Through	1,000	51	8	43	66	331	45	287	410	NO
	Right Turn	1,000	47	8	40	62	332	45	288	411	NO
	Second Right										

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	860	847	98.4%	18.6	20.0	C
	Through	50	48	95.0%	10.4	12.2	B
	Right Turn	10	9	91.0%	5.1	9.5	A
	Subtotal	920	903	98.2%	18.1	19.5	C
SB	Left Turn						
	Through	70	67	95.6%	**146.7**	183.2	**F**
	Right Turn	30	28	93.7%	26.0	33.1	D
	Subtotal	100	95	95.0%	103.9	115.4	F
EB	Left Turn	30	23	77.7%	65.8	80.9	F
	Through						
	Right Turn	1,000	769	76.9%	6.2	5.8	A
	Subtotal	1,030	792	76.9%	8.9	8.9	A
WB	Left Turn						
	Through	10	4	36.0%	52.7	128.9	F
	Right Turn	10	7	66.0%	30.4	73.6	D
	Subtotal	20	10	51.0%	46.4	109.9	E
Total		2,070	1,801	87.0%	18.9	16.4	C

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	180	178	98.6%	64.9	14.9	E
	Through	370	370	99.9%	39.5	5.4	D
	Right Turn	60	65	107.8%	24.8	6.9	C
	Subtotal	610	612	100.3%	44.7	5.6	D
SB	Left Turn	60	61	102.3%	33.4	6.2	C
	Through	270	277	102.7%	57.0	8.6	E
	Right Turn	570	562	98.5%	30.1	20.6	C
	Subtotal	900	900	100.0%	38.9	13.7	D
EB	Left Turn	660	512	77.6%	46.6	4.2	D
	Through	210	167	79.3%	45.7	4.7	D
	Right Turn	200	153	76.3%	27.9	5.8	C
	Subtotal	1,070	831	77.7%	42.9	4.1	D
WB	Left Turn	110	113	102.8%	61.0	11.7	E
	Through	170	163	95.9%	67.6	25.0	E
	Right Turn	50	47	94.8%	49.6	16.4	D
	Subtotal	330	324	98.0%	63.1	18.3	E
Total		2,910	2,667	91.6%	44.7	7.0	D

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Conditions
PM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Side-street Stop**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	560	129	50	40	190	908	104	714	991	MAX
	Through	560	0	0	0	0	9	10	0	20	NO
	Right Turn	560	45	22	8	79	490	104	296	573	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	32	17	9	63	237	81	106	356	MAX
	Right Turn	100	129	50	40	190	908	104	714	991	AVG
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	63	186	2	592	283	706	39	2,291	MAX
	Through										
	Right Turn	1,000	113	196	0	503	721	755	0	2,020	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	1	2	0	6	36	29	23	117	NO
	Right Turn	100	1	2	0	6	34	29	24	116	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Conditions
PM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	150	80	17	61	119	387	150	241	781	MAX
	Through	1,000	63	5	55	72	372	61	265	470	NO
	Right Turn	1,000	63	6	55	73	375	61	268	473	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	10	2	7	13	110	23	74	152	NO
	Through	930	144	38	109	234	638	166	415	950	NO
	Right Turn	930	144	39	109	236	640	166	416	952	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	148	24	128	201	873	65	691	928	MAX
	Through	560	147	24	127	200	873	65	691	928	MAX
	Right Turn	100	18	11	3	35	583	334	138	895	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	53	15	36	90	399	105	279	582	MAX
	Through	1,000	90	14	71	111	466	77	366	581	NO
	Right Turn	1,000	87	15	63	110	467	77	367	582	NO
	Second Right										

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	920	910	98.9%	7.6	1.4	A
	Through	50	46	91.2%	7.5	3.4	A
	Right Turn	40	39	97.8%	6.9	2.8	A
	Subtotal	1,010	995	98.5%	7.5	1.5	A
SB	Left Turn	6	6	98.3%	13.0	14.3	B
	Through	60	60	99.7%	23.5	7.2	C
	Right Turn	50	50	99.2%	19.4	6.1	C
	Subtotal	116	115	99.4%	21.7	5.2	C
EB	Left Turn	60	57	95.3%	17.5	7.9	C
	Through	30	30	101.3%	17.3	9.7	C
	Right Turn	770	764	99.2%	16.6	6.8	C
	Subtotal	860	851	99.0%	16.7	6.8	C
WB	Left Turn	30	27	89.7%	16.6	5.1	C
	Through	20	21	106.0%	19.4	8.2	C
	Right Turn	3	2	63.3%	8.3	15.2	A
	Subtotal	53	50	94.3%	17.5	5.4	C
Total		2,039	2,011	98.6%	12.6	2.9	B

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	250	249	99.5%	65.2	18.8	E
	Through	270	266	98.6%	38.0	6.2	D
	Right Turn	70	70	99.7%	21.6	6.4	C
	Subtotal	590	585	99.1%	48.2	11.7	D
SB	Left Turn	60	60	100.7%	60.9	17.6	E
	Through	260	266	102.4%	71.1	24.7	E
	Right Turn	630	618	98.0%	95.6	24.6	F
	Subtotal	950	944	99.4%	86.8	19.0	F
EB	Left Turn	550	541	98.3%	41.0	5.0	D
	Through	160	168	104.9%	41.7	5.3	D
	Right Turn	150	146	97.0%	10.1	1.3	B
	Subtotal	860	854	99.3%	35.9	4.2	D
WB	Left Turn	80	82	103.0%	50.6	5.4	D
	Through	130	127	97.7%	48.9	9.3	D
	Right Turn	20	18	91.0%	9.1	4.9	A
	Subtotal	230	228	99.0%	46.8	6.8	D
Total		2,630	2,611	99.3%	58.4	8.8	E

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Plus Project Conditions
AM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	18	5	12	26	430	60	346	528	NO
	Through	560	18	5	12	26	430	60	346	528	NO
	Right Turn	560	18	5	12	26	431	60	347	528	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	14	3	10	20	131	36	88	205	MAX
	Right Turn	100	14	3	10	20	131	36	89	205	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	1,000	64	63	24	237	970	485	509	2,263	NO
	Through										
	Right Turn	1,000	64	63	24	237	970	485	509	2,263	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	3	1	2	5	83	32	42	114	NO
	Right Turn	100	3	1	2	5	83	32	42	114	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Plus Project Conditions
AM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	150	112	19	85	143	547	151	358	808	MAX
	Through	1,000	45	4	39	52	252	38	189	298	NO
	Right Turn	1,000	44	4	38	52	256	38	192	301	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	25	6	17	34	164	66	90	317	NO
	Through	930	358	78	258	513	940	94	791	1,093	MAX
	Right Turn	930	360	78	260	515	942	94	794	1,096	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	112	11	93	130	593	84	374	650	MAX
	Through	560	112	11	93	130	593	84	374	650	MAX
	Right Turn	100	4	1	3	8	104	34	71	167	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	35	8	22	42	288	46	214	347	MAX
	Through	750	48	6	40	58	310	32	256	345	NO
	Right Turn	100	0	0	0	1	46	18	27	86	NO
	Second Right										

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	860	853	99.2%	6.5	3.5	A
	Through	50	46	91.4%	5.8	3.5	A
	Right Turn	5	6	110.0%	6.8	10.4	A
	Subtotal	915	904	98.8%	6.4	3.5	A
SB	Left Turn	2	3	135.0%	11.1	15.1	B
	Through	70	70	99.9%	16.9	6.5	C
	Right Turn	30	28	93.0%	14.7	8.4	B
	Subtotal	102	101	98.5%	16.4	7.3	C
EB	Left Turn	30	33	109.3%	49.5	14.3	E
	Through	6	6	91.7%	43.3	26.1	E
	Right Turn	1,000	966	96.6%	50.2	11.1	F
	Subtotal	1,036	1,004	96.9%	50.2	11.0	F
WB	Left Turn	5	4	86.0%	8.5	6.8	A
	Through	6	6	105.0%	10.1	7.1	B
	Right Turn	2	1	70.0%	4.8	9.3	A
	Subtotal	13	12	92.3%	10.8	4.7	B
Total		2,066	2,021	97.8%	28.8	5.7	D

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	180	179	99.3%	68.9	11.6	E
	Through	370	368	99.5%	45.5	4.2	D
	Right Turn	60	58	97.3%	28.5	10.7	C
	Subtotal	610	605	99.2%	50.9	3.2	D
SB	Left Turn	60	60	99.2%	67.1	7.6	E
	Through	270	267	98.9%	68.9	17.7	E
	Right Turn	570	563	98.7%	56.0	28.5	E
	Subtotal	900	889	98.8%	61.4	18.1	E
EB	Left Turn	670	654	97.6%	47.2	4.3	D
	Through	210	199	94.7%	48.4	4.7	D
	Right Turn	200	189	94.6%	13.0	1.6	B
	Subtotal	1,080	1,042	96.4%	41.3	4.1	D
WB	Left Turn	110	114	103.5%	65.8	10.5	E
	Through	170	164	96.4%	67.1	11.8	E
	Right Turn	50	48	95.2%	16.1	6.0	B
	Subtotal	330	325	98.6%	59.1	10.4	E
Total		2,920	2,861	98.0%	51.5	5.9	D

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Plus Project Conditions
PM Peak Hour

Intersection 1 **Lindsey Rd/Kawaihae Rd-Parker School Dwy** **Roundabout**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	560	10	7	4	25	368	135	192	620	NO
	Through	560	10	7	4	25	368	135	192	620	NO
	Right Turn	560	10	6	4	25	369	135	192	620	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	100	7	2	4	10	104	17	84	131	MAX
	Right Turn	100	6	2	4	10	104	17	84	132	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	1,000	654	224	269	980	2,173	144	1,765	2,246	MAX
	Through										
	Right Turn	1,000	654	224	269	980	2,173	144	1,765	2,246	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through	100	1	0	0	1	29	10	20	43	NO
	Right Turn	100	1	0	0	1	29	10	20	43	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

Waimea Roadway Improvements
Future Plus Project Conditions
PM Peak Hour

Intersection 2 **Mamalahoa Hwy/Lindsey Rd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	150	82	8	62	92	326	47	265	431	MAX
	Through	1,000	69	4	59	74	301	36	271	390	NO
	Right Turn	1,000	70	4	60	74	305	36	275	394	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	375	25	4	17	30	134	21	88	164	NO
	Through	930	245	66	148	382	759	204	425	1,016	NO
	Right Turn	930	248	66	151	384	762	204	428	1,019	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	560	180	16	159	207	693	97	635	960	MAX
	Through	350	180	16	159	207	693	97	635	960	MAX
	Right Turn	350	8	1	6	10	125	16	100	157	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	60	63	10	41	76	365	33	317	408	AVG
	Through	750	79	11	63	94	388	70	315	562	NO
	Right Turn	100	1	0	1	2	49	14	38	82	NO
	Second Right										

Appendix D: Detailed Roadway Segment Analysis

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Opelo Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Class	**III - Moderately developed area**					
Grade type	**Level Terrain**					
Peak hour:	**AM Peak Hour : 10 am**			**PM Peak Hour : 4 pm**		
Mean speed of sample (v>200 veh/h)		25	mph		25	mph
Total demand, analysis direction		554	veh/h		667	veh/h
Total demand, opposing		495	veh/h		454	veh/h
Total demand flow rate, both directions		1049	veh/h		1121	veh/h
PHF, analysis direction		0.86			0.90	
PHF, opposing direction		0.92			0.97	
Total demand flow rate, analysis direction		641	veh/h		737	veh/h
Total demand flow rate, opposing		539	veh/h		470	veh/h
Number of Trucks, analysis direction		49			61	
Passenger car equivalent for trucks	E_T =	1.1	pc/truck	E_T =	1.1	pc/truck
Number of RVs, analysis direction		124			144	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		48			29	
Passenger car equivalent for trucks		1.2	pc/truck		1.2	pc/truck
Number of RVs, opposing direction		106			101	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.98			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.98			0.98	
Free Flow Speed		33	mph		34	mph
Adjusted demand flow rate, analysis direction		646	pc/h		744	pc/h
Adjusted demand flow rate, opposing direction		550	pc/h		476	pc/h
ATS Adjustment Factor for No-Passing Zones		2			2.4	
Average Travel Speed		22	mph		22	mph
Percent of Free Flow Speed		66.1%			64.9%	
LOS		E			E	

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Opelo Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Class	**III - Moderately developed area**					
Grade type	**Level Terrain**					
Peak hour:	**AM Peak Hour : 10 am**			**PM Peak Hour : 4 pm**		
Mean speed of sample (v>200 veh/h)		25	mph		25	mph
Total demand, analysis direction		495	veh/h		454	veh/h
Total demand, opposing		554	veh/h		667	veh/h
Total demand flow rate, both directions		1049	veh/h		1121	veh/h
PHF, analysis direction		0.86			0.86	
PHF, opposing direction		0.92			0.92	
Total demand flow rate, analysis direction		572	veh/h		525	veh/h
Total demand flow rate, opposing		604	veh/h		727	veh/h
Number of Trucks, analysis direction		48			29	
Passenger car equivalent for trucks	E_T =	1.2	pc/truck	E_T =	1.2	pc/truck
Number of RVs, analysis direction		106			101	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		49			61	
Passenger car equivalent for trucks		1.1	pc/truck		1.1	pc/truck
Number of RVs, opposing direction		124			144	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.99	
Free Flow Speed		33	mph		34	mph
Adjusted demand flow rate, analysis direction		578	pc/h		528	pc/h
Adjusted demand flow rate, opposing direction		609	pc/h		733	pc/h
ATS Adjustment Factor for No-Passing Zones		1.8			1.4	
Average Travel Speed		22	mph		23	mph
Percent of Free Flow Speed		66.9%			66.9%	
LOS		**D**			**D**	

Urban Street Segment LOS Calculation - HCM 6th Edition

Scenario:	**Existing Conditions**					
Roadway segment:	**Mamalahoa Highway**					
Upstream cross street:	**Kaomoloa Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,770	feet	L =	1,770	feet
Width of upstream intersection	W_i =	30	feet	W_i =	30	feet
Upstream intersection control	Stop-Controlled			Stop-Controlled		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	2	points	$N_{ap,s}$ =	2	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	4	points	$N_{ap,o}$ =	4	points
Total access points (both sides) with turn bay	N_{tb} =	3	points	N_{tb} =	3	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	14	%	p_{curb} =	14	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	V_m =	561	veh/h	V_m =	547	veh/h
Delay of through movement	d_t =	27	seconds	d_t =	36	seconds
V/C ratio of through movement	v/c_t =	0.30		v/c_t =	0.42	
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	0.7	mi/h	f_{cs} =	0.7	mi/h
Access density	D_a =	18.2	points/mi	D_a =	18.2	points/mi
Adjustment for access points	f_A =	-1.4	mi/h	f_A =	-1.4	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	39.0	mi/h	S_{f0} =	39.0	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	37.8	mi/h	S_f =	37.8	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	0.8	seconds	d_{ap} =	0.5	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	36.6	seconds	t_R =	36.3	seconds
Segment travel speed	$S_{T,seg}$ =	19.0	mi/h	$S_{T,seg}$ =	16.8	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	49	%	t_R =	43	%
	LOS =	**D**		**LOS =**	**D**	

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Lindsey Road**					
Downstream cross street:	**Kaomoloa Road**					
Direction:	**Westbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,860	feet	L =	1,860	feet
Width of upstream intersection	W_i =	120	feet	W_i =	120	feet
Upstream intersection control	Signalized			Signalized		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	6	points	$N_{ap,s}$ =	6	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	2	points	$N_{ap,o}$ =	2	points
Total access points (both sides) with turn bay	N_{tb} =	2	points	N_{tb} =	2	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	37	%	p_{curb} =	37	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	V_m =	470	veh/h	V_m =	522	veh/h
Delay of through movement	d_t =	0	seconds	d_t =	0	seconds
V/C ratio of through movement	v/c_t =	0.00		v/c_t =	0.00	
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	-0.1	mi/h	f_{cs} =	-0.1	mi/h
Access density	D_a =	24.3	points/mi	D_a =	24.3	points/mi
Adjustment for access points	f_A =	-1.9	mi/h	f_A =	-1.9	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	37.7	mi/h	S_{f0} =	37.7	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	36.8	mi/h	S_f =	36.8	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	1.1	seconds	d_{ap} =	1.1	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	39.4	seconds	t_R =	39.6	seconds
Segment travel speed	$S_{T,seg}$ =	32.2	mi/h	$S_{T,seg}$ =	32.0	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	85	%	t_R =	85	%
	LOS =	**A**		**LOS =**	**A**	

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Plus Project Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Opelo Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Class	**III - Moderately developed area**					
Grade type	**Level Terrain**					
Peak hour:	**AM Peak Hour : 10 am**			**PM Peak Hour : 4 pm**		
Mean speed of sample (v>200 veh/h)		30	* mph		30	* mph
Total demand, analysis direction		554	veh/h		667	veh/h
Total demand, opposing		495	veh/h		454	veh/h
Total demand flow rate, both directions		1049	veh/h		1121	veh/h
PHF, analysis direction		0.86			0.90	
PHF, opposing direction		0.92			0.97	
Total demand flow rate, analysis direction		641	veh/h		737	veh/h
Total demand flow rate, opposing		539	veh/h		470	veh/h
Number of Trucks, analysis direction		49			61	
Passenger car equivalent for trucks	E_T =	1.1	pc/truck	E_T =	1.1	pc/truck
Number of RVs, analysis direction		124			144	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		48			29	
Passenger car equivalent for trucks		1.2	pc/truck		1.2	pc/truck
Number of RVs, opposing direction		106			101	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.98			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.98			0.98	
Free Flow Speed		38	mph		39	mph
Adjusted demand flow rate, analysis direction		646	pc/h		744	pc/h
Adjusted demand flow rate, opposing direction		550	pc/h		476	pc/h
ATS Adjustment Factor for No-Passing Zones		2			2.4	
Average Travel Speed		27	mph		27	mph
Percent of Free Flow Speed		70.5%			69.4%	
LOS		**D**			**D**	

*Based on HCM 6 Exhibit 15-8, vehicle speeds were assumed to increase based on a decrease in vehicle conflicts due to the two-way left-turn lane. Based on 11 driveways on the left-hand side along this segment, the speed would be expected to increase by 6.7 mph. We conservatively assumed a 5 mph increase in average speed.

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	Existing Plus Project Conditions					
Roadway segment:	Kawaihae Road					
Upstream cross street:	Opelo Road					
Downstream cross street:	Lindsey Road					
Direction:	Eastbound					
Class	III - Moderately developed area					
Grade type	Level Terrain					
Peak hour:	AM Peak Hour : 10 am			PM Peak Hour : 4 pm		
Mean speed of sample (v>200 veh/h)		30	* mph		30	* mph
Total demand, analysis direction		495	veh/h		454	veh/h
Total demand, opposing		554	veh/h		667	veh/h
Total demand flow rate, both directions		1049	veh/h		1121	veh/h
PHF, analysis direction		0.86			0.86	
PHF, opposing direction		0.92			0.92	
Total demand flow rate, analysis direction		572	veh/h		525	veh/h
Total demand flow rate, opposing		604	veh/h		727	veh/h
Number of Trucks, analysis direction		48			29	
Passenger car equivalent for trucks	E_T =	1.2	pc/truck	E_T =	1.2	pc/truck
Number of RVs, analysis direction		106			101	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		49			61	
Passenger car equivalent for trucks		1.1	pc/truck		1.1	pc/truck
Number of RVs, opposing direction		124			144	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.99	
Free Flow Speed		38	mph		39	mph
Adjusted demand flow rate, analysis direction		578	pc/h		528	pc/h
Adjusted demand flow rate, opposing direction		609	pc/h		733	pc/h
ATS Adjustment Factor for No-Passing Zones		1.8			1.4	
Average Travel Speed		27	mph		28	mph
Percent of Free Flow Speed		71.2%			71.1%	
LOS		D			D	

*Based on HCM 6 Exhibit 15-8, vehicle speeds were assumed to increase based on a decrease in vehicle conflicts due to the two-way left-turn lane. Based on 15 driveways on the left-hand side along this segment, the speed would be expected to increase by 9.1 mph. We conservatively assumed a 5 mph increase in average speed.

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Plus Project Conditions**					
Roadway segment:	**Mamalahoa Highway**					
Upstream cross street:	**Kaomoloa Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	$L =$	1,770	feet	$L =$	1,770	feet
Width of upstream intersection	$W_i =$	30	feet	$W_i =$	30	feet
Upstream intersection control	Stop-Controlled			Stop-Controlled		
Posted speed limit	$S_{pl} =$	30	mi/h	$S_{pl} =$	30	mi/h
Through lanes	$N_{th} =$	1	lanes	$N_{th} =$	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s} =$	2	points	$N_{ap,s} =$	2	points
Right-side access points in opposing direction of travel	$N_{ap,o} =$	4	points	$N_{ap,o} =$	4	points
Total access points (both sides) with turn bay	$N_{tb} =$	3	points	$N_{tb} =$	3	points
Link length with restrictive median	$p_{rm} =$	82	%	$p_{rm} =$	82	%
Link length with curb on right-hand side	$p_{curb} =$	14	%	$p_{curb} =$	14	%
Link length with on-street parking	$p_{pk} =$	0	%	$p_{pk} =$	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	$V_m =$	561	veh/h	$V_m =$	547	veh/h
Delay of through movement	$d_t =$	32	seconds	$d_t =$	40	seconds
V/C ratio of through movement	$v/c_t =$	0.30		$v/c_t =$	0.44	
Speed constant	$S_0 =$	39.7	mi/h	$S_0 =$	39.7	mi/h
Adjustment for cross section	$f_{cs} =$	0.7	mi/h	$f_{cs} =$	0.7	mi/h
Access density	$D_a =$	18.2	points/mi	$D_a =$	18.2	points/mi
Adjustment for access points	$f_A =$	-1.4	mi/h	$f_A =$	-1.4	mi/h
Adjustment for on-street parking	$f_A =$	0.0	mi/h	$f_A =$	0.0	mi/h
Base free-flow speed	$S_{f0} =$	39.0	mi/h	$S_{f0} =$	39.0	mi/h
Signal spacing adjustment factor	$f_L =$	1.0		$f_L =$	1.0	
Free-flow speed	$S_f =$	37.8	mi/h	$S_f =$	37.8	mi/h
Proximity adjustment factor	$f_v =$	1.0		$f_v =$	1.0	
Turning movement delay at access points	$d_{ap} =$	0.8	seconds	$d_{ap} =$	0.5	seconds
Other delay	$d_{other} =$	2.0	seconds	$d_{other} =$	2.0	seconds
Segment running time	$t_R =$	36.6	seconds	$t_R =$	36.3	seconds
Segment travel speed	$S_{T,seg} =$	17.5	mi/h	$S_{T,seg} =$	15.8	mi/h
Travel speed as a percentage of base free-flow speed	$t_R =$	45	%	$t_R =$	40	%
	LOS =	**D**		**LOS =**	**D**	

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Existing Plus Project Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Lindsey Road**					
Downstream cross street:	**Kaomoloa Road**					
Direction:	**Westbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	$L =$	1,860	feet	$L =$	1,860	feet
Width of upstream intersection	$W_i =$	120	feet	$W_i =$	120	feet
Upstream intersection control	Signalized			Signalized		
Posted speed limit	$S_{pl} =$	30	mi/h	$S_{pl} =$	30	mi/h
Through lanes	$N_{th} =$	1	lanes	$N_{th} =$	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s} =$	6	points	$N_{ap,s} =$	6	points
Right-side access points in opposing direction of travel	$N_{ap,o} =$	2	points	$N_{ap,o} =$	2	points
Total access points (both sides) with turn bay	$N_{tb} =$	2	points	$N_{tb} =$	2	points
Link length with restrictive median	$p_{rm} =$	82	%	$p_{rm} =$	82	%
Link length with curb on right-hand side	$p_{curb} =$	47	%	$p_{curb} =$	47	%
Link length with on-street parking	$p_{pk} =$	0	%	$p_{pk} =$	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	$V_m =$	470	veh/h	$V_m =$	522	veh/h
Delay of through movement	$d_t =$	0	seconds	$d_t =$	0	seconds
V/C ratio of through movement	$v/c_t =$	0.00		$v/c_t =$	0.00	
Speed constant	$S_0 =$	39.7	mi/h	$S_0 =$	39.7	mi/h
Adjustment for cross section	$f_{cs} =$	-0.4	mi/h	$f_{cs} =$	-0.4	mi/h
Access density	$D_a =$	24.3	points/mi	$D_a =$	24.3	points/mi
Adjustment for access points	$f_A =$	-1.9	mi/h	$f_A =$	-1.9	mi/h
Adjustment for on-street parking	$f_A =$	0.0	mi/h	$f_A =$	0.0	mi/h
Base free-flow speed	$S_{f0} =$	37.4	mi/h	$S_{f0} =$	37.4	mi/h
Signal spacing adjustment factor	$f_L =$	1.0		$f_L =$	1.0	
Free-flow speed	$S_f =$	36.5	mi/h	$S_f =$	36.5	mi/h
Proximity adjustment factor	$f_v =$	1.0		$f_v =$	1.0	
Turning movement delay at access points	$d_{ap} =$	1.1	seconds	$d_{ap} =$	1.1	seconds
Other delay	$d_{other} =$	2.0	seconds	$d_{other} =$	2.0	seconds
Segment running time	$t_R =$	39.7	seconds	$t_R =$	39.9	seconds
Segment travel speed	$S_{T,seg} =$	31.9	mi/h	$S_{T,seg} =$	31.8	mi/h
Travel speed as a percentage of base free-flow speed	$t_R =$	85	%	$t_R =$	85	%
	LOS =	**A**		**LOS =**	**A**	

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	**Future Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Opelo Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Class	**III - Moderately developed area**					
Grade type	**Level Terrain**					
Peak hour:	**AM Peak Hour : 10 am**			**PM Peak Hour : 4 pm**		
Mean speed of sample (v>200 veh/h)		25	mph		25	mph
Total demand, analysis direction		610	veh/h		740	veh/h
Total demand, opposing		550	veh/h		500	veh/h
Total demand flow rate, both directions		1160	veh/h		1240	veh/h
PHF, analysis direction		0.86			0.90	
PHF, opposing direction		0.92			0.97	
Total demand flow rate, analysis direction		705	veh/h		818	veh/h
Total demand flow rate, opposing		599	veh/h		518	veh/h
Number of Trucks, analysis direction		54			67	
Passenger car equivalent for trucks	E_T =	1.1	pc/truck	E_T =	1.1	pc/truck
Number of RVs, analysis direction		136			160	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		53			32	
Passenger car equivalent for trucks		1.1	pc/truck		1.2	pc/truck
Number of RVs, opposing direction		117			111	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.98	
Free Flow Speed		34	mph		35	mph
Adjusted demand flow rate, analysis direction		712	pc/h		825	pc/h
Adjusted demand flow rate, opposing direction		605	pc/h		525	pc/h
ATS Adjustment Factor for No-Passing Zones		1.8			2.1	
Average Travel Speed		22	mph		22	mph
Percent of Free Flow Speed		64.7%			63.8%	
LOS		**E**			**E**	

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	**Future Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Opelo Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Class	**III - Moderately developed area**					
Grade type	**Level Terrain**					
Peak hour:	**AM Peak Hour : 10 am**			**PM Peak Hour : 4 pm**		
Mean speed of sample (v>200 veh/h)		25	mph		25	mph
Total demand, analysis direction		550	veh/h		500	veh/h
Total demand, opposing		610	veh/h		740	veh/h
Total demand flow rate, both directions		1160	veh/h		1240	veh/h
PHF, analysis direction		0.86			0.86	
PHF, opposing direction		0.92			0.92	
Total demand flow rate, analysis direction		636	veh/h		578	veh/h
Total demand flow rate, opposing		665	veh/h		806	veh/h
Number of Trucks, analysis direction		53			31.93833	
Passenger car equivalent for trucks	$E_T =$	1.1	pc/truck	$E_T =$	1.2	pc/truck
Number of RVs, analysis direction		117			111	
Passenger car equivalent for RVs	$E_R =$	1	pc/RV	$E_R =$	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		1.00			0.99	
Number of Trucks, opposing direction		54			67	
Passenger car equivalent for trucks		1.1	pc/truck		1.1	pc/truck
Number of RVs, opposing direction		136			160	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.99	
Free Flow Speed		34	mph		35	mph
Adjusted demand flow rate, analysis direction		639	pc/h		581	pc/h
Adjusted demand flow rate, opposing direction		670	pc/h		814	pc/h
ATS Adjustment Factor for No-Passing Zones		1.6			1.2	
Average Travel Speed		22	mph		23	mph
Percent of Free Flow Speed		65.5%			65.4%	
LOS		**E**			**E**	

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Future Conditions**					
Roadway segment:	**Mamalahoa Highway**					
Upstream cross street:	**Kaomoloa Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,770	feet	L =	1,770	feet
Width of upstream intersection	W_i =	30	feet	W_i =	30	feet
Upstream intersection control	Stop-Controlled			Stop-Controlled		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	2	points	$N_{ap,s}$ =	2	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	4	points	$N_{ap,o}$ =	4	points
Total access points (both sides) with turn bay	N_{tb} =	3	points	N_{tb} =	3	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	14	%	p_{curb} =	14	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	V_m =	634	veh/h	V_m =	612	veh/h
Delay of through movement	d_t =	31	seconds	d_t =	42	seconds
V/C ratio of through movement	v/c_t =	0.31		v/c_t =	0.44	
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	0.7	mi/h	f_{cs} =	0.7	mi/h
Access density	D_a =	18.2	points/mi	D_a =	18.2	points/mi
Adjustment for access points	f_A =	-1.4	mi/h	f_A =	-1.4	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	39.0	mi/h	S_{f0} =	39.0	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	37.8	mi/h	S_f =	37.8	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	0.8	seconds	d_{ap} =	0.8	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	36.8	seconds	t_R =	36.8	seconds
Segment travel speed	$S_{T,seg}$ =	17.8	mi/h	$S_{T,seg}$ =	15.4	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	46	%	t_R =	40	%
	LOS =	**D**		**LOS =**	**E**	

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Future Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Lindsey Road**					
Downstream cross street:	**Kaomoloa Road**					
Direction:	**Westbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,860	feet	L =	1,860	feet
Width of upstream intersection	W_i =	120	feet	W_i =	120	feet
Upstream intersection control	Signalized			Signalized		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	6	points	$N_{ap,s}$ =	6	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	2	points	$N_{ap,o}$ =	2	points
Total access points (both sides) with turn bay	N_{tb} =	2	points	N_{tb} =	2	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	37	%	p_{curb} =	37	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	V_m =	538	veh/h	V_m =	602	veh/h
Delay of through movement	d_t =	0	seconds	d_t =	0	seconds
V/C ratio of through movement	v/c_t =	0.00		v/c_t =	0.00	
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	-0.1	mi/h	f_{cs} =	-0.1	mi/h
Access density	D_a =	24.3	points/mi	D_a =	24.3	points/mi
Adjustment for access points	f_A =	-1.9	mi/h	f_A =	-1.9	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	37.7	mi/h	S_{f0} =	37.7	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	36.8	mi/h	S_f =	36.8	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	1.1	seconds	d_{ap} =	1.6	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	39.6	seconds	t_R =	40.3	seconds
Segment travel speed	$S_{T,seg}$ =	32.0	mi/h	$S_{T,seg}$ =	31.5	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	85	%	t_R =	83	%
	LOS =	**A**		**LOS =**	**A**	

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	Future Plus Project Conditions					
Roadway segment:	Kawaihae Road					
Upstream cross street:	Opelo Road					
Downstream cross street:	Lindsey Road					
Direction:	Eastbound					
Class	III - Moderately developed area					
Grade type	Level Terrain					
Peak hour:	AM Peak Hour : 10 am			PM Peak Hour : 4 pm		
Mean speed of sample (v>200 veh/h)		30	* mph		30	* mph
Total demand, analysis direction		610	veh/h		740	veh/h
Total demand, opposing		550	veh/h		500	veh/h
Total demand flow rate, both directions		1160	veh/h		1240	veh/h
PHF, analysis direction		0.86			0.90	
PHF, opposing direction		0.92			0.97	
Total demand flow rate, analysis direction		705	veh/h		818	veh/h
Total demand flow rate, opposing		599	veh/h		518	veh/h
Number of Trucks, analysis direction		53.95307			67.12144	
Passenger car equivalent for trucks	E_T =	1.1	pc/truck	E_T =	1.1	pc/truck
Number of RVs, analysis direction		136			160	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		0.99			0.99	
Number of Trucks, opposing direction		53			29	
Passenger car equivalent for trucks		1.1	pc/truck		1.2	pc/truck
Number of RVs, opposing direction		117			111	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.98	
Free Flow Speed		39	mph		40	mph
Adjusted demand flow rate, analysis direction		712	pc/h		825	pc/h
Adjusted demand flow rate, opposing direction		605	pc/h		524	pc/h
ATS Adjustment Factor for No-Passing Zones		1.8			2.1	
Average Travel Speed		27	mph		27	mph
Percent of Free Flow Speed		69.3%			68.4%	
LOS		D			D	

*Based on HCM 6 Exhibit 15-8, vehicle speeds were assumed to increase based on a decrease in vehicle conflicts due to the two-way left-turn lane. Based on 11 driveways on the left-hand side along this segment, the speed would be expected to increase by 6.7 mph. We conservatively assumed a 5 mph increase in average speed.

2-Lane Hwy LOS Calculation - HCM 6th Edition						
Scenario:	Future Plus Project Conditions					
Roadway segment:	Kawaihae Road					
Upstream cross street:	Opelo Road					
Downstream cross street:	Lindsey Road					
Direction:	Eastbound					
Class	III - Moderately developed area					
Grade type	Level Terrain					
Peak hour:	AM Peak Hour : 10 am			PM Peak Hour : 4 pm		
Mean speed of sample (v>200 veh/h)		30	* mph		30	* mph
Total demand, analysis direction		550	veh/h		500	veh/h
Total demand, opposing		610	veh/h		740	veh/h
Total demand flow rate, both directions		1160	veh/h		1240	veh/h
PHF, analysis direction		0.86			0.86	
PHF, opposing direction		0.92			0.92	
Total demand flow rate, analysis direction		636	veh/h		578	veh/h
Total demand flow rate, opposing		665	veh/h		806	veh/h
Number of Trucks, analysis direction		53			29	
Passenger car equivalent for trucks	E_T =	1.1	pc/truck	E_T =	1.2	pc/truck
Number of RVs, analysis direction		117			111	
Passenger car equivalent for RVs	E_R =	1	pc/RV	E_R =	1	pc/RV
Heavy Vehicle Adjustment Factor, analysis direction		1.00			1.00	
Number of Trucks, opposing direction		54			67	
Passenger car equivalent for trucks		1.1	pc/truck		1.1	pc/truck
Number of RVs, opposing direction		136			160	
Passenger car equivalent for RVs		1	pc/RV		1	pc/RV
Heavy Vehicle Adjustment Factor, opposing direction		0.99			0.99	
Heavy Vehicle Adjustment Factor, both directions		0.99			0.99	
Free Flow Speed		39	mph		40	mph
Adjusted demand flow rate, analysis direction		639	pc/h		581	pc/h
Adjusted demand flow rate, opposing direction		670	pc/h		814	pc/h
ATS Adjustment Factor for No-Passing Zones		1.6			1.2	
Average Travel Speed		27	mph		28	mph
Percent of Free Flow Speed		69.9%			69.7%	
LOS		D			D	

*Based on HCM 6 Exhibit 15-8, vehicle speeds were assumed to increase based on a decrease in vehicle conflicts due to the two-way left-turn lane. Based on 15 driveways on the left-hand side along this segment, the speed would be expected to increase by 9.1 mph. We conservatively assumed a 5 mph increase in average speed.

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Future Plus Project Conditions**					
Roadway segment:	**Mamalahoa Highway**					
Upstream cross street:	**Kaomoloa Road**					
Downstream cross street:	**Lindsey Road**					
Direction:	**Eastbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,770	feet	L =	1,770	feet
Width of upstream intersection	W_i =	30	feet	W_i =	30	feet
Upstream intersection control	Stop-Controlled			Stop-Controlled		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	2	points	$N_{ap,s}$ =	2	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	4	points	$N_{ap,o}$ =	4	points
Total access points (both sides) with turn bay	N_{tb} =	4	points	N_{tb} =	4	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	14	%	p_{curb} =	14	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	V_m =	634	veh/h	V_m =	612	veh/h
Delay of through movement	d_t =	36	seconds	d_t =	45	seconds
V/C ratio of through movement	v/c_t =	0.34		v/c_t =	0.51	
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	0.7	mi/h	f_{cs} =	0.7	mi/h
Access density	D_a =	18.2	points/mi	D_a =	18.2	points/mi
Adjustment for access points	f_A =	-1.4	mi/h	f_A =	-1.4	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	39.0	mi/h	S_{f0} =	39.0	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	37.8	mi/h	S_f =	37.8	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	0.5	seconds	d_{ap} =	0.5	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	36.6	seconds	t_R =	36.5	seconds
Segment travel speed	$S_{T,seg}$ =	16.6	mi/h	$S_{T,seg}$ =	14.8	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	43	%	t_R =	38	%
	LOS =	**D**		**LOS =**	**E**	

Urban Street Segment LOS Calculation - HCM 6th Edition						
Scenario:	**Future Plus Project Conditions**					
Roadway segment:	**Kawaihae Road**					
Upstream cross street:	**Lindsey Road**					
Downstream cross street:	**Kaomoloa Road**					
Direction:	**Westbound**					
Peak hour:	**AM Peak Hour**			**PM Peak Hour**		
Segment length	L =	1,860	feet	L =	1,860	feet
Width of upstream intersection	W_i =	120	feet	W_i =	120	feet
Upstream intersection control	Signalized			Signalized		
Posted speed limit	S_{pl} =	30	mi/h	S_{pl} =	30	mi/h
Through lanes	N_{th} =	1	lanes	N_{th} =	1	lanes
Right-side access points in subject direction of travel	$N_{ap,s}$ =	6	points	$N_{ap,s}$ =	6	points
Right-side access points in opposing direction of travel	$N_{ap,o}$ =	2	points	$N_{ap,o}$ =	2	points
Total access points (both sides) with turn bay	N_{tb} =	2	points	N_{tb} =	2	points
Link length with restrictive median	p_{rm} =	82	%	p_{rm} =	82	%
Link length with curb on right-hand side	p_{curb} =	47	%	p_{curb} =	47	%
Link length with on-street parking	p_{pk} =	0	%	p_{pk} =	0	%
Turning volume at access points		20	%		20	%
Midsegment demand flow rate	Vm =	538	veh/h	Vm =	602	veh/h
Delay of through movement	dt =	0	seconds	dt =	0	seconds
V/C ratio of through movement	v/ct =	0.00	0	v/ct =	0.00	0
Speed constant	S_0 =	39.7	mi/h	S_0 =	39.7	mi/h
Adjustment for cross section	f_{cs} =	-0.4	mi/h	f_{cs} =	-0.4	mi/h
Access density	D_a =	24.3	points/mi	D_a =	24.3	points/mi
Adjustment for access points	f_A =	-1.9	mi/h	f_A =	-1.9	mi/h
Adjustment for on-street parking	f_A =	0.0	mi/h	f_A =	0.0	mi/h
Base free-flow speed	S_{f0} =	37.4	mi/h	S_{f0} =	37.4	mi/h
Signal spacing adjustment factor	f_L =	1.0		f_L =	1.0	
Free-flow speed	S_f =	36.5	mi/h	S_f =	36.5	mi/h
Proximity adjustment factor	f_v =	1.0		f_v =	1.0	
Turning movement delay at access points	d_{ap} =	1.1	seconds	d_{ap} =	1.6	seconds
Other delay	d_{other}=	2.0	seconds	d_{other}=	2.0	seconds
Segment running time	t_R =	39.9	seconds	t_R =	40.6	seconds
Segment travel speed	$S_{T,seg}$ =	31.8	mi/h	$S_{T,seg}$ =	31.2	mi/h
Travel speed as a percentage of base free-flow speed	t_R =	85	%	t_R =	83	%
	LOS =	**A**		**LOS =**	**A**	

Appendix E: Detailed Travel Time Results

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Existing Conditions
AM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	2.8	2.3
Average Travel Speed (mph)	19.8	22.7
Average Delay per Vehicle (min)	1.0	0.6
Max Individual Vehicle Delay (min)	1.1	0.6

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	2.74	2.29
2.00	2.97	2.40
3.00	2.79	2.28
4.00	2.80	2.32

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	3.4	2.8
Average Travel Speed (mph)	16.5	18.6
Average Delay per Vehicle (min)	1.5	1.1
Max Individual Vehicle Delay (min)	1.7	1.2

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	3.19	2.74
2.00	3.38	2.63
3.00	3.49	2.96
4.00	3.57	2.99

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Existing Plus Project Conditions
AM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	2.8	2.6
Average Travel Speed (mph)	19.8	20.7
Average Delay per Vehicle (min)	1.0	0.8
Max Individual Vehicle Delay (min)	1.0	0.9

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	2.82	2.54
2.00	2.90	2.71
3.00	2.80	2.64
4.00	2.82	2.43

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Existing Plus Project Conditions
PM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	3.0	2.5
Average Travel Speed (mph)	18.5	21.3
Average Delay per Vehicle (min)	1.2	0.7
Max Individual Vehicle Delay (min)	1.3	0.8

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	2.99	2.51
2.00	2.99	2.54
3.00	3.12	2.52
4.00	3.01	2.50

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	3.7	2.8
Average Travel Speed (mph)	15.0	18.6
Average Delay per Vehicle (min)	1.9	1.1
Max Individual Vehicle Delay (min)	2.5	1.3

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	3.17	2.46
2.00	3.66	2.83
3.00	4.33	3.04
4.00	3.74	2.91

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Future Conditions
PM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	4.7	3.7
Average Travel Speed (mph)	12.0	13.9
Average Delay per Vehicle (min)	2.8	2.0
Max Individual Vehicle Delay (min)	3.0	2.1

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	4.25	3.66
2.00	4.77	3.75
3.00	4.90	3.84
4.00	4.85	3.58

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Future Plus Project Conditions
AM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	3.0	3.3
Average Travel Speed (mph)	18.5	16.2
Average Delay per Vehicle (min)	1.2	1.5
Max Individual Vehicle Delay (min)	1.3	1.9

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	2.94	2.86
2.00	3.22	3.44
3.00	2.98	3.67
4.00	2.96	3.17

Vissim Post-Processor
Average Results from 10 Runs
Travel Times

Waimea Roadway Improvements
Future Plus Project Conditions
PM Peak Hour

Corridor Performance Measurements		
Stats Summary	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
Average Travel Time (min)	4.1	3.2
Average Travel Speed (mph)	13.7	16.7
Average Delay per Vehicle (min)	2.2	1.4
Max Individual Vehicle Delay (min)	2.4	1.7

Corridor Travel Time by Time Interval Summary		
Time interval	Eastbound Kawaihae Road to Northbound Mamalahoa Highway	Southbound Mamalahoa Highway to Westbound Kawaihae Road
1.00	3.74	2.86
2.00	4.13	3.19
3.00	4.23	3.44
4.00	4.31	3.34

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APPENDIX C

Environmental Noise Assessment Report

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D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

970 N. Kalaheo Ave.
Suite A311
Kailua, HI 96734
www.dlaa.com
808.254.3318

Environmental Noise Assessment
Waimea Roadway Multi-modal Improvements Project
Waimea (Kamuela), Island of Hawaii, Hawaii

October 2020
Revision 1 – December 2020

Prepared by:
D.L. Adams Associates, Ltd.
970 N. Kalaheo Avenue, Suite A-311
Kailua, Hawaii 96734
DLAA Project No. 20-023

Prepared for:
SSFM International, Inc.
Hilo, Hawaii

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LIST OF ACRONYMS

C&D	Construction and Demolition
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
HDOH	Hawaii Department of Health
HDOT	Hawaii Department of Transportation
HUD	U.S. Department of Housing and Urban Development
ISO	International Standards Organization

APPENDICES

1.0 EXECUTIVE SUMMARY

1.1 The Hawaii Department of Transportation is proposing improvements to Kawaihae Road and Lindsey Road in Waimea (Kamuela) on the Island of Hawai'i. The improvements will be constructed in two phases. Phase 1 includes installation of a roundabout at the Kawaihae Road and Lindsey Road intersection and multi-modal treatments to Kawaihae Road between Lindsey Road and Opelo Road. The multi-modal changes to Kawaihae Road include the installation of a center turn lane, sidewalks and bikeways on both sides of the road, marked crosswalks with a rectangular rapid flash beacon at Opelo Road, and a gateway feature west of Opelo Road. Phase 2 includes improvements to the Mamalahoa Highway and Lindsey Road intersection, including installation of raised pedestrian islands with bollards, reconfigured lanes, and bicycle facilities, as well as optimized signal timing.

1.2 The project area along Kawaihae Road and Lindsey Road currently experiences relatively high ambient noise levels that are dynamic and depend significantly on the vehicular traffic patterns of Kawaihae Road and Lindsey Road. Long term noise measurements conducted along Kawaihae Road and Lindsey Road show that noise levels range from 62 to 68 dBA during peak traffic hours and 57 to 65 dBA at night.

1.3 The various construction phases of the project may generate significant amounts of noise that could impact the residences, businesses, houses of worship, schools and recreation areas located along the project corridor. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. The noise from construction activities should be relatively short term, occur only during daytime hours, and must comply with State Department of Health noise regulations.

1.4 A detour route is not planned to divert traffic away from the construction zone. However, during project construction, the area surrounding Kawaihae Road and Lindsey Road may experience heavier traffic due to the reduced speed and possible reduction in travel lanes. As a result, traffic noise (from vehicular traffic only, not including construction noise) is likely to decrease during the construction period. However, these changes will be short term and only during the construction period.

1.5 A moderate sound level increase at the Hawaii Preparatory Academy and Annunciation Catholic Church is expected as a result of the project compared to either the "existing" 2018 or 2036 "no-project" scenarios. The traffic noise increases correlate with the projected decrease in distance between the receivers and the nearest through lane. The noise level increment is approximately 6 dB, which would be considered noticeable, but not a substantial noise increase.

1.6 The change in traffic noise due to multi-modal alterations to Kawaihae Road and improvements to the Mamalahoa Highway and Lindsey Road intersection is predicted to be less than 3 dB at all other receptors. A change in sound level less than 3 dB is not considered to be significant.

1.7 Some noise receptors located alongside Kawaihae Road and Lindsey Road currently experience (or will experience in the future) traffic noise levels that exceed the Federal Highway Administration (FHWA) and Hawaii Department of Transportation (HDOT) noise abatement criteria. Some additional receptors will exceed the criteria due to the multi-modal improvements, while others will no longer exceed the criteria. Noise mitigation should be considered for these receptors.

1.8 Traffic volumes projected for 2018 result in traffic noise levels that were calculated to be different than the measured ambient noise levels in 2020. Ambient noise levels were measured while intra-Pacific travel restrictions were in place due to COVID-19, which may have resulted in reduced or different traffic volumes and vehicle classifications on the subject roadways. Noise levels were adjusted to reflect 2018 traffic volumes to reflect "typical" traffic conditions.

2.0 PROJECT DESCRIPTION

The Waimea Roadway Multi-modal Improvements project is located in Waimea (Kamuela) on the north side of the Big Island of Hawaii. The proposed project is approximately 0.5 miles from Opelo Road to Mamalahoa Highway along Kawaihae Road and Lindsey Road, and approximately 0.9 miles from Kaomoloa Road to Kamamalu Street along Mamalahoa Highway/Hawaii Belt Road. The area along the proposed project corridor is an urban area with mostly school, religious and commercial buildings situated on both sides of the roadway.

The project proposes to add a left turn, pedestrian and bicycle lane along Kawaihae Road which would result in through lanes located closer to receptors than in the existing condition. Additionally, a roundabout is proposed at the intersection of Lindsey Road and Kawaihae Road, along with intersection improvements at the intersection of Lindsey Road and Mamalahoa Highway.

Along Mamalahoa Highway, pedestrian and bicycle paths are proposed to replace the existing shoulder, along with alterations to the turning lane alignments. Through lane alterations to Mamalahoa Highway would not result in a significant reduction in distance to sensitive receptors, nor would they result in the addition of new through or auxiliary lanes, and therefore would not be considered a Type 1 project according to the Highway Noise Policy and Abatement Guidelines. Noise impacts are not assessed along the Mamalahoa Highway portion of the project.

During construction, continual traffic will be permitted along the roadways throughout the project and a detour route is not planned. However, traffic speed will likely be reduced through the construction area.

3.0 NOISE GUIDELINES, STANDARDS, AND REGULATIONS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most *moving* sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to construction activities, which may not be stationary.

The maximum permissible noise levels are enforced by the State Department of Health (HDOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the HDOH.

3.2 U.S. Federal Highway Administration (FHWA)

The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq(h)}$, for traffic noise exposure [Reference 2], which are listed in Figure 2. For example, Category C, which includes auditoriums, day care centers, hospitals, places of worship, public meeting rooms, public or nonprofit institutional structures, and schools, has a corresponding maximum exterior L_{eq} of 67dBA and a maximum interior L_{eq} of 52 dBA. In this study, most land can be considered to fall into land use category B or C. These limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards. Calculation of traffic noise levels should be conducted using a Federal Highway Administration traffic noise model [Reference 3].

3.3 Hawaii Department of Transportation (HDOT)

The HDOT has adopted FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 4]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dB. The Hawai'i State DOT Highway Noise Policy only applies to FHWA Type 1 projects, and does not apply to Type 2 or 3 projects.

3.4 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 5]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment within the project corridor. The first noise measurement type consisted of continuous long-term ambient noise level measurements (Locations L1, L2 and L3). The second type of noise measurement was short-term (Spots S1, S2 and S3). The methodology, location, and results for each of the measurements are described below and the measurement locations are illustrated in Figure 3.

4.1 Long Term Noise Measurements

4.1.1 Long-Term Noise Measurement Procedure

The ambient noise levels were measured between July 31, 2020 to August 4, 2020. Continuous, hourly averaged sound levels were recorded for 96 hours at each location. The measurements were taken using Larson-Davis Laboratories, Model 831, Type 1 Sound Level Meters with Model 377B20 1/2" microphones. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. The sound level meters and the calibrator have been certified by the manufacturer within the recommended calibration period. The microphones were mounted, approximately 5.5 feet above grade. Windscreens covered the microphones during the entire measurement period. The sound level meters were secured in a weather resistant case.

4.1.2 Long-Term Noise Measurement Locations

Private Residence - 65-1219 Opelo Road (L1): The meter was located on the south-western side of the intersection of Kawaihae Road with Opelo Road on the property line of 65-1219 Opelo Road, approximately 30 feet south of the centerline of the road.

Hawaii Preparatory Academy (L2): The meter was located on the northern side of Kawaihae Road within the property line of Hawaii Preparatory Academy, approximately 30 feet north of the centerline of the road.

Parker School (L3): The meter was located on the eastern side of intersection of Kawaihae Road and Lindsey Road within the property line of The Parker School, approximately 50 feet east of the centerline of the road.

4.1.3 Long-Term Noise Measurement Results

The results from these long-term sound measurements are graphically presented in Figures 4 through 6, which show the measured hourly equivalent sound level, L_{eq}, and the 90 percent exceedance level, L_{90}, in A-weighted decibels (dBA) as a function of the measurement date and time. The L_{eq} during the day (7:00 AM to 10:00 PM) and during the night (10:00 PM to 7:00 AM) and average calculated day-night level, L_{dn}, are summarized for each location in **Table 1** below.

Table 1. Summary of Long-Term Noise Measurement Results (dBA)

Measurement Location	Average Daytime Leq	Average Nighttime Leq	Average L_{dn}
L1	68	62	70
L2	68	65	72
L3	62	57	64

The ambient sound levels at all locations are relatively dynamic and depend significantly on the vehicular traffic patterns of Kawaihae Road and Lindsey Road. The dominant noise source for all locations is vehicular traffic noise along Kawaihae Road and Lindsey Road. Secondary noise sources include birds, wind, and occasional aircraft flyovers.

4.2 Short Term Noise Measurements

4.2.1 Short-Term Noise Measurement Procedure

Approximate 1-hour equivalent sound level, L_{eq}, measurements occurred in the vicinity of Locations L1, L2 and L3 at spots S1, S2 and S3. At each spot location, ambient noise levels, vehicular traffic counts and traffic mix were documented during peak AM and PM traffic hours. The noise measurements were taken using a Larson-Davis Laboratories, Model 831, Type-1 Sound Level Meter together with a Larson-Davis, Model 377B20 Type-1 1/2" Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. The sound level meters and calibrator have been certified by the manufacturer within the recommended calibration period. The microphone and sound level meter were mounted on a tripod, approximately 5 feet above grade. A windscreen covered the microphone during the entire measurement period.

The measurements were conducted during the peak AM and PM traffic hour and were used to validate the traffic noise model prediction software (as discussed in Section 6.2.1 below).

4.2.2 Short-Term Noise Measurement Locations

Private Residence - 65-1218 Opelo Road (S1): The meter was located on the east side of Opelo Road on the property line of 65-1218 Opelo Road, approximately 250 feet south of the centerline of Kawaihae Road.

Waimea Community Center (S2): The meter was located on the northern side of Kawaihae Road within the Waimea Community Park near the Tee-ball field behind Waimea Community Center, approximately 250 feet north of the centerline of the road.

Intersection Mamalahoa Highway and Lindsey Road (S3): The meter was located on the northwest side of the intersection of Mamalahoa Highway and Lindsey Road, approximately 20 feet from the centerline of Lindsey road.

4.2.3 Short-Term Noise Measurement Results

The results from these short-term sound measurements are presented in **Table 2**, which shows the measured hourly equivalent sound level, L_{eq}, in A-weighted decibels (dBA) as a function of the measurement date and time.

Table 2. Summary of Short Term Noise Measurement Results (dBA)

Measurement Location	AM Leq (10:00 AM)	PM Leq (3:00 PM)
S1	54	56
S2	54	56
S3	73	71

The dominant noise source at Spot S1 was vehicular traffic on Opelo Road and Kawaihae Road with secondary noise sources including birds and occasional aircraft flyovers. The dominant noise source at Spot S2 is vehicular traffic on Kawaihae Road with secondary noise sources including recreational activity in Waimea Community Park and occasional aircraft flyovers. The dominant noise source at Spot S3 is vehicular traffic along Lindsey Road and Mamalahoa Highway. Any secondary sources at Spot S3 were imperceptible above vehicular traffic noise.

5.0 POTENTIAL NOISE IMPACTS

5.1 Project Construction Noise

The study area along Kawaihae Road is zoned primarily as a village commercial district, which includes multi-family rental residential, commercial, hotel, school and house of worship uses, as well as some areas designation for active and passive recreation. Land uses along Lindsey Road and Mamalahoa Highway within the study area include commercial and school uses. The Hawaii Community Noise Control Rules state that the primary land use designation shall be used to determine the applicable zoning district class. Maximum permissible noise levels are specified by the State rules for daytime and nighttime hours, but ambient noise levels are also taken into account. Construction noise levels are expected to exceed the daytime limits and a permit must be obtained from the State HDOH to allow the operation of construction equipment.

Much of the project area can be considered noise sensitive as schools, houses of worship, parks and businesses along Kawaihae Road, Lindsey Road and Mamalahoa Highway may be impacted by the project construction noise due to their proximity to the project. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Noise emissions for anticipated construction equipment are shown in **Table 3**.

Table 3. General Construction Equipment Noise Emissions

Expected Equipment	Acoustical Use Factor (%)[N1]	L_{max} at 50 feet (dBA, slow) [N2]	Impact Device[N3]
Excavators	40	85	
Backhoe	40	80	
Hoe Ram	20	90	Yes
Loader	40	80	
Generators	50	82	
Air Compressor	40	80	
Dump Trucks	40	84	
Vacuum Excavator	40	85	
Water Truck	40	84	
Pickup Trucks	40	55	
Concrete Saw Cutter	20	90	
Concrete Mixer	40	85	
Paver	50	85	
Cold Planer	40	85	
Shuttlebuggy	50	85	
Rubber Tire Roller	20	85	
Steel Drum Roller	20	85	
Steel Drum Roller w/vibration	20	90	
Saw	50	85	
K/P Broom Street Sweeper	10	80	
Grader	40	85	
Jackhammer	20	85	Yes
Core Drilling Machine	20	84	
Dozer	40	85	

Notes:

N1. The acoustical usage factor is an estimate of the fraction of time each piece of construction equipment is operating at full power (i.e., the equipment will be operating in its loudest condition). The usage factors value is based on the Federal Highway Administration Roadway Construction Noise Model (RCNM) [Reference 6] database.

N2. The A-weighted maximum sound level (L_{max}) values are based on the RCNM construction equipment noise database.

N3. Impact equipment is equipment that generates an impulsive noise produced by the periodic impact of a mass on a surface which is of short duration and high intensity, characterized by abrupt onset and rapid decay, and often rapidly changing spectral composition.

The improvements are expected to involve demolition, excavation for deep drywells, utility adjustment, installation of new concrete sidewalks, curbs and gutters, and repaving activities. Demolition and excavation activities involving hoe rams, excavators, concrete saws, drills and jackhammers will likely be the loudest construction activity, with concrete sidewalk installation and paving operations loudest during the remainder of construction.

Due to the proximity of construction activities to neighboring property lines, exceedances of HDOT property line limits are expected. Noise mitigation during construction is discussed below.

5.2 Compliance with FHWA/HDOT Noise Guidelines

5.2.1 Traffic Noise Model Overview

As required by the Federal Highway Administration, traffic noise levels were calculated using the FHWA's Traffic Noise Model [Reference 7]. The existing road conditions were modeled for peak hour AM (10:00 AM) and PM (4:00 PM) traffic and a vehicular traffic noise analysis was completed at 41 noise receiver locations. Noise projections were calculated for the same receiver locations during the peak hour AM and PM traffic for the "2018 With Project", "2036 No Project" and "2036 With Project" analysis scenarios. For the “With Project” noise impact analyses, the roadway alignment provided in Appendix C was the basis for the traffic noise model.

The traffic noise analysis is also based on the peak hour AM and PM traffic volumes provided by the Traffic Consultant [Reference 8]. The short term noise level measurements and traffic counts were used to validate the traffic noise model prediction software. Vehicular traffic was modeled under free flow conditions at a speed of 30 miles per hour, consistent with local speed limits. The terrain surrounding the project corridor was assumed to be soft (i.e., acoustically absorptive) and flat (i.e., no change in elevation). Sound levels predicted at the receiver locations have been calculated at approximately 12 feet above grade. This height represents a worst-case scenario of a listener on a second story lanai or near an open window with line of sight to through lane centerlines in both directions. In almost all cases, predicted sound levels at 5 feet would be equal to or slightly less than noise levels at 12 feet. Per HDOT requirements, where properties include both exterior spaces and residences, receptors were modeled to represent sound levels in the exterior space rather than along the building façade.

Noise levels were assessed at receptors within a 500-foot study area centered on the Kawaihae Road and Lindsey Road centerlines, per HDOT requirements.

5.2.2 Vehicular Traffic Noise Projection

A comparison of projected future peak hour traffic noise levels with and without the roadway improvements is presented in **Table 4**.

Noise levels with 2036 traffic volumes without the project result in a sound level increase of 0 dB to 1 dB over noise levels from 2018 traffic volumes without the project. The increase in noise is imperceptible, and correlates to the increases in traffic volume.

In both 2018 and 2036, the proposed roadway changes result in both decreased noise levels and increased noise levels, depending on proximity to new lane centerlines. In general, receptors west of Opelo Road aligned with center mediums will experience a decrease in noise level as a result of the proposed actions, receptors along Kawaihae Road between Opelo Road and Lindsey Road and adjacent to the roundabout at the intersection of Kawaihae and Lindsey Road will experience an increase in noise levels, depending on line of sight, shielding and distance from the traffic lanes.

At residential and commercial receptors along Kawaihae Road to the intersection with Opelo Road, noise levels with the proposed project are predicted to result in a sound level decrease ranging from 0 to 6 dB compared to noise levels without the project. The decrease in noise level correlates to increased distance between the receptors and the farthest traffic lane, as well as the traffic center median. Changes in noise level of this magnitude would be perceived as imperceptible to readily noticeable.

At the Hawaii Preparatory Academy, noise levels with the proposed project are predicted to result in a sound level increase ranging from 2 to 6 dB compared to noise levels without the project. The increase in noise level correlates to decreased distance between the receptors and the nearest traffic lane, as well as the addition of the center left turn lane. At all other receptors along Kawaihae Road between Opelo Road and the intersection with Lindsey Road, noise levels with the proposed project are predicted to result in a sound level decrease ranging from 0 to 6 dB compared to noise levels without the project. The decrease in noise level correlates to increased distance to the farthest travel lane. Changes in noise level of this magnitude would be perceived as imperceptible to readily noticeable. Increases at Hawaii Preparatory Academy despite decreases at other receptors along the same roadway can be attributed to the reflections from the school itself as well as from neighboring properties across Kawaihae Road. The reflections serve to focus and amplify the changes due to reduced distance to the nearest traveling lane and the addition of the center left turn lane.

At the Parker School and other receptors east of the proposed roundabout, noise levels with the proposed project are predicted to result in a sound level decrease ranging from 1 to 3 dB compared to noise levels without the project. The decrease in noise level correlates to the increased distance to the lane of traffic traversing from Kawaihae Road to Lindsey Road, i.e., the south side of the proposed roundabout. Changes in noise level of this magnitude would be perceived as imperceptible. Conversely, at the Annunciation Catholic Church noise levels with the proposed project are predicted to result in a sound level increase of approximately 4 to 5 dB compared to noise levels without the project. The increase in noise level correlates to the decreased distance between the receptor and the south side of the roundabout. Changes in noise level of this magnitude would be perceived as just noticeable.

At receptors adjacent to the intersection of Lindsey Road and Mamalahoa Highway, noise levels with the proposed project are predicted to result in a sound level change of 0 to 2 dB compared to noise levels without the project. This change in noise level would be considered imperceptible.

Projected noise level predictions assume vehicle class mix remain consistent with existing conditions. The only changes to traffic conditions are assumed to be due to roadway configurations. In general, the project involves adjusting the locations of the center line of traffic, either increasing or decreasing the distance between receivers and the centerline of nearest through lane.

Some receptors, particularly those along Kawaihae Road that will experience a decreased distance to through lane centerlines are expected to experience an increase in noise levels ranging from approximately 1 to 6 dBA above existing conditions, while others are calculated to experience a decrease of up to approximately 6 dBA. Increases of 6 dBA are less than the threshold for substantial noise increase of 15 dBA defined in the Highway Noise Policy and Abatement Guidelines.

The FHWA has a design goal of 67 dBA or less for Land Use Category B (residences, churches, schools, etc.) and 72 dBA for Land Use Category C (agricultural and commercial areas, etc.) According to HDOT's Noise Analysis and Abatement Policy, when traffic noise levels "approach" the FHWA design goal, i.e., within one decibel, traffic noise impact will occur and noise abatement measures must be considered.

Table 5 shows that for existing 2018 traffic volumes, of the 41 noise receiver locations, ten (10) receivers are calculated to approach or exceed the FHWA/HDOT exterior noise abatement criteria (NAC) under the existing roadway alignment. Four (4) of these existing buildings can be classified as Land Use Category D, are expected to have an interior noise level within the NAC for interior environments and exterior activities, if any, are not expected to be affected by the traffic noise. With the project, two (2) additional receivers will approach or exceed the NAC, and five (5) receivers will no longer approach or exceed the NAC with the roadway improvements project.

For projected 2036 traffic volumes, of the 41 noise receiver locations, nine (9) receivers are calculated to approach or exceed the FHWA/HDOT exterior noise abatement criteria (NAC) under the existing roadway alignment. Four (4) of these existing buildings can be classified as Land Use Category D, are expected to have an interior noise level within the NAC for interior environments and exterior activities, if any, are not expected to be affected by the traffic noise. With the project, two (2) additional receivers will approach or exceed the NAC, and three (3) receivers will no longer approach or exceed the NAC with the roadway improvements project.

A detour route is not planned to divert traffic away from the construction zone. However, residences in the area surrounding Keaau-Pahoa Road may experience heavier traffic due to the reduced speed and possible reduction in travel lanes. As a result, vehicular traffic noise (which does not include construction noise) is likely to decrease during the construction period. However, these changes will be short term and only during the construction period.

Noise Impact Summary

The increase in noise level resulting from the proposed action is expected to be noticeable at the Hawaii Preparatory Academy and the Annunciation Catholic Church. Noise levels at the Hawaii Preparatory Academy school building already exceed the FHWA's design goal of 67 dBA for exterior noise, therefore increases due to the project would not result in new impacts at classroom spaces. Noise levels at the Hawaii Preparatory Academy recreation field, west of the school building, would increase to above the NAC as a result of the proposed action. Existing exterior noise levels at the Annunciation Catholic Church do not approach the FHWA's 67 dBA threshold, therefore the project would produce an exterior noise impact at this receptor. Both the Hawaii Preparatory Academy and the Annunciation Catholic Church could be classified as Land Use Category D, and are primarily used for interior activities. Based on an assumed 25 dB reduction for closed window attenuation [Reference 9], interior noise levels are below the FHWA's interior noise level goal of 52 dBA. The Hawaii Preparatory Academy recreational field appears to be primarily used for athletic events, and does not appear to require serenity and quiet. Furthermore, the increase in noise level due to the roadway improvements at any receptor is less than 15 dB and complies with HDOT's traffic noise policy. Therefore, while exterior noise levels will exceed the NAC for exterior noise at some receptors, the project itself is not expected to result in any new impacts.

5.3 Compliance with EPA Noise Guidelines

The EPA has an existing design goal of Ldn $\leq$ 65 dBA and a future design goal Ldn $\leq$ 55 dBA for exterior noise levels. In the future, increased traffic noise will contribute to the overall ambient noise level. Although some of the residences currently experience noise levels that exceed the EPA guidelines, the expected increase in L_{dn} due to the proposed actions are expected to be less than 3 dB. It is important to note that the EPA noise guidelines are design goals and not enforceable regulations. However, these guidelines and design goals are useful tools for assessing the noise environment.

6.0 NOISE IMPACT MITIGATION

6.1 Mitigation of Construction Noise

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the HDOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for the HDOH to issue a construction noise permit, the Contractor must submit a noise permit application to the HDOH, which describes the construction activities for the project. Prior to issuing the noise permit, the HDOH may require action by the Contractor to incorporate noise mitigation into the construction plan. The HDOH may also require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the HDOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 a.m. and after 6:00 p.m. on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of hoe rams and jack hammers 25 lbs. or larger, high pressure sprayers, chain saws, and pile drivers are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers [Reference 1].

The HDOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the HDOH permit are followed.

6.2 Mitigation of Vehicular Traffic Noise

As discussed above, traffic noise levels along Kawaihae Road and Lindsey Road already approach or exceed FHWA/HDOT's noise abatement criteria at approximately 25% of the properties listed in **Table 4**. Thus, the noise receptors adjacent to the roadway are experiencing a traffic noise impact even before proposed changes to through lane alignment and roundabout are constructed. Although the proposed changes do not substantially increase future traffic noise levels over the no-action condition noise levels, a traffic noise impact still occurs since the traffic noise levels exceed the FHWA criteria [Reference 10]. Therefore, noise abatement measures must be considered.

Abatement consideration should weigh the abatement benefits, costs, and overall social, economic, and environmental effects. The FHWA considers a 5 dB reduction in noise level to be significant. Per FHWA/HDOT's standards, mitigation measures need to be economically reasonable and feasible (i.e., acceptable to the affected receptors). Possible mitigation measures, listed in order of effectiveness, include:

a. Air-conditioning or forced ventilation for those impacted receptors along Kawaihae Road. At impacted homes, jalousie windows should be replaced with standard storm windows with acoustical gaskets. Typical exterior-to-interior noise reduction for naturally ventilated homes, i.e., with open windows, is only 9 dB. Noise reduction for air-conditioned homes with the windows closed is significantly higher.

b. Construction of noise barriers (that incorporate landscaping for aesthetic purposes) whether within or outside the roadway right-of-way. Factors such as distances to roadways and setbacks, intervening ground conditions, barrier construction, barrier height, roadway elevations, receiver height, etc., will determine the noise reduction afforded by a traffic noise barrier. Typically, a sound level reduction of at least 5 dB can be expected where a noise barrier just breaks the line-of-sight from the receiver to the roadway. However, many these receptors have driveways off of Kawaihae Road which would necessitate a break or gap in the noise barrier wall. The reduction in traffic noise levels will be less significant for the areas of the project corridor where gaps in the noise barrier wall would be common. In the case of multiple story or elevated structures, it is not likely that the 5 dB reduction would be achieved without using excessively high walls.

c. Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise.

d. Traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive land designations).

Specific receptors requiring mitigation are shown in **Table 5** and discussed below along with acoustical parameters to aid in evaluation Feasibility and Reasonableness.

6.2.1 Traffic Noise Impact Mitigation Without Project and 2018 "Existing" Traffic Volumes

Noise impacts were identified at ten (10) receptors based on existing roadway alignment and "existing" 2018 traffic volumes.

Four (4) receptors could be classified as NAC Activity Category D. With the assumed 25 dB façade noise level reduction from aluminum single hung windows, interior noise levels are predicted to be less than the 52 dBA L_{eq} interior noise level criteria. Therefore, additional noise mitigation is not required for these receptors.

Six (6) receptors, with addresses of 65-1305, 65-1317, 65-1319, 65-1323 and 65-1325 Kawaihae Road and 65-1219 Opelo Road are classified as NAC Activity Category B. Existing noise levels either approach or match the 67 dBA L_{eq} criteria. Mitigation should provide minimum 1 to 2 dBA attenuation in order to reduce noise levels to below the criteria. Since these receptors include outdoor areas for recreation, only noise barriers would be an appropriate mitigation option. Noise barriers must obtain at least 5 dBA noise reduction for impacted receptors to be considered feasible, and must provide a noise reduction design goal of 7 dB(A) for 75% of the benefiting front-row receptors to be considered reasonable. A 10 feet tall noise barrier along the property lines adjacent to Kawaihae Road would be expected to reduce noise levels by only approximately 1 to 4 dBA. Noise barriers would not provide sufficient noise level reduction to be considered reasonable and feasible, due to barrier interruptions at driveways.

6.2.2 Traffic Noise Impact Mitigation With Action and 2018 "Existing" Traffic Volumes

Noise impacts were identified at seven (7) receptors with implementation of the project roadway modifications using "existing" 2018 traffic volumes.

Five (5) receptors could be classified as NAC Activity Category D. With the assumed 25 dB façade noise level reduction from aluminum single hung windows, interior noise levels are predicted to be less than the 52 dBA L_{eq} interior noise level criteria. Therefore, additional noise mitigation is not required for these receptors.

One (1) receptor, the Hawaii Preparatory Academy Athletic Field, is considered NAC Activity Category C. With the project under existing traffic conditions, noise levels at the field would approach the abatement criteria threshold of 67 dBA L_{eq}. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels at the field by less than 2 dBA. The noise barrier would provide the required noise reduction to achieve noise levels below the NAC but would not achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

One (1) receptor, with an address of 65-1325 Kawaihae Road, is classified as NAC Activity Category B. With the project under existing traffic conditions, noise levels at this receptor would approach the abatement criteria threshold of 67 dBA L_{eq}. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels by 3 dBA. The noise barrier would provide the required noise reduction to achieve noise levels below the NAC but would not achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

6.2.3 Traffic Noise Impact Mitigation Without Project 2036 Projected Traffic Volumes

Noise impacts were identified at nine (9) receptors in 2036 without implementation of the project roadway modifications.

Four (4) receptors could be classified as NAC Activity Category D. With the assumed 25 dB façade noise level reduction from aluminum single hung windows, interior noise levels are predicted to be less than the 52 dBA L_{eq} interior noise level criteria. Therefore, additional noise mitigation is not required for these receptors.

Five (5) receptors, with addresses of 65-1317, 65-1319, 65-1323 and 65-1325 Kawaihae Road and 65-1219 Opelo Road, are classified as NAC Activity Category B. Without the project under 2036 projected traffic conditions, noise levels at these receptors would either approach or match the abatement criteria threshold of 67 dBA L_{eq}. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels by 1 to 4 dBA. The noise barrier would provide the required noise reduction to achieve noise levels below the NAC but would not achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

6.2.4 Traffic Noise Impact Mitigation With Action and 2036 Projected Traffic Volumes

Noise impacts were identified at eight (8) receptors with implementation of the project roadway modifications using 2036 projected traffic volumes.

Five (5) receptors could be classified as NAC Activity Category D. With the assumed 25 dB façade noise level reduction from aluminum single hung windows, interior noise levels at four of these receptors are predicted to be less than the 52 dBA L_{eq} interior noise level criteria. Therefore, additional noise mitigation is not required for these receptors. At the Hawaii Preparatory Academy, noise levels would approach the 52 dBA L_{eq} interior noise level criteria. This building already has air conditioning allowing for maintenance of a closed window condition, and appears to include insulated windows. Therefore a noise barrier along the property line would be the only available mitigation measure. The noise barrier would need to break line of site from the 2nd floor windows to the roadway. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels at the school by less than 1 dBA and would not provide the required noise reduction to achieve noise levels below the NAC, nor to achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

One (1) receptor, the Hawaii Preparatory Academy Athletic Field, is considered NAC Activity Category C. With the project under 2036 traffic conditions, noise levels at the field would reach the abatement criteria threshold of 67 dBA L_{eq}. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels at the field by 2 dBA. The noise barrier would provide the required noise reduction to achieve noise levels below the NAC but would not achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

Two (2) receptors, with addresses of 65-1319 and 65-1323 Kawaihae Road, are classified as NAC Activity Category B. With the project under 2036 traffic conditions, noise levels at this receptor would approach the abatement criteria threshold of 67 dBA L_{eq}. A 10 feet tall noise barrier along the property line adjacent to Kawaihae Road would be expected to reduce noise levels by less than 1 dBA. The noise barrier would not provide the required noise reduction to achieve noise levels below the NAC nor would it achieve the Feasibility and Reasonableness criteria according to the 2016 HDOT Highway Noise Policy.

6.2.5 Traffic Noise Impact Mitigation Summary

While noise level impacts were identified with and without the project in 2018 and 2036, available noise mitigation measures, e.g., noise barriers, are not expected to achieve the acoustical criteria to be considered reasonable and feasible. However, the roadway realignment (i.e., the project) does result in reduced impacts at some receptors.

REFERENCES

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.

2. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 47 FR 29654, July 8, 1982.

3. *Federal Highway Administration's Traffic Noise Model*, FHWA-RD-77-108; U.S. Department of Transportation, December 1978.

4. *Noise Analysis and Abatement Policy*, Department of Transportation, Highways Division, State of Hawaii, June 1997.

5. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

6. *Federal Highway Administration's Roadway Construction Noise Model*, FHWA-HEP-05-054, U.S. Department of Transportation, February 2006.

7. *Federal Highway Administrations Traffic Noise Model*, Version 3.0, U.S. Department of Transportation, February 2020.

8. *Waimea Roadway Improvement Project, Traffic Impact Analysis Report*, Fehr & Peers, 2020.

9. *HUD Noise Guidebook*, U.S. Department of Housing and Urban Development, March 2009.

10. *Highway Traffic Noise Analysis and Abatement Policy and Guidance*, U.S. Department of Transportation, Federal Highways Administration, June 1995.

TABLE 4
Predicted Traffic Noise Levels and Resulting Increases Due to the Project[1]

Noise levels shown in the table were calculated by the Traffic Noise Model.

Location: TMK	Distance to Road[2] (ft)	Existing 2018[3] (dBA)		2018 With Project (dBA)		2018 Increase With Project (dB)		2036 No Project (dBA)		2036 With Project (dBA)		2036 Increase Without Project (dB)		2036 Increase With Project (dB)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
6-5-02-159	57	63.2	63.0	61.6	61.7	-1.6	-1.3	63.1	63.3	61.2	62.2	-0.1	0.3	-1.9	-1.1
6-5-02-158	58	64.4	64.2	63.1	62.2	-1.3	-2.0	64.3	64.5	62.5	63.5	-0.1	0.3	-1.8	-1.0
6-5-02-157	153	56.2	56.1	55.3	55.5	-0.9	-0.6	56.2	56.4	55.2	55.9	0.0	0.3	-1.0	-0.5
6-5-02-43	81	62.3	62.2	61.2	61.5	-1.1	-0.7	62.3	62.5	60.8	61.7	0.0	0.3	-1.5	-0.8
6-5-02-177 (Commercial)	81	62.7	62.6	60.8	61.1	-1.9	-1.5	62.7	62.9	61.0	61.9	0.0	0.3	-1.7	-1.0
6-5-02-177 (Restaurant)	156	58.7	58.8	55.8	56.2	-2.9	-2.6	58.8	59.2	56.1	56.9	0.1	0.4	-2.7	-2.3
6-5-07-54	398	49.3	49.2	48.8	48.2	-0.5	-1.0	49.3	49.5	50.3	49.5	0.0	0.3	1.0	0.0
6-5-07-53 (Sports Field)	90	63.5	63.2	66.0	65.2	2.5	2.0	63.4	63.5	66.9	66.6	-0.1	0.3	3.5	3.1
6-5-07-53 (School)	50	69.9	69.7	75.2	74.5	5.3	4.8	69.9	70.0	76.0	75.3	0.0	0.3	6.1	5.3
6-5-07-3	57	70.4	70.1	69.5	70.2	-0.9	0.1	70.4	70.5	70.0	70.6	0.0	0.4	-0.4	0.1
6-5-07-2 (Community Center)	140	64.6	64.4	61.2	61.1	-3.4	-3.3	64.6	64.7	61.4	62.2	0.0	0.3	-3.2	-2.5
6-5-07-2 (Park)	122	62.2	62.2	59.5	59.4	-2.7	-2.8	62.3	62.6	60.4	60.7	0.1	0.4	-1.9	-1.9
6-5-05-19	61	62.3	61.4	61.1	59.5	-1.2	-1.9	62.8	61.8	60.8	60.6	0.5	0.4	-2.0	-1.2
6-5-05-21	75	65.5	64.7	63.4	63.6	-2.1	-1.1	66.0	65.2	63.3	64.2	0.5	0.5	-2.7	-1.0
6-5-05-9	172	57.6	56.9	56.4	55.8	-1.2	-1.1	58.1	57.5	56.6	57.5	0.5	0.6	-1.5	0.0
6-7-02-27	61	62.5	63.6	66.7	68.1	4.2	4.5	63.1	64.3	67.2	69.3	0.6	0.7	4.1	5.0
6-5-09-37	68	62.9	62.8	61.6	62.1	-1.3	-0.7	62.9	63.1	61.3	62.7	0.0	0.3	-1.6	-0.4
6-5-09-36	41	65.9	65.8	65.6	65.1	-0.3	-0.7	65.9	66.1	64.3	65.7	0.0	0.3	-1.6	-0.4
6-5-09-88	38	66.4	66.4	65.4	65.0	-1.0	-1.4	66.4	66.7	64.7	66.0	0.0	0.3	-1.7	-0.7
6-5-09-34	34	67.0	67.0	65.1	65.7	-1.9	-1.3	67.0	67.3	64.7	66.1	0.0	0.3	-2.3	-1.2
6-5-09-33	43	66.6	66.6	65.1	64.6	-1.5	-2.0	66.6	66.9	64.1	65.5	0.0	0.3	-2.5	-1.4
6-5-09-32	68	65.9	66.1	62.0	62.8	-3.9	-3.3	66.1	66.5	61.8	63.1	0.2	0.4	-4.3	-3.4
6-5-03-28	46	66.6	67.0	60.9	61.7	-5.7	-5.3	66.9	67.4	60.9	62.2	0.3	0.4	-6.0	-5.2

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Kawaihae Road and Lindsey Road alignment.
[3] The 2018 traffic noise levels are calculated values based on predictions from the Traffic Noise Model in combination with noise measurements conducted while COVID-19 travel restrictions were in place in 2020.

TABLE 4
Predicted Traffic Noise Levels and Resulting Increases Due to the Project[1]

Noise levels shown in the table were calculated by the Traffic Noise Model.

Location: TMK	Distance to Road[2] (ft)	Existing 2018[3] (dBA)		2018 With Project (dBA)		2018 Increase With Project (dB)		2036 No Project (dBA)		2036 With Project (dBA)		2036 Increase Without Project (dB)		2036 Increase With Project (dB)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
6-5-02-159	57	63.2	63.0	61.6	61.7	-1.6	-1.3	63.1	63.3	61.2	62.2	-0.1	0.3	-1.9	-1.1
6-5-02-158	58	64.4	64.2	63.1	62.2	-1.3	-2.0	64.3	64.5	62.5	63.5	-0.1	0.3	-1.8	-1.0
6-5-02-157	153	56.2	56.1	55.3	55.5	-0.9	-0.6	56.2	56.4	55.2	55.9	0.0	0.3	-1.0	-0.5
6-5-02-43	81	62.3	62.2	61.2	61.5	-1.1	-0.7	62.3	62.5	60.8	61.7	0.0	0.3	-1.5	-0.8
6-5-02-177 (Commercial)	81	62.7	62.6	60.8	61.1	-1.9	-1.5	62.7	62.9	61.0	61.9	0.0	0.3	-1.7	-1.0
6-5-02-177 (Restaurant)	156	58.7	58.8	55.8	56.2	-2.9	-2.6	58.8	59.2	56.1	56.9	0.1	0.4	-2.7	-2.3
6-5-07-54	398	49.3	49.2	48.8	48.2	-0.5	-1.0	49.3	49.5	50.3	49.5	0.0	0.3	1.0	0.0
6-5-07-53 (Sports Field)	90	63.5	63.2	66.0	65.2	2.5	2.0	63.4	63.5	66.9	66.6	-0.1	0.3	3.5	3.1
6-5-07-53 (School)	50	69.9	69.7	75.2	74.5	5.3	4.8	69.9	70.0	76.0	75.3	0.0	0.3	6.1	5.3
6-5-07-3	57	70.4	70.1	69.5	70.2	-0.9	0.1	70.4	70.5	70.0	70.6	0.0	0.4	-0.4	0.1
6-5-07-2 (Community Center)	140	64.6	64.4	61.2	61.1	-3.4	-3.3	64.6	64.7	61.4	62.2	0.0	0.3	-3.2	-2.5
6-5-07-2 (Park)	122	62.2	62.2	59.5	59.4	-2.7	-2.8	62.3	62.6	60.4	60.7	0.1	0.4	-1.9	-1.9
6-5-05-19	61	62.3	61.4	61.1	59.5	-1.2	-1.9	62.8	61.8	60.8	60.6	0.5	0.4	-2.0	-1.2
6-5-05-21	75	65.5	64.7	63.4	63.6	-2.1	-1.1	66.0	65.2	63.3	64.2	0.5	0.5	-2.7	-1.0
6-5-05-9	172	57.6	56.9	56.4	55.8	-1.2	-1.1	58.1	57.5	56.6	57.5	0.5	0.6	-1.5	0.0
6-7-02-27	61	62.5	63.6	66.7	68.1	4.2	4.5	63.1	64.3	67.2	69.3	0.6	0.7	4.1	5.0
6-5-09-37	68	62.9	62.8	61.6	62.1	-1.3	-0.7	62.9	63.1	61.3	62.7	0.0	0.3	-1.6	-0.4
6-5-09-36	41	65.9	65.8	65.6	65.1	-0.3	-0.7	65.9	66.1	64.3	65.7	0.0	0.3	-1.6	-0.4
6-5-09-88	38	66.4	66.4	65.4	65.0	-1.0	-1.4	66.4	66.7	64.7	66.0	0.0	0.3	-1.7	-0.7
6-5-09-34	34	67.0	67.0	65.1	65.7	-1.9	-1.3	67.0	67.3	64.7	66.1	0.0	0.3	-2.3	-1.2
6-5-09-33	43	66.6	66.6	65.1	64.6	-1.5	-2.0	66.6	66.9	64.1	65.5	0.0	0.3	-2.5	-1.4
6-5-09-32	68	65.9	66.1	62.0	62.8	-3.9	-3.3	66.1	66.5	61.8	63.1	0.2	0.4	-4.3	-3.4
6-5-03-28	46	66.6	67.0	60.9	61.7	-5.7	-5.3	66.9	67.4	60.9	62.2	0.3	0.4	-6.0	-5.2

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Kawaihae Road and Lindsey Road alignment.
[3] The 2018 traffic noise levels are calculated values based on predictions from the Traffic Noise Model in combination with noise measurements conducted while COVID-19 travel restrictions were in place in 2020.

TABLE 4
Predicted Traffic Noise Levels and Resulting Increases Due to the Project[1]

Location: TMK	Distance to Road[2] (ft)	Existing 2018[3] (dBA)		2018 With Project (dBA)		2018 Increase With Project (dB)		2036 No Project (dBA)		2036 With Project (dBA)		2036 Increase Without Project (dB)		2036 Increase With Project (dB)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
6-5-03-26	40	65.2	65.6	61.1	60.9	-4.1	-4.7	65.5	65.9	60.5	61.8	0.3	0.3	-5.0	-4.1
6-5-03-43	43	65.2	65.5	63.2	62.8	-2.0	-2.7	65.4	65.8	62.8	63.8	0.2	0.3	-2.6	-2.0
6-5-03-42	85	64.5	64.6	63.5	63.6	-1.0	-1.0	64.6	64.9	64.0	64.5	0.1	0.3	-0.6	-0.4
6-5-03-8	97	64.0	63.8	62.7	62.6	-1.3	-1.2	64.0	64.1	62.6	63.3	0.0	0.3	-1.4	-0.8
6-5-03-46	43	72.3	72.6	69.6	69.0	-2.7	-3.6	72.5	72.9	69.1	69.9	0.2	0.3	-3.4	-3.0
6-5-03-6	50	73.0	73.4	68.1	67.6	-4.9	-5.8	73.3	73.8	67.7	68.7	0.3	0.4	-5.6	-5.1
6-5-03-29	40	61.8	62.0	66.6	66.9	4.8	4.9	62.2	62.5	66.3	67.4	0.4	0.5	4.1	4.9
6-5-03-5	62	62.2	62.0	62.1	62.1	-0.1	0.1	62.7	62.5	61.5	62.6	0.5	0.5	-1.2	0.1
6-5-03-1	198	52.3	51.9	52.2	51.2	-0.1	-0.7	52.8	52.5	52.9	52.9	0.5	0.6	0.1	0.4
6-7-02-25	90	59.7	60.3	64.0	64.7	4.3	4.4	60.3	61.1	64.3	66.2	0.6	0.8	4.0	5.1
6-5-02-189	319	50.9	50.8	49.3	49.3	-1.6	-1.5	50.9	51.1	49.8	50.0	0.0	0.3	-1.1	-1.1
6-5-02-180	293	54.0	54.1	51.3	51.5	-2.7	-2.6	54.1	54.4	51.8	51.9	0.1	0.3	-2.3	-2.5
6-5-04-81	390	63.2	60.0	62.1	56.8	-1.1	-3.2	63.4	60.5	60.1	58.2	0.2	0.5	-3.3	-2.3
6-5-05-15	38	62.6	62.5	63.0	63.3	0.4	0.8	63.3	63.2	63.4	64.6	0.7	0.7	0.1	1.4
6-5-09-27	505	49.7	49.7	48.4	48.4	-1.3	-1.3	49.7	49.9	49.0	48.8	0.0	0.2	-0.7	-1.1
6-5-03-43	170	53.3	53.4	52.0	50.9	-1.3	-2.5	53.4	53.7	52.1	52.0	0.1	0.3	-1.3	-1.7
6-5-03-7	330	50.6	50.5	48.5	48.0	-2.1	-2.5	50.8	50.8	49.2	49.1	0.2	0.3	-1.6	-1.7
6-7-02-15	57	60.7	61.5	62.6	62.7	1.9	1.2	61.3	62.2	62.9	63.9	0.6	0.7	1.6	1.7

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Kawaihae Road and Lindsey Road alignment.
[3] The 2018 traffic noise levels are calculated values based on predictions from the Traffic Noise Model in combination with noise measurements conducted while COVID-19 travel restrictions were in place in 2020.

TABLE 5a
2018 No Project (Existing) Traffic Noise Impacts[1]

Noise levels shown in the table were calculated by the Traffic Noise Model

Location: TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptors (dBA)[4]	Required Reduction to be within Noise Abatement Criteria (dBA)
6-5-07-53 (School)	50	C/D	70	45	--
6-5-07-3	57	C/D	70	45	--
6-5-09-36	41	B	66	--	1
6-5-09-88	38	B	66	--	1
6-5-09-34	34	B	67	--	2
6-5-09-33	43	B	67	--	2
6-5-09-32	68	B	66	--	1
6-5-03-26	40	B	66	--	1
6-5-03-46	43	C/D	73	48	--
6-5-03-6	50	C/D	73	48	--

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Keaau-Pahoa Road alignment.
[3] Noise levels that will "approach or exceed" the FHWA/HDOT noise abatement criteria for each Land Use Category.
4Interior Noise Level Analysis assumes 25 dB attenuation from aluminum single hung, closed, glazed with 7/16" insulating glass per [Reference 9]

TABLE 5b
2018 With Action Predicted Traffic Noise Impacts[1]

Noise levels shown in the table were calculated by the Traffic Noise Model

Location: TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptors (dBA)[4]	Required Reduction to be within Noise Abatement Criteria (dBA)
6-5-07-53 (Sports Field)	90	C	66	--	1
6-5-07-53 (School)	50	C/D	75	50	--
6-5-07-3	57	C/D	70	45	--
6-5-09-36	41	B	66	--	1
6-5-03-46	43	C/D	69	44	--
6-5-03-6	50	C/D	68	43	--
6-5-03-29	40	C/D	67	42	--

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Keaau-Pahoa Road alignment.
[3] Noise levels that will "approach or exceed" the FHWA/HDOT noise abatement criteria for each Land Use Category.
4Interior Noise Level Analysis assumes 25 dB attenuation from aluminum single hung, closed, glazed with 7/16" insulating glass per [Reference 9]

TABLE 5c
2036 No Project Predicted Traffic Noise Impacts[1]

Noise levels shown in the table were calculated by the Traffic Noise Model

Location: TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptors (dBA)[4]	Required Reduction to be within Noise Abatement Criteria (dBA)
6-5-07-53 (School)	50	C/D	70	45	--
6-5-07-3	57	C/D	71	46	--
6-5-09-36	41	B	66	--	1
6-5-09-88	38	B	67	--	2
6-5-09-34	34	B	67	--	2
6-5-09-33	43	B	67	--	2
6-5-09-32	68	B	67	--	2
6-5-03-46	43	C/D	73	48	--
6-5-03-6	50	C/D	74	49	--

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Keaau-Pahoa Road alignment.
[3] Noise levels that will “approach or exceed” the FHWA/HDOT noise abatement criteria for each Land Use Category.
4Interior Noise Level Analysis assumes 25 dB attenuation from aluminum single hung, closed, glazed with 7/16” insulating glass per [Reference 9]

TABLE 5d
2036 With Project Predicted Traffic Noise Impacts[1]

Noise levels shown in the table were calculated by the Traffic Noise Model

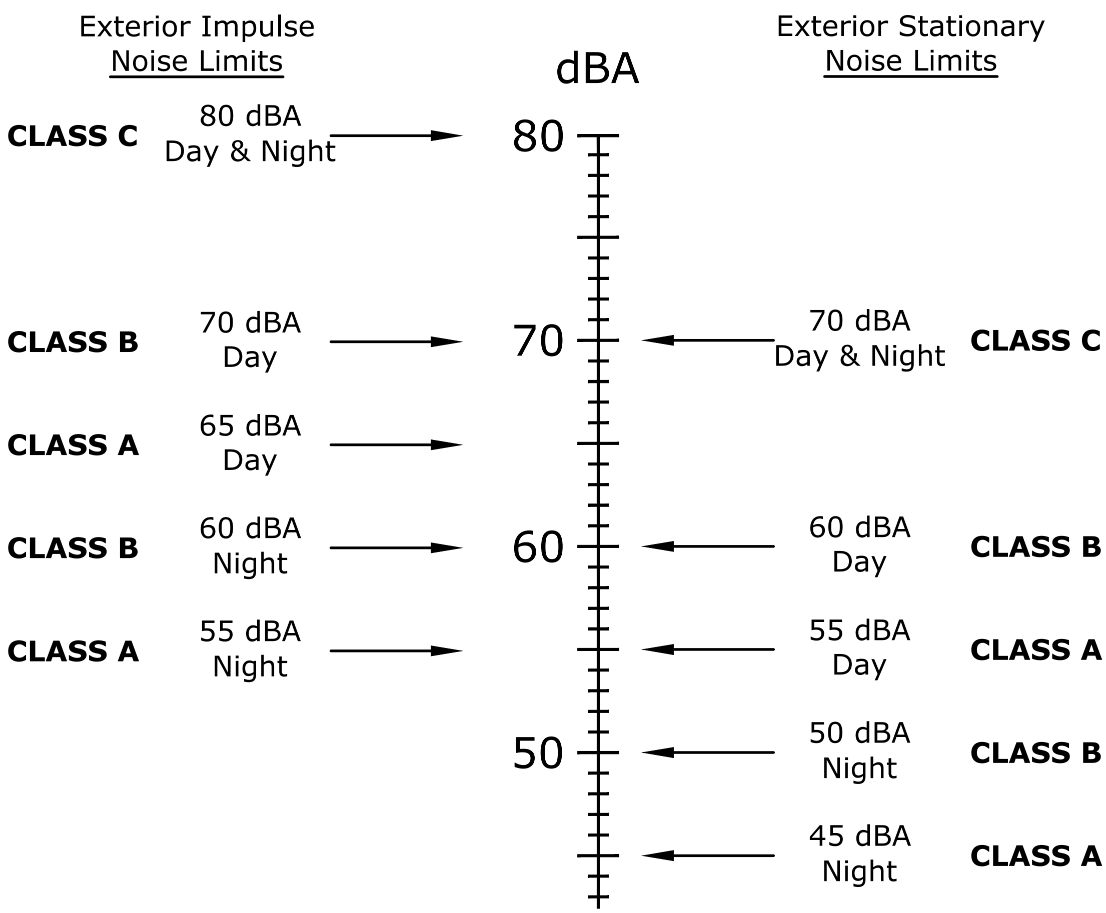
Location: TMK	Distance to Road[2] (ft)	Land Use Category	Maximum Peak Hour Traffic Noise Levels[3] (dBA)	Interior Noise Level for Category D Receptors (dBA)[4]	Required Reduction to be within Noise Abatement Criteria (dBA)
6-5-07-53 (Sports Field)	90	C	67	--	2
6-5-07-53 (School)	50	C/D	76	51	1
6-5-07-3	57	C/D	71	46	--
6-5-09-88	38	B	66	--	1
6-5-09-34	34	B	66	--	1
6-5-03-46	43	C/D	70	45	--
6-5-03-6	50	C/D	69	44	--
6-5-03-29	40	C/D	67	42	--

[1] The noise level calculations were based on the peak hour traffic volumes from the Traffic Impact Analysis Report [Reference 8].
[2] The approximate distance is from the façade of the building to the centerline of the existing Keaau-Pahoa Road alignment.
[3] Noise levels that will "approach or exceed" the FHWA/HDOT noise abatement criteria for each Land Use Category.
4Interior Noise Level Analysis assumes 25 dB attenuation from aluminum single hung, closed, glazed with 7/16" insulating glass per [Reference 9]

HAWAII DEPARTMENT OF HEALTH MAXIMUM PERMISSIBLE SOUND LEVELS FOR VARIOUS ZONING DISTRICTS

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)

IMPULSE NOISE:
The maximum permissible noise limit for impulse noise is 10 dBA above the stationary noise limits.



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PROJECT: Waimea Town Multi-Modal Improvements EA		
PROJECT NO: 20-023	DATE: October 2020	FIGURE: 1

FEDERAL HIGHWAY ADMINISTRATION NOISE ABATEMENT CRITERIA FOR HIGHWAY NOISE

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	HOURLY EQUIVALENT SOUND LEVEL L_{eq}
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	RESIDENTIAL	67 dBA (EXTERIOR)
C	ACTIVE SPORT AREAS, AMPHITHEATERS, AUDITORIUMS, CAMPGROUNDS, CEMETERIES, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PARKS, PICNIC AREAS, PLACES OF WORSHIP, PLAYGROUNDS, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, RECREATION AREAS, SECTION 4(F) SITES, SCHOOLS, TELEVISION STUDIOS, TRAILS, AND TRAIL CROSSINGS	67 dBA (EXTERIOR)
D	AUDITORIUMS, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PLACES OF WORSHIP, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, SCHOOLS, AND TELEVISION STUDIOS .	52 dBA (INTERIOR)
E	HOTELS, MOTELS, OFFICES, RESTAURANTS/BARS, AND OTHER DEVELOPED LANDS, PROPERTIES OR ACTIVITIES NOT INCLUDED IN A-D OR F.	72 dBA (EXTERIOR)
F	AGRICULTURE, AIRPORTS, BUS YARDS, EMERGENCY SERVICES, INDUSTRIAL, LOGGING, MAINTENANCE FACILITIES, MANUFACTURING, MINING, RAIL YARDS, RETAIL FACILITIES, SHIPYARDS, UTILITIES (WATER RESOURCES, WATER TREATMENT, ELECTRICAL), AND WAREHOUSING	N/A
G	UNDEVELOPED LANDS THAT ARE NOT PREMITTED	N/A

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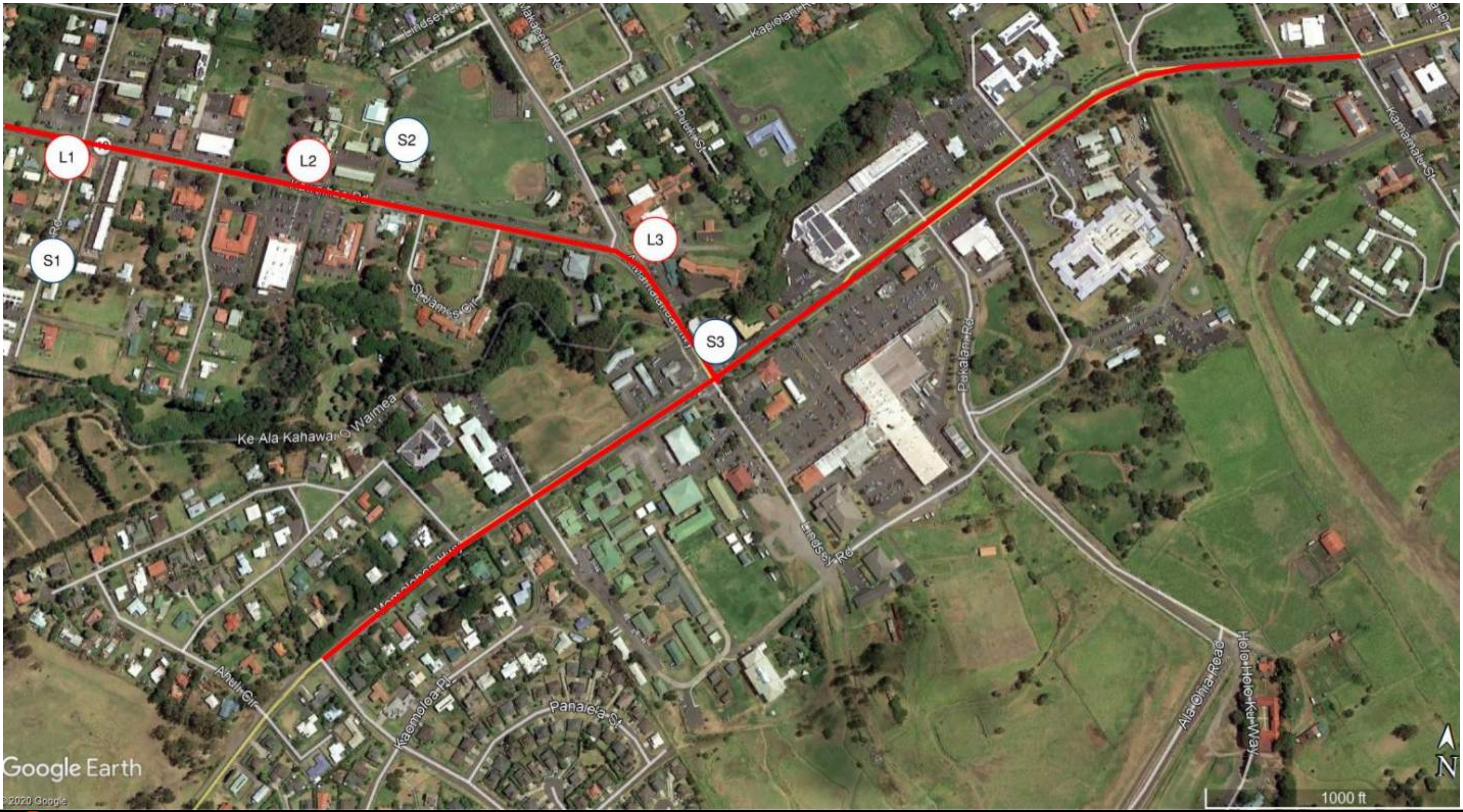
PROJECT: Waimea Town Multi-Modal Improvements EA

PROJECT NO:	DATE:	FIGURE:
20-023	October 2020	2

Project Site and Noise Measurement Locations



L1 - **Long-Term Measurement Location**	**Legend**
S1 - **Short-term Measurement Location**	**Extent of Multi-Modal Improvements Study Area**

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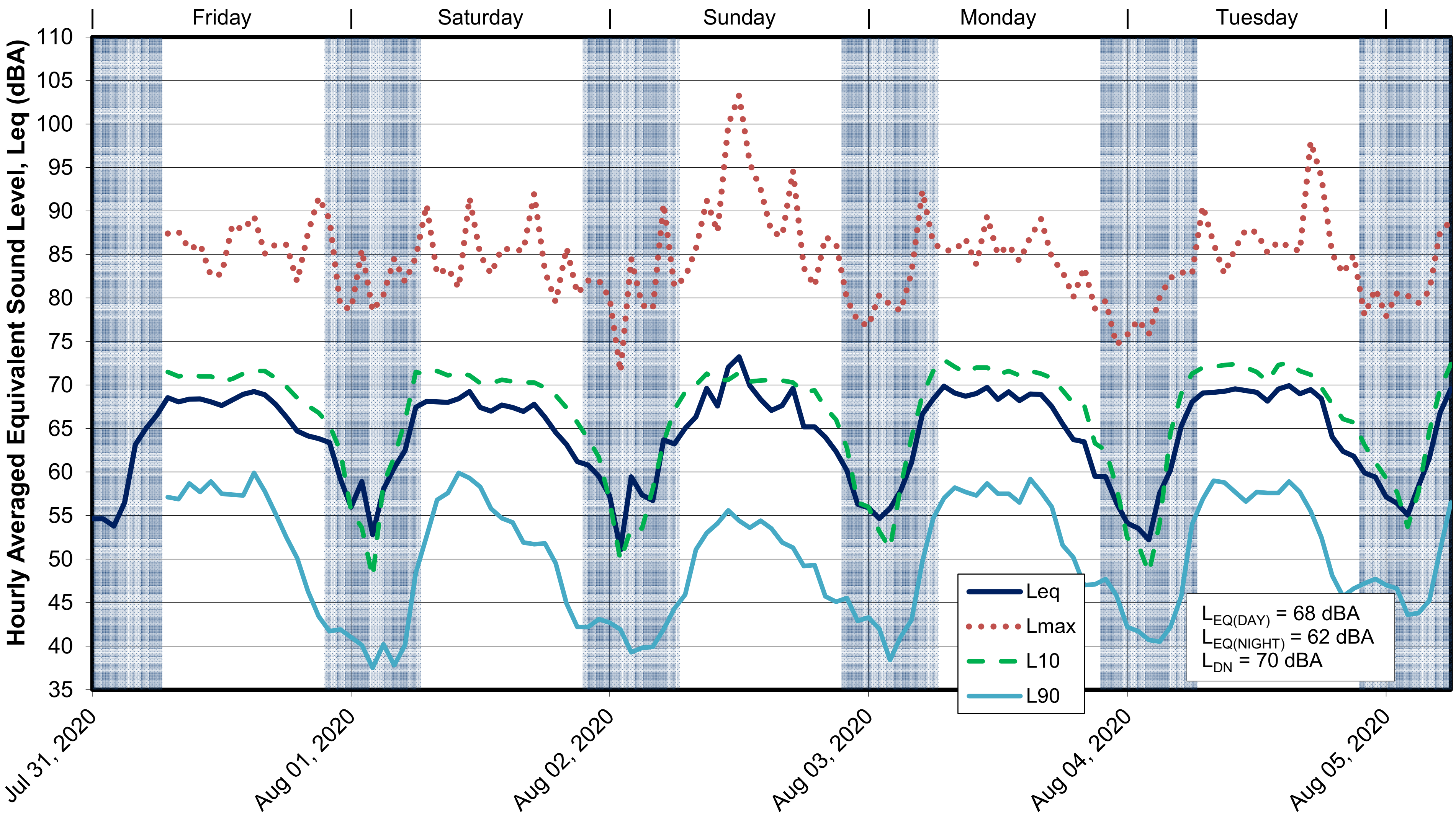
	PROJECT NO: 20-023	DATE: October 2020	DETAIL: FIGURE: 3

L1- 65-1219 Opelo Road Noise Measurement Location



Date & Time of Measurement

L_{eq}: Equivalent Sound Level - Logrithmic average of sound levels of time.
L_{max}: Maximum Noise Level - Highest noise level reached during each hourly measurement.
L_{10}: Highest noise level exceeded 10% of each hourly recording.
L_{90}: Ambient Noise Level: Highest noise level exceeded 90% of each hourly recording.

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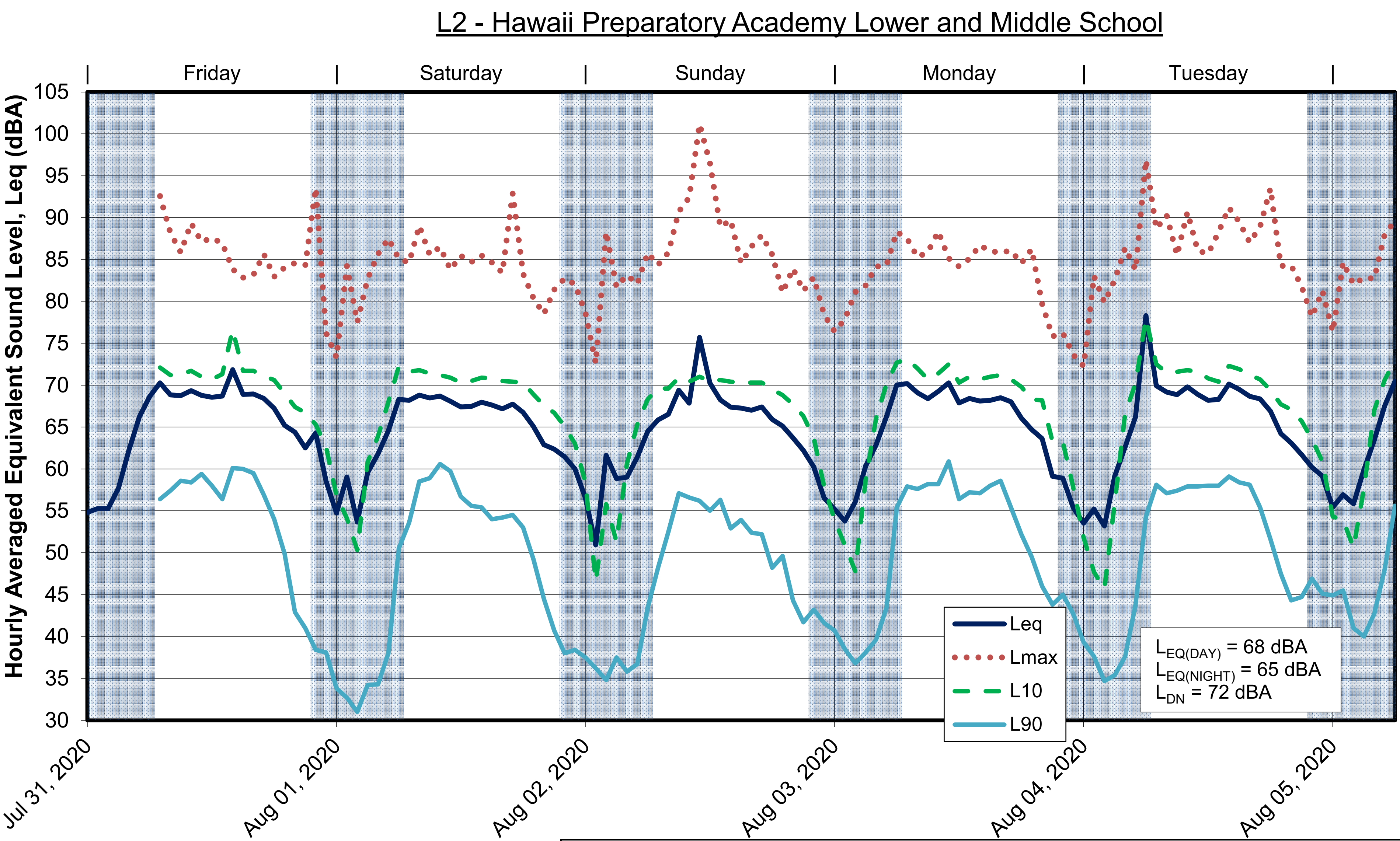
PROJECT: Waimea Town Multi-Modal improvements EA		
PROJECT NO: 20-023	DATE: October 2020	FIGURE: 4



Date & Time of Measurement

L_{eq}: Equivalent Sound Level - Logrithmic average of sound levels of time.
L_{max}: Maximum Noise Level - Highest noise level reached during each hourly measurement.
L_{10}: Highest noise level exceeded 10% of each hourly recording.
L_{90}: Ambient Noise Level: Highest noise level exceeded 90% of each hourly recording.

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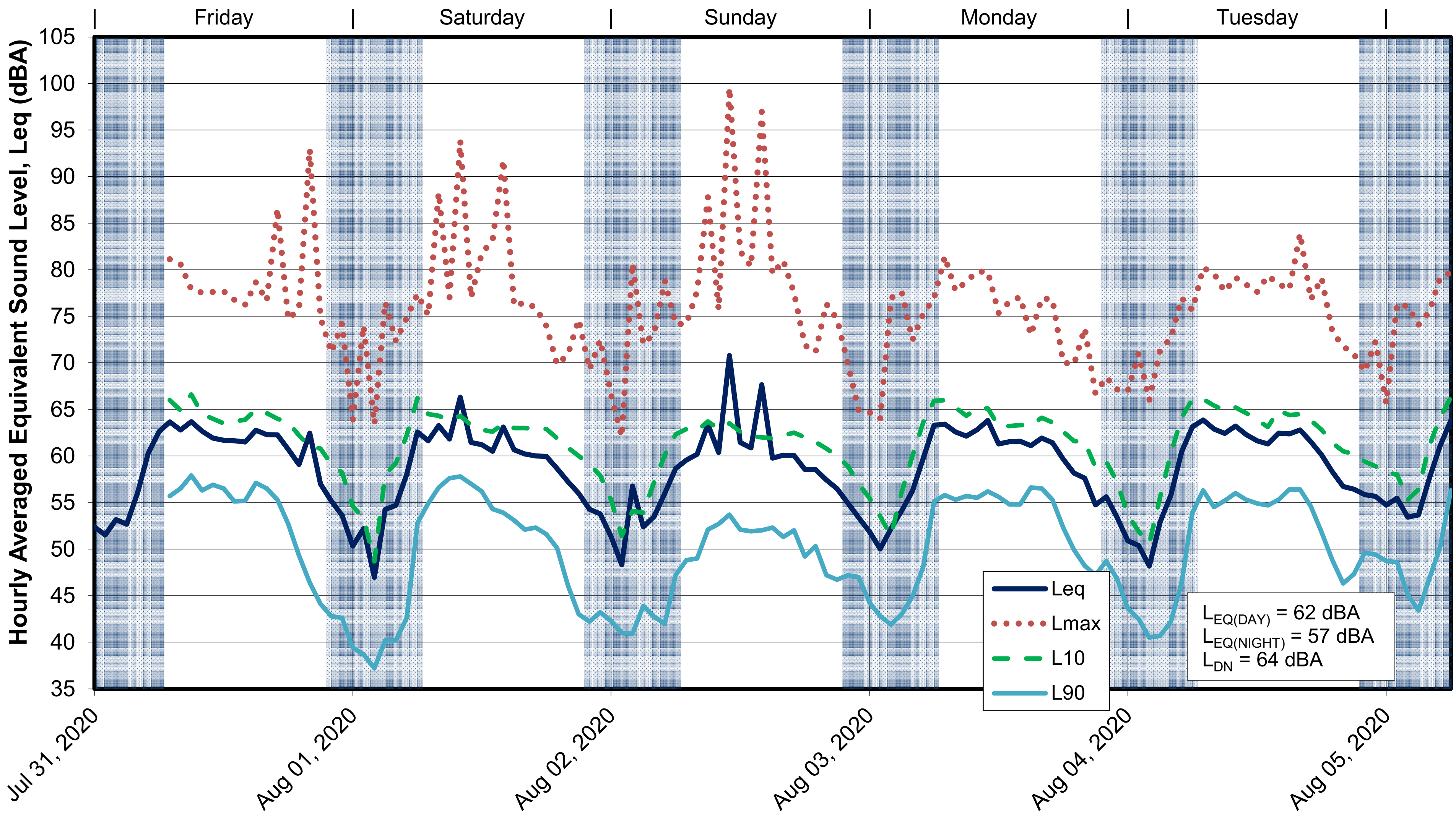
	PROJECT NO: 20-023	DATE: October 2020	FIGURE: 5

L3 - Parker School Noise Measurement Location



Date & Time of Measurement

L_{eq}: Equivalent Sound Level - Logrithmic average of sound levels of time.
L_{max}: Maximum Noise Level - Highest noise level reached during each hourly measurement.
L_{10}: Highest noise level exceeded 10% of each hourly recording.
L_{90}: Ambient Noise Level: Highest noise level exceeded 90% of each hourly recording.

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PROJECT: Waimea Town Multi-Modal Improvements EA		
PROJECT NO: 20-023	DATE: October 2020	FIGURE: 6

APPENDIX A

Acoustic Terminology

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as unwanted sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 µPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 µPa, then SPL = 0 dB
If P = 200 µPa, then SPL = 20 dB
If P = 2000 µPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the

---

[1] D.W. Robinson and R.S. Dadson, AA Re-Determination of the Equal-Loudness Relations for Pure Tones,@ *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

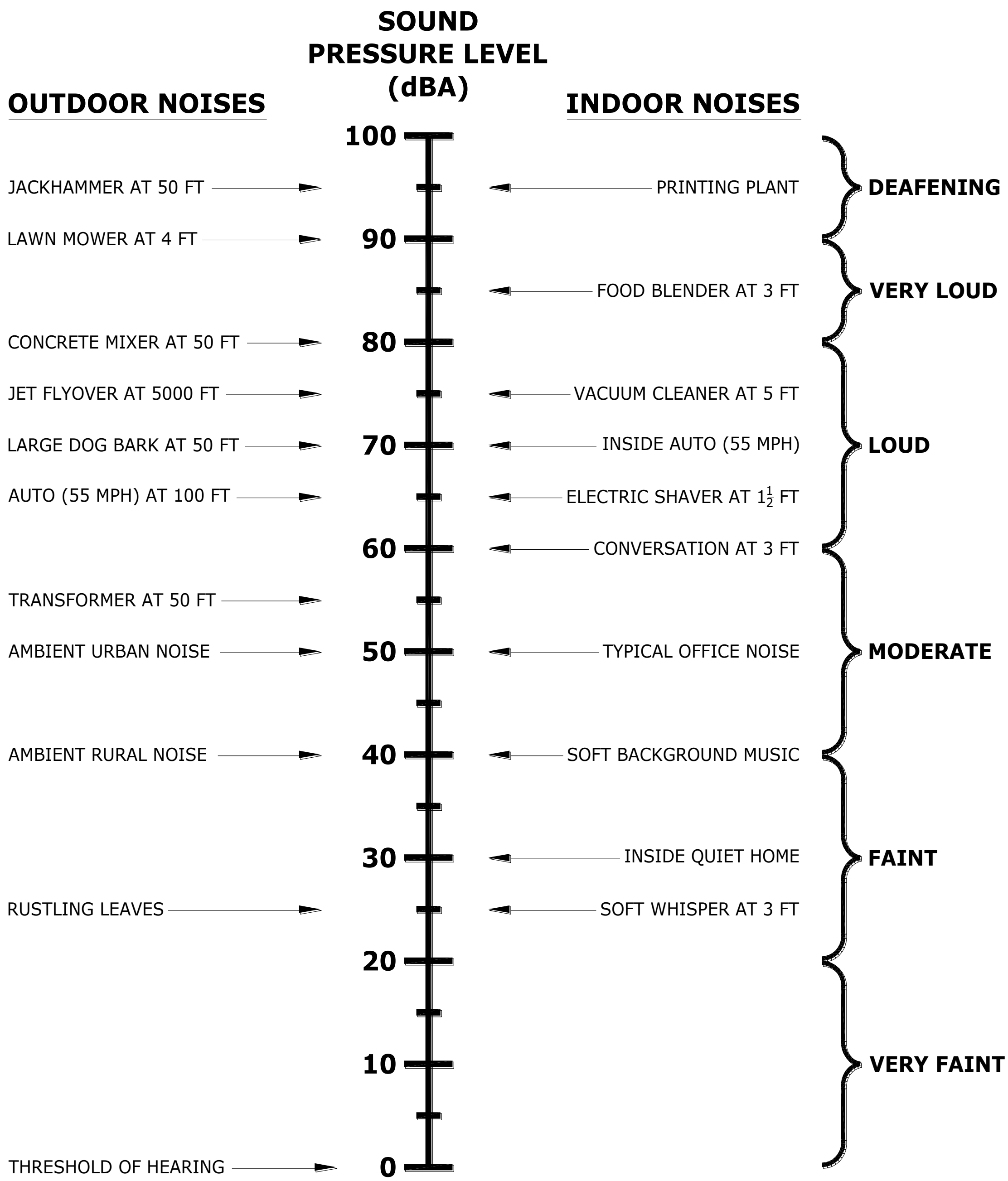


Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

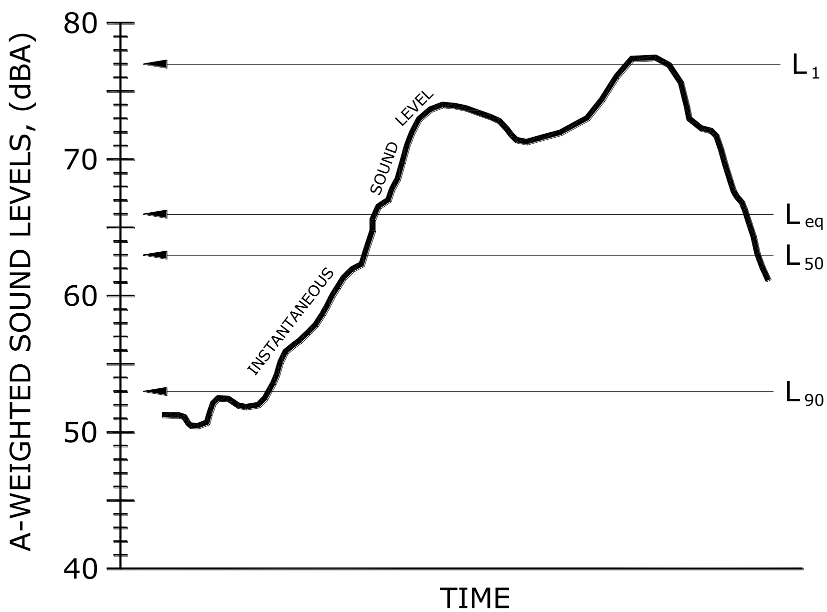


Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedance Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedance Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

APPENDIX B

Photographs of Sound Level Meter Locations

Noise Measurement Location L1

Noise Measurement Location L2

Noise Measurement Location L3

Noise Measurement Location S1

Noise Measurement Location S2

Noise Measurement Location S3

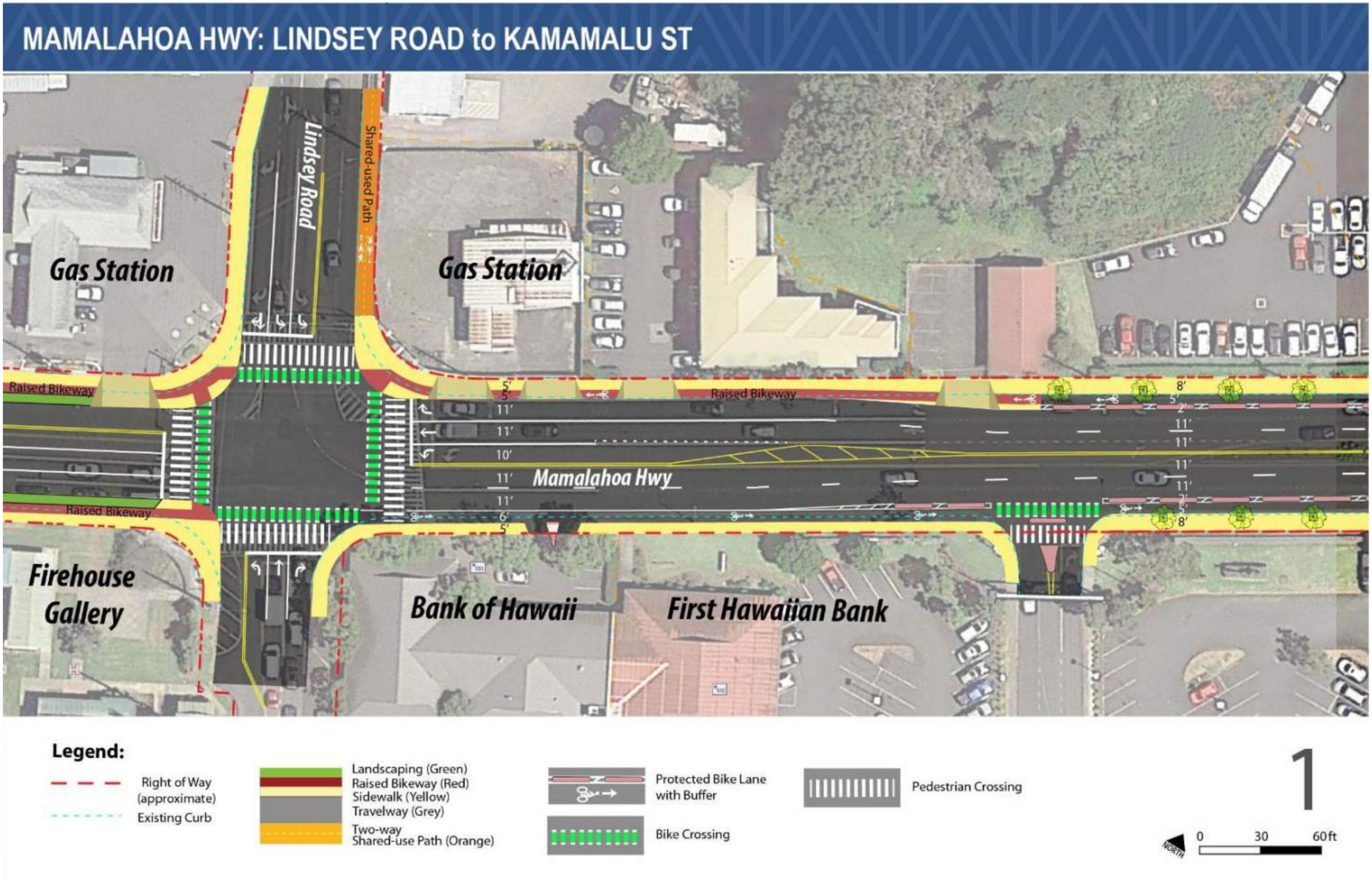
APPENDIX C

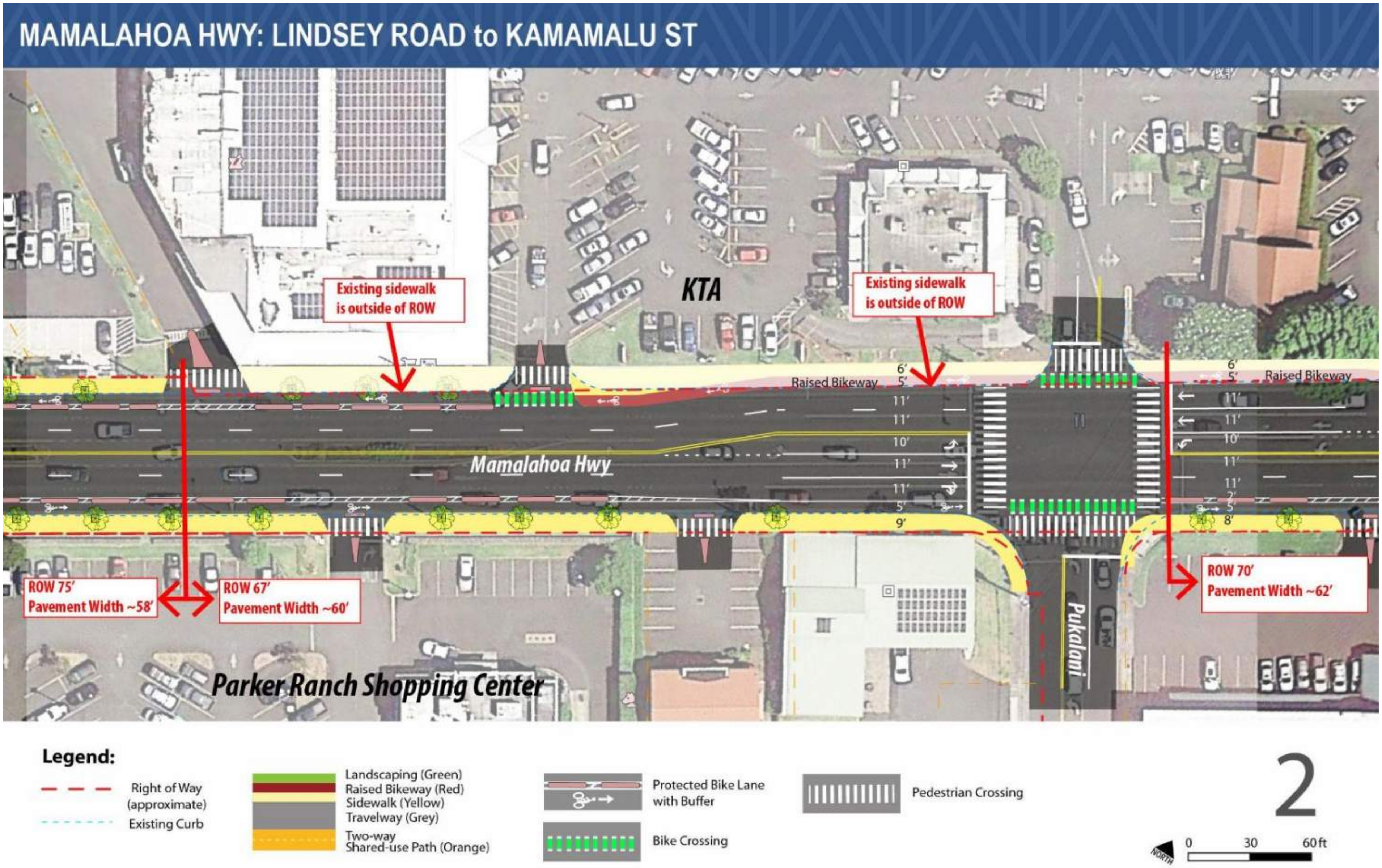
Sketches of Proposed Roadway Improvements

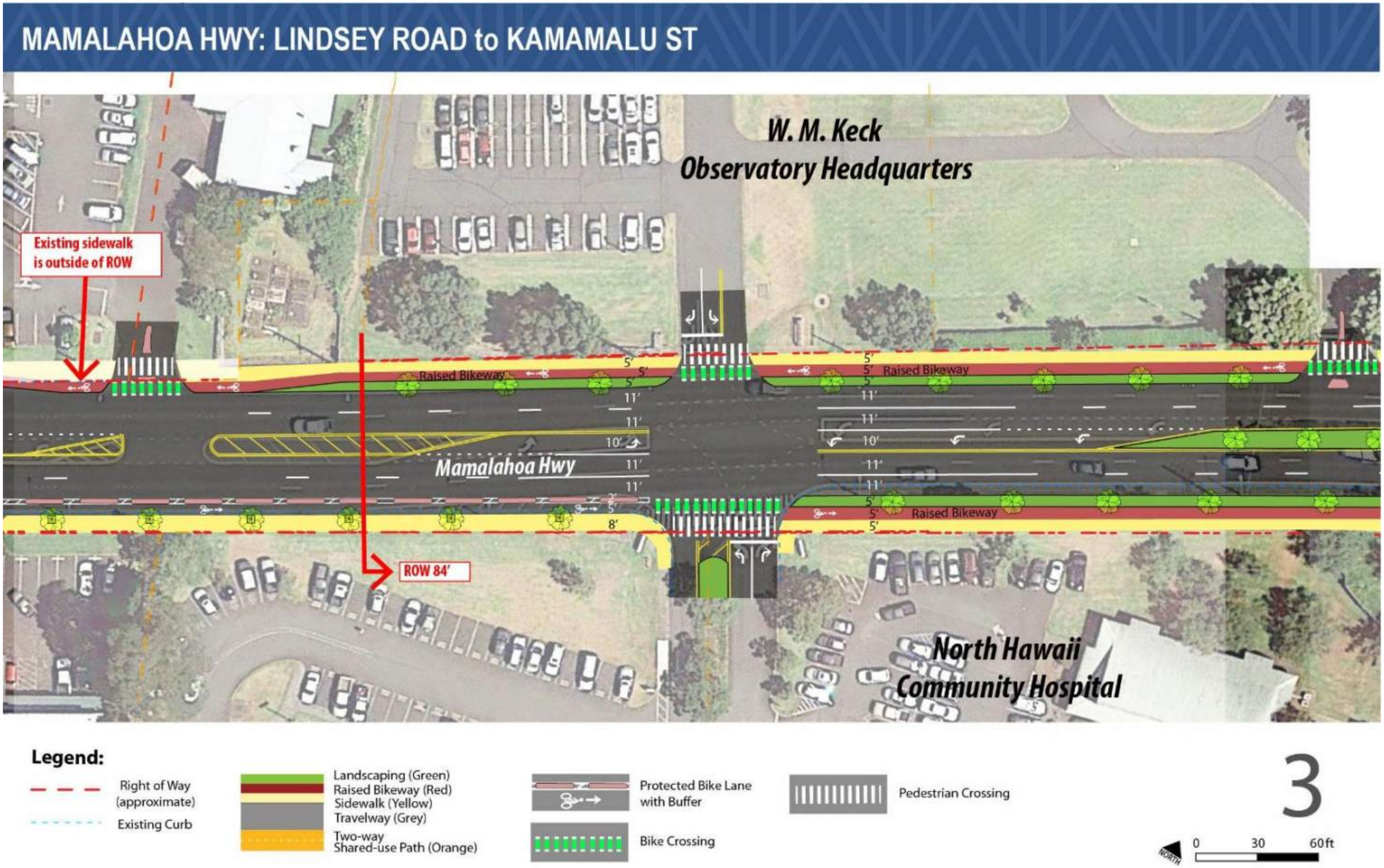

WAIMEA REGIONAL SAFETY STUDY: KAWAIHAE ROAD AND LINDSEY ROAD
Parker School
Truck Apron
Center Island
Circulatory Roadway
Proposed Sidewalk
Existing Sidewalk
Annunciation Catholic Church
Splitter Island
Crosswalk
Paniolo Lodge
DISCLAIMER: THIS GRAPHIC WAS PREPARED FOR PLANNING DISCUSSION PURPOSES ONLY
Legend:
Right of Way
Tax Map Key (TMK) Boundary
Existing Sidewalk (Yellow)
Proposed Sidewalk (Orange)
Travelway (Grey)
0
50
100ft

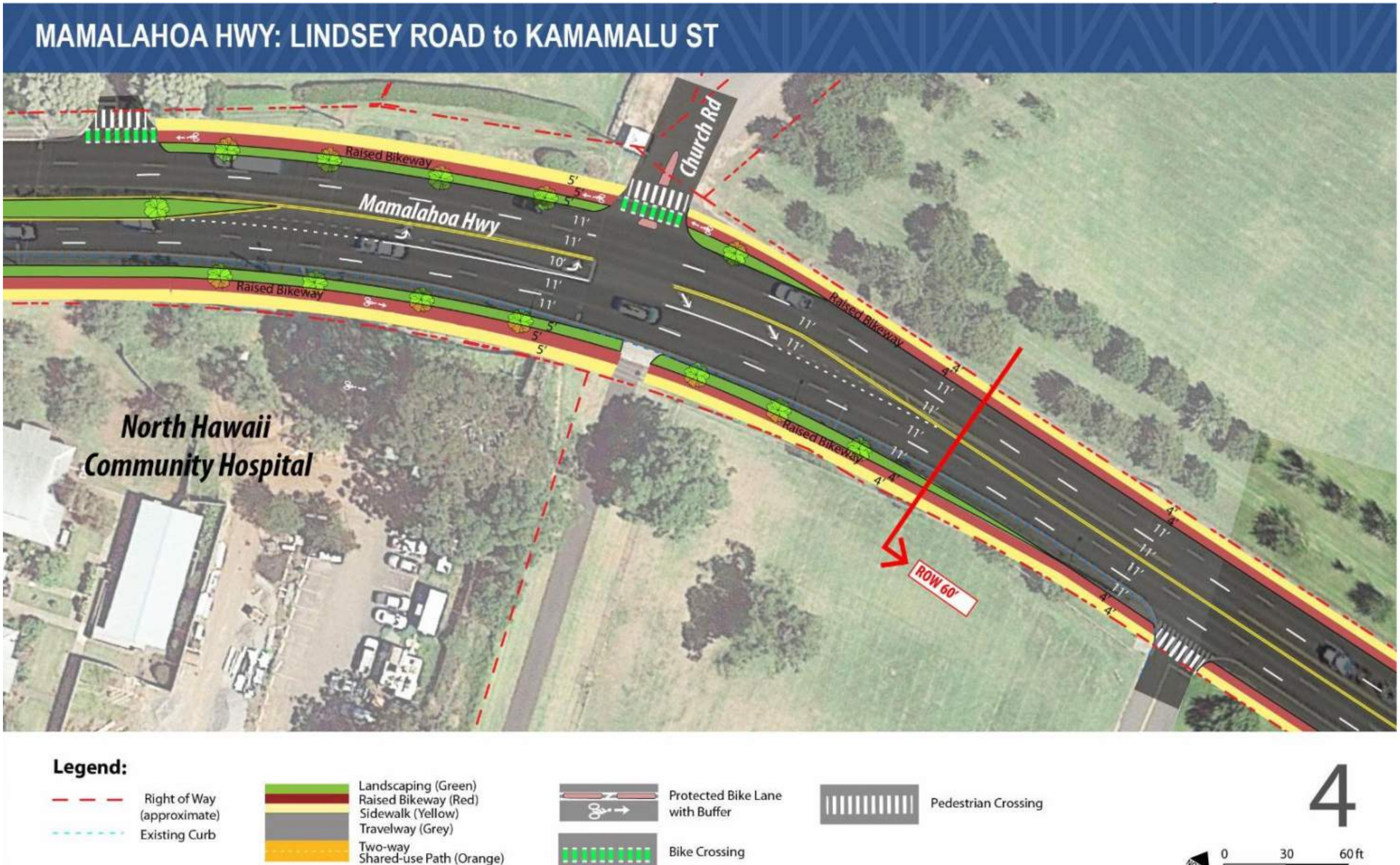
WAIMEA REGIONAL SAFETY STUDY: KAWAIHAE ROAD AT OPELO ROAD
1. Center turn lane
2. Sidewalks and bikeways
3. Marked crosswalks
4. Rectangular Rapid Flash Beacon (RRFB)
5. Gateway feature
Opelo Plaza
Opelo Road
Kawaihae Road
Waimea Express
Red Water Cafe
To Lindsey Rd
Gateway Feature
Example
Welcome To WAIMEA
SECTION A-A Kawaihae Rd looking west
DISCLAIMER: THIS GRAPHIC WAS PREPARED FOR PLANNING DISCUSSION PURPOSES ONLY
Legend:
Right of Way
Raised Bikeway (red)
Landscape strip (green) with street tree
Driveway (Black lines)
Sidewalk (yellow)
Raised Bikeway (red)
0
50
100ft


WAIMEA REGIONAL SAFETY STUDY: MAMALAHOA HWY AND LINDSEY ROAD
1. Raised pedestrian islands
2. Reconfigured lanes
3. Optimized signal timing
4. Bicycle facilities
Raised Channelized Island and Crosswalk
Raised Channelized Island
Bollard
Gas Station
Gas Station
First Hawaiian Bank
Bank of Hawaii
Protected Corner
Firehouse Gallery
To Kamamalu Rd
To Kaomoloa Rd
Lindsey Road
Mamalahoa Hwy
Protected corner
DISCLAIMER: THIS GRAPHIC WAS PREPARED FOR PLANNING DISCUSSION PURPOSES ONLY
Legend:
Right of Way
Tax Map Key (TMK) Boundary
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
0
50
100ft

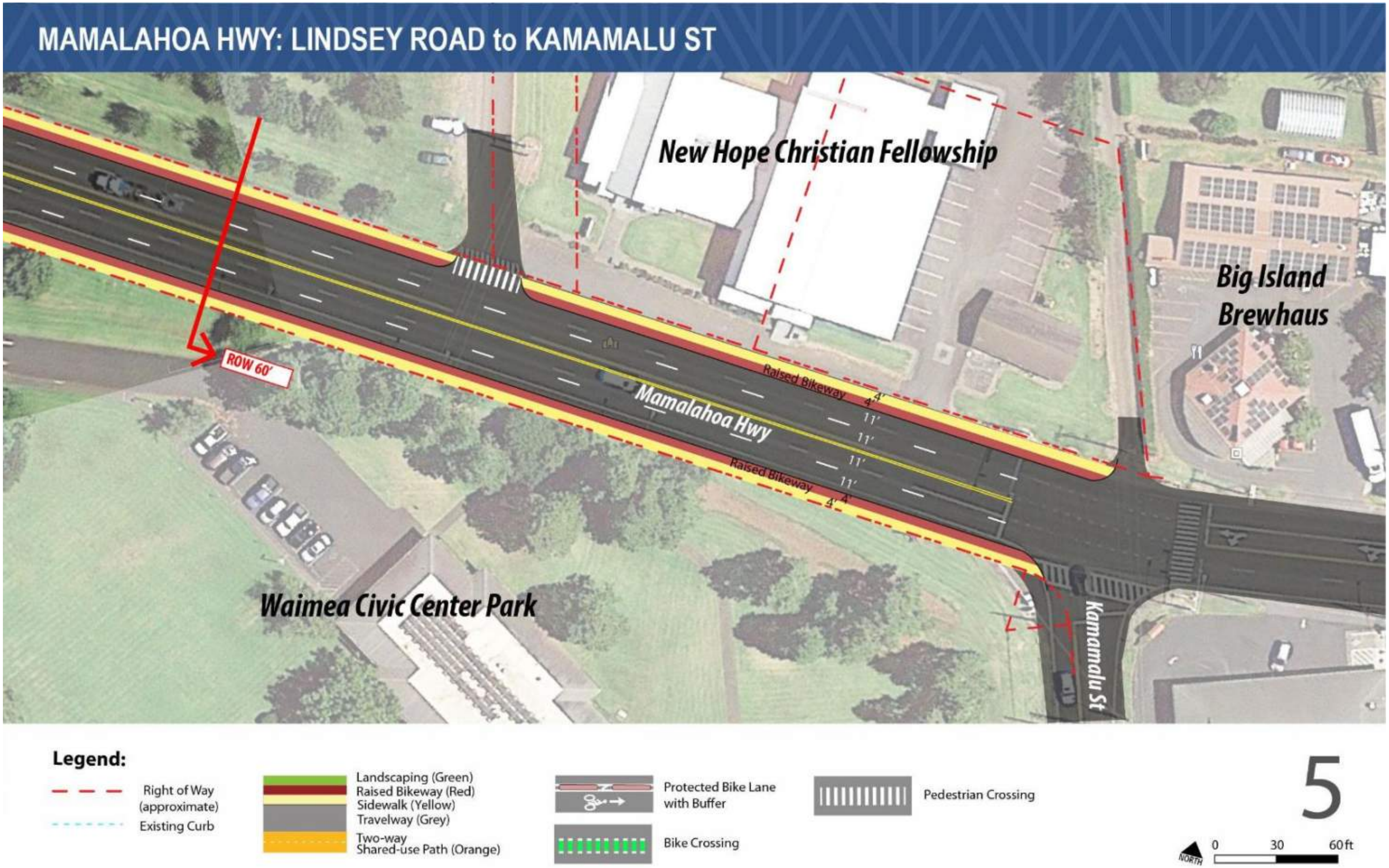

MAMALAHOA HWY: LINDSEY ROAD to KAMAMALU ST
Lindsey Road
Shared-used Path
Gas Station
Gas Station
Raised Bikeway
Raised Bikeway
Raised Bikeway
Mamalahoa Hwy
Firehouse Gallery
Bank of Hawaii
First Hawaiian Bank
Legend:
Right of Way (approximate)
Existing Curb
Landscaping (Green)
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
Two-way Shared-use Path (Orange)
Protected Bike Lane with Buffer
Bike Crossing
Pedestrian Crossing
1
0
30
60ft


MAMALAHOA HWY: LINDSEY ROAD to KAMAMALU ST
Existing sidewalk is outside of ROW
KTA
Existing sidewalk is outside of ROW
Raised Bikeway
Raised Bikeway
Mamalahoa Hwy
ROW 75' Pavement Width ~58'
ROW 67' Pavement Width ~60'
ROW 70' Pavement Width ~62'
Pukalani
Parker Ranch Shopping Center
Legend:
Right of Way (approximate)
Existing Curb
Landscaping (Green)
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
Two-way Shared-use Path (Orange)
Protected Bike Lane with Buffer
Bike Crossing
Pedestrian Crossing
2
NORTH
0
30
60ft


MAMALAHOA HWY: LINDSEY ROAD to KAMAMALU ST
W. M. Keck
Observatory Headquarters
Existing sidewalk
is outside of ROW
Raised Bikeway
Mamalahoa Hwy
ROW 84'
North Hawaii
Community Hospital
Legend:
Right of Way (approximate)
Existing Curb
Landscaping (Green)
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
Two-way Shared-use Path (Orange)
Protected Bike Lane with Buffer
Bike Crossing
Pedestrian Crossing
3
0 30 60ft



MAMALAHOA HWY: LINDSEY ROAD to KAMAMALU ST
Church Rd
Mamalahoa Hwy
Raised Bikeway
North Hawaii Community Hospital
ROW 60'
Legend:
Right of Way (approximate)
Existing Curb
Landscaping (Green)
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
Two-way Shared-use Path (Orange)
Protected Bike Lane with Buffer
Bike Crossing
Pedestrian Crossing
4
0
30
60 ft
NORTH


MAMALAHOA HWY: LINDSEY ROAD to KAMAMALU ST
New Hope Christian Fellowship
Big Island Brewhaus
ROW 60'
Raised Bikeway
Mamalahoa Hwy
4'
11'
11'
11'
11'
Raised Bikeway
4'
Waimea Civic Center Park
Kamamalu St
Legend:
Right of Way (approximate)
Existing Curb
Landscaping (Green)
Raised Bikeway (Red)
Sidewalk (Yellow)
Travelway (Grey)
Two-way Shared-use Path (Orange)
Protected Bike Lane with Buffer
Bike Crossing
Pedestrian Crossing
5
NORTH
0
30
60 ft

APPENDIX D

Biological Survey Report

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Biological Survey
Waimea Roadway Improvements
Island of Hawai‘i

By Ron Terry, Ph.D. and Jen Lawson, B.S.
Prepared for SSFM International Inc. and the Hawaii Department of Transportation
April 2020

Introduction

The State of Hawaii Department of Transportation (HDOT), Highways Division, has identified projects that would improve safety and operations and relieve congestion within Waimea Town. The proposed project would include multimodal safety and operations improvements to existing roadways within the town of Waimea. This includes multimodal roadway improvements along Kawaihae Road between Lindsey Road and Opelo Road and intersection improvements at the Lindsey Road/Kawaihae Road intersection and Mamalahoa Highway/Lindsey Road intersection. The purpose is to improve pedestrian and bicycle safety while relieving motor vehicle congestion and preserving the scenic landscape of this corridor. The project corridor is illustrated in Figures 1-3.

This biological survey of the project corridor was undertaken to provide an assessment of the overall biological environment and potential impacts of the project and to inform implementation of the project in case there is a need for avoidance or other mitigation.

The work involved a full pedestrian botanical survey of the involved right-of-way, as well as an "over the fence" survey of plants on adjacent property that had any potential to be impacted directly or indirectly by construction and use of the improvements. The objectives of the botanical survey were to: 1) describe the vegetation; 2) list all native species encountered; and 3) identify rare, threatened or endangered plant species. Plant species were identified in the field and later in the laboratory. Special attention was given to the possible presence of any federally (USFWS 2020) listed threatened or endangered plant species.

The fieldwork also included a limited faunal survey focused on generating a list of birds and introduced mammals, reptiles, or amphibians observed during the botanical survey. Also considered in this report is the general value of the habitat for native birds and Hawaiian hoary bats. No surveys of invertebrates or aquatic species were conducted, although there is a general discussion of aquatic habitat and endangered invertebrate habitat. Members of the Solanaceae plant family, many of which are known to be host plants for the endangered Blackburn's sphinx moth (*Manduca blackburnii*), were specifically searched for.

Included in this report are discussions of threatened and endangered species. Federal and State of Hawai‘i endangered species laws require government agencies to ensure that their actions are not likely to jeopardize the continued existence of federal or State listed threatened endangered species (16 U.S.C. §1536(a)(2) and (4); Chapter 195D, HRS). The U.S. Endangered Species Act defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S.C. §1532 (5)).

Ecological Context and Biological Literature

Physical Factors Influencing Vegetation and Animal Habitat

There are several factors that influence the flora, vegetation and faunal habitat of this basically urban habitat in Waimea. The geologic substrate consists of different-aged lava flows from Mauna Kea ranging from as young as 65,000 years to as old as 250,000 years (Wolfe and Morris 1996). Soils here are classified by the U.S. Natural Resources Conservation Service (NRCS) as Waimea medial very fine sandy loam, 0 to 6 percent slopes, on the west side of the project corridor, and Kikoni medial silt loam, 0 to 3 percent slopes, on the east side. Both soils are well-drained, fine to very fine sandy loams that form in volcanic ash and support native forests and shrublands – depending on annual rainfall – under natural conditions. The elevation is about 2,650 feet above sea level, creating the cool climate for which Waimea is celebrated. Winds in the area are dominantly northeast trades funneled between Mauna Kea and the Kohala Mountains. These are replaced periodically by a southerly winds that can bring with them volcanic haze, or vog, when Kilauea Volcano is active (UH Hilo 1998). The improvements occur at the junction between what are commonly known as "the wet side" and "the dry side" of Waimea. The average annual rainfall at Mud Lane on the eastern end of Waimea is 61 inches, while the Ouli subdivision in the west receives only 26 inches. Rainfall in the actual project corridor is between 32 and 39 inches per year, and is actually less in the east than in the west, because of the influence of the Kohala Mountains rising steeply behind the western end. Year to year rainfall can be quite variable. Waikōloa Stream traverses the project corridor just west of the Lindsey Road and Mamalahoa Highway intersection, creating a small, urban riparian zone on either side of a concrete bridge and culvert (Figure 3-g).

Vegetation

It is difficult to speculate on the precise pre-human vegetation of the area, since it has been completely transformed by removal of tree cover, planting with traditional Hawaiian crops, later introduction and promotion of pasture grasses maintained by heavy cattle grazing, and finally urban development and landscaping. The vegetation of undeveloped portions of Puʻukapu Hawaiian Home Lands, which are very similar in elevation, rainfall and geology, is currently dominated by the alien kikuyu grass (*Cenchrus clandestinus*). Rockier patches that are not grazed may have significant cover from the native shrubs aʻaliʻi (*Dodonaea viscosa*), ʻakia (*Wikstroemia pulcherrima*) and sandalwood (*Santalum ellipticum*). In a few special areas, endangered plants such as poʻe (*Portulaca sclerocarpa*), nehe (*Melanthera venosa*), and *Stenogyne angustifolia* still persist (Geometrician Associates 2017). Slightly wetter areas just to the east, though now covered in kikuyu grass as well, were originally sub-montane wet forest dominated by **ʻ**ōhiʻa (*Metrosideros polymorpha*), koa (*Acacia koa*) and hapuʻu (*Cibotium* spp.) and a variety of other trees, shrubs, herbs, grasses, sedges and ferns (Gagne and Cuddihy 1990). Research contained in the *Final Environmental Assessment, Kapoaula Koa Forest Management Plan* (Cardno and Geometrician Associates 2019) found historical records indicating that this entire upland flank on the Hamakua/Kohala Border was once a dense koa-ʻōhiʻa forest. This forest was evidently nearly eliminated and replaced by grazing land in the 1850s. An 1856 account from the *Sandwich Island Monthly Magazine* reported:

> "…it is in the memory of many foreigners now living here, when the whole of these plains were covered in a thick wood…where hardly a tree stands for miles…….Thousands of old dead trees both standing upright and prostrate, from the present boundaries of these woods, exhibit a mode in which the destruction is effected; for whilst the old trees die of age, no young ones are seen taking their place, as during the last thirty or forty years, the cattle have eaten or trodden them down.…..."In former times when I was a boy (said Ha'alelea), Waimea was a thickly wooded region all about there…. but of late years round about where I lived, it is as cleared of trees as the Esplanade is."….. He explained that white settlers had felled the trees for fuel and fences for cattle pens and that "a good many of the young trees were destroyed by the cattle" (Fischer 2015: 62).
>
> "From the nature of the country to the windward of our private lands [Waimea] (a dense forest and almost impenetrable undergrowth covering nearly the whole of it) as the herds increased it became an impossibility to prevent cattle from getting beyond the reach of our control, and gradually they have filled this land with their offspring" (Fischer 2015: 188).

Over the last century, however, only small areas of forest patches of ʻōhiʻa confined to the slopes of the Kohala Mountains remain to represent the original vegetation. The koa variety (or close relative of koa) known as koaiʻa (*Acacia koaia*) dots the pastures on the slopes above the Kohala Mountain Road. The Waimea Plains themselves have been utterly transformed, and the location and nature of prehistoric interface between the native shrublands of the south and west and the mesic/wet forests of the north and east will probably never be known.

Today, no threatened or endangered plant species are known from the general area near the project corridor. No plant critical habitat is present on or near the project corridor. The closest plant critical habitat is found in various units about two miles west, for the plant *Achyranthes mutica*, found mainly in gulches in this area; two miles south, for a complex of rare plants found on cinder cones, including aupaka (*Isodendrion hosakae*), poʻe (*Portulaca sclerocarpa*) ʻihi (*Portulaca villosa*), nehe (*Melanthera venosa*) and Oʻahu cowpea (*Vigna o-wahuensis*); and two miles north, in wet forest high in the Kohala Mountains, where a complex of plants are protected in a large unit. (https://ecos.fws.gov/ecp/report/table/critical-habitat.html) (Figure 4).

General Bird Habitat

The quality of habitat for native birds is primarily determined by vegetation and the degree of disturbance. The general area is highly disturbed, and therefore the bird fauna along the project corridor would be expected to be highly diverse but dominated by non-native species that are adapted to urban environments and the urban/grassland interface. No critical habitat for birds is present near the project corridor (https://ecos.fws.gov/ecp/report/table/critical-habitat.html). The closest bird critical habitat is 12 miles away on Mauna Kea, for palila (*Loxioides bailleui*). Nevertheless, a few widespread native forest birds might be present, as nearby ʻōhiʻa forest patches – found less than a mile from the project corridor – may attract native birds that could wander into town. Furthermore, certain wide-ranging endangered species may fly over, and, in some cases, nest, roost, forage, or otherwise utilize some features of the habitat on the project corridor.

A number of native forest birds occur along the Hilo-Hāmākua-Kohala uplands coast within the elevational range of the project corridor. These include honeycreepers such as the ʻapapane

(*Himatione sanguinea*) and ‘amakihi (*Chlorodrepanis virens*), the ‘elepaio (*Chasiempis sandwicensis* – a monarch flycatcher), the ‘ōma‘o thrush (*Myadestes obscurus*), and the Hawaiian hawk (*Buteo solitarius*). All of these species generally require ‘ōhi‘a forest, but the hawk is known to breed successfully in both native and non-native forests. Bird survey work on the eastern end of the Island of Hawai‘i documented in Spiegel et al. (2006) indicate that in many lowland forests, ‘amakihi are the most common and widespread native birds and are significantly associated with ‘ōhi‘a. These lowland ‘ōhi‘a forests can also support endangered Hawaiian hawks which forage in forests nearby agricultural tracts and nest in tall trees. At low elevations there has been widespread recovery of both these species and a changing composition of the forest bird community; nevertheless, lowlands dominated by non-native vegetation and bird species continue to have few forest birds, with just a few exceptions. Rarer native forest bird species are only found in the montane forests along the Hāmākua Coast outside the mosquito belt (generally above 4,000 feet in elevation), where native plant resources are still present and *Culex* mosquitos are absent or scarce. These include the threatened ‘i‘iwi (*Drepanis coccinea*), as well as the endangered ‘akiapōlā‘au (*Hemignathus munroi*), Hawai‘i creeper (*Loxops mana*) and Hawai‘i ‘akepa (*Loxops coccineus*), which are not expected to be found in the Waimea area.

By contrast, some native waterbirds are common in both upland and lowland environments. In the uplands of Mauna Kea in general, waterbirds may be found in streams, estuaries, natural and artificial ponds, and wetlands. The most common native waterbird at lower elevations is the indigenous black-crowned night heron, or ‘auku‘u (*Nycticorax nycticorax hoactli*), a wetland bird. It is also not unusual to spot the endangered Hawaiian goose or nēnē (*Branta sandwicensis*), a wide-ranging bird unafraid of humans, in a variety of environments and elevations throughout the island. Both these species are likely occasionally present in Waikōloa Stream. Conceivably present in isolated ponds in the uplands on both the Kohala Mountain and Mauna Kea side is the endangered waterbird Hawaiian duck or koloa maoli (*Anas wyvilliana*). Because of the intense disturbance, it is highly unlikely to be present in Waikōloa Stream or other environments near the project corridor.

A very common native resident migratory bird is the Pacific golden-plover or kolea (*Pluvialis fulva*) (protected under the Migratory Bird Treaty Act). The kolea is often seen in grassy areas far from the coast throughout the region during its winter residency in Hawai‘i, even on medians and shoulders of busy roadways such as those on the project corridor.

While seabirds are rarely detected visually in this region, they may actually be transiting it at night. The Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian sub-species of Newell’s shearwater (*Puffinus newelli*), and the band-rumped storm-petrel (*Oceanodroma castro*) have been recorded over-flying various areas on the Island of Hawai‘i between mid-March and December each year. The Hawaiian petrel and band-rumped storm-petrel are listed as endangered, and Newell’s shearwater as threatened, under both federal and State of Hawai‘i endangered species statutes. The petrels and shearwaters hunt over the ocean during the day and fly to higher elevations at night to nest. The Hawaiian petrel and the band-rumped storm petrel generally nest well above 5,000 feet in elevation on the Big Island, but some nests have recently been found at lower elevations on Kohala volcano. Both the Newell’s shearwater and Hawaiian petrel are known to burrow under ferns on forested mountain slopes. These burrows are used year after year, usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, they need an open downhill flight path through which they can become airborne. Although once abundant on all the main Hawaiian islands, most Newell’s shearwater colonies today are found in the steep terrain between

500 to 2,300 feet on Kaua‘i. Hawaiian petrel colonies are found on Kaua‘i, Maui, Lana‘i, and Hawai‘i islands (https://www.fws.gov/pacificislands/fauna/newellsshearwater.html). Band-rumped storm petrels have recently been discovered to be nesting on the Mauna Loa side of the saddle between this mountain and Mauna Kea. The primary cause of mortality in all three of these species in Hawai‘i is predation by alien mammals at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals.

Mammals

Small Indian mongooses (*Herpestes a. auropunctatus*), mice (*Mus* spp.), rats (*Rattus* spp.), domestic and feral cats (*Felis catus*), feral pigs (*Sus scrofa*) and domestic dogs, (*Canis f. familiaris*) are known to be present in urban Waimea. None of these animals have conservation value and all are deleterious to native flora and fauna.

Hawai‘i’s only native land mammal is the endangered Hawaiian hoary bat or ōpe‘ape‘a (*Lasiurus cinereus semotus*). These solitary, nocturnal bats roost in tall shrubs and trees and rarely in lava tubes, cracks in rocks, or man-made structures. They are found at all elevations on Kaua‘i, Maui, Hawai‘i and O‘ahu. They roost in native and non-native vegetation alike, utilizing ‘ōhi‘a, hala, coconut palms, kukui, kiawe, lychee, avocado, shower trees, and even fern clumps, as well as possibly eucalyptus and sugi pine. Prime foraging areas include forest and pasture interfaces, forest road corridors, streams, bays, and inlets, and they are not unusual in urban areas They use echolocation to find and capture native and non-native night-flying insects such as moths, beetles, crickets, mosquitoes, and termites. Hawaiian hoary bats have adapted to urban and agricultural land uses fairly successfully, probably because of high levels of insect prey found there. Research indicates that bats reproduce in the lowlands but move to higher elevations during the winter, possibly because the cooler temperatures allow a lower metabolic rate while roosting. Maps produced by DLNR (2015) indicate that they have been sighted throughout all areas of the island, including Waimea.

Bats are vulnerable to habitat loss, pesticides, predation, snagging in barbed wire, and roost disturbance. During clearing, grubbing or tree trimming/cutting, the removal of tall, woody vegetation can temporarily displace bats using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season, from about June 1 to September 15 each year, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled. (DLNR- 2005; Bonaccorso 2010; https://www.pacificrimconservation.org/wp-content/.../Hawaiian%20Hoary%20Bat.pdf.

Reptiles and Amphibians

There are no native terrestrial reptiles or amphibians in Hawaiʻi. Several species of gecko, anole and skink, as well as a cryptic, wormlike blind snake, are common throughout the island. Bufo toads (*Bufo marinus*), bullfrogs (*Rana catesbeiana*) and the highly invasive coqui frog (*Eleutherodactylus coqui*) are found in all of the rainier lowlands of the island of Hawaiʻi. All are present in Waimea to some extent.

Invertebrates and Aquatic Fauna

Twenty-three species of invertebrate are currently listed as threatened or endangered in the State of Hawaiʻi (U.S. Fish and Wildlife Service 2020). These include a spider, an amphipod, a moth, snails, picturewing flies, yellow-faced bees and damselflies. Critical habitat for a Hawaiian picturewing fly, *Drosophila ochrobasis*, is present high in the Kohala Mountains, about five miles from the project corridor (https://ecos.fws.gov/ecp/report/table/critical-habitat.html). Most of these listed species are restricted to other islands or found at substantially higher elevations with intact native forest, often with specific host plant species. Invertebrate fauna in agricultural and urban areas are almost exclusively non-native species, because of the lack of native plants and the periodic application of insecticides. While few of Hawaiʻi's endangered insects could be found in the urban environment of the project corridor, two have at least some potential to be present and merit discussion: Blackburn's sphinx moth (*Manduca blackburnii*) and the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*).

Blackburn's sphinx moth is found at many locations throughout West Hawaiʻi and could conceivably be present under unusual circumstances in urban Waimea, although it is far more common in very dry areas of recent lava rather than the soil-covered slopes of Waimea. The adult moth feeds on nectar from native plants including beach morning glory (*Ipomoea pes-caprae*), ilieʻe (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*). Moth larvae historically fed primarily on the native aiea tree (*Nothocestrum* sp.), which was formerly common in dry to moist forests at elevations from 1,500 to 5,000 feet. Aiea has almost completely disappeared throughout the State, and none remains near Waimea. However, the moth has adapted to feed on a relative of aiea in the Solanaceae family, the non-native tree tobacco (*Nicotiana glauca*). This highly invasive plant rapidly colonizes disturbed areas such as open fields and roadway margins. Tree tobacco is very common about five miles southwest of Waimea.

The orangeblack Hawaiian damselfly lives in streams and wetlands at locations around the coastline on the Island of Hawaiʻi, primarily in estuaries and ponds at sea level. On other islands, it has been sighted as high as 3,280 feet above sea level, which is above the project corridor's elevation. According to conservationists, its limited habitat and small scattered populations may affect long-term stability. The species is susceptible to the effects of habitat loss and introduced species (https://xerces.org/orangeblack-hawaiian-damselfly/; https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=I063; DLNR-DOFAW 2013; Polhemus 1993 and 1995; Polhemus and Asquith 1996).

A December 2001 insect survey by the firm AECOS of Waikōloa and Keanuʻiʻomanō Streams was conducted for the Department of Hawaiian Home's (DHHL) Lālāmilo housing project, west of the project corridor (cited in Hawaiʻi County P&R Department of Parks and Recreation 2011). AECOS surveyed Waikōloa Stream up into Waimea Town. The aquatic macrofauna of the Waikōloa Stream system within a four-mile stretch including this area was described as sparse. A significant portion of the stream fauna observed during the surveys was aquatic insects. Adult dragonflies, both green darner (*Anax junius*) and globe skimmer (*Pantala flavescens*) were regularly encountered flying along the stream bed. A native Megalagrion damselfly (*M. blackburni*) was encountered during the 2000 survey along Waikōloa Stream near Waimea Town. However, the likelihood that the stream supported endangered damselflies was considered low.

Other aquatic biota identified during the AECOS surveys included aquatic snails, flatworms, and leeches. No fish of any kind were observed in the entire stream survey, although both guppies (*Poecilia reticulata*) and mosquitofish (*Gambusia affinis*) – both considered invasive – are reported from the streams here. No federally listed threatened or endangered species of aquatic animals were found in or around the Waikōloa or Keanu‘i‘omanō Stream areas during either the 2001 survey or an earlier stream survey of 2000. However, the Department of Land and Natural Resources, Division of Aquatic Resources (DLNR-DAR) has found that the endemic goby, ‘o‘opu ‘alamo‘o (*Lentipes concolor*) utilizes the stream channel to access the permanently flowing, upper reaches of Waikōloa Stream in the Kohala Mountains.

Current Vegetation and Flora on the Improvements Corridor

Our team of two biologists spent a portion of one day conducting botanical surveys along the length of the project corridor, covering the right-of-way as well as immediately adjacent property (i.e., within 10-20 feet of the right-of-way). The edge of the right-of-way was not marked in any way, so the boundary was approximated by referring to utility poles, presumably in the right-of-way, and private structures such as fences, walls and buildings, presumably outside the right-of-way. The current vegetation is completely “managed” by vegetation control or landscaping. The photos in Figure 3 provide a sample of the vegetation.

The only unmanaged vegetation in the area is the riparian area adjacent to the Waikōloa Stream Bridge. In the area of the corridor, the stream has a concrete bridge and culvert. Plant species are all non-native, including autograph tree (*Clusia rosea*), Christmas berry (*Schinus terebinthifolius*), honohono (*Commelina diffusa*), castor bean (*Ricinus communis*) and Guinea grass (*Megathyrsus maximus*). No valuable native, scenic or cultural vegetation is present here, and in any event, no project activities are expected to affect this area.

A full list of the native flora found on the property is contained in Table 1, which also includes culturally important Polynesian introductions. In general, most vegetation on the project corridor is non-native, but native plants, nearly all of which have been deliberately planted as part of landscaping, make up a very significant element. Within the right-of-way itself, the main native elements are ‘ōhi‘a trees, which are present on Kawaihae Road near Waimea Park and also on Mamalahoa Highway near the signalized intersection. Many yellow-blossomed ‘ōhi‘a are present, in addition to the more common red flowers (Figures 3a, 3b, 3e). Most of the several hundred individuals of native trees and shrubs, including ‘ōhi‘a, koa, hāpu‘u, koai‘a and koki‘o ke‘oke‘o (*Hibiscus waimeae* subsp. *waimeae*) are just off the right-of-way in adjacent landscaping (Figures 3c, h, i). A few patches landscaped with kupukupu (*Nephrolepis cordifolia*), ‘ilima and pōhinahina (*Vitex rotundifolia*) (Figure 3d) are also present just off the right-of-way. A few common smaller native plants grow semi-naturally in and out of the right-of-way, including the fern palaʻa (*Sphenomeris chinensis*), the sedge *Cyperus polystachyos*, and the fern ally moa (*Psilotum nudum*).

Several Polynesian introductions are also present in areas just outside the right-of-way, notably kalo (*Colocasia esculenta*), kukui (*Aleurites moluccana*), and ti (*Cordyline fruticosa*). Street trees of non-native, non-Polynesian origin, more valuable for their scenic and historic character than for botanical interest, include sugi "pine" (*Crytptomeria japonica*), pepper tree (*Schinus mollus*), Taiwanese flowering cherry (*Prunus campanulata*), olive (*Olea europea*), coral tree (*Erythrina crista-galli*), avocado (*Persea americana*) and eucalyptus (*Eucalyptus* spp.) (Figures 3b, f, j).

Taken all together, the native, Polynesian and non-native vegetation within and directly adjacent to the right-of-way is a significant amenity that helps give Waimea its unique and charming character.

An issue for projects that may affect ʻōhiʻa trees has recently surfaced. Two species of fungus called *Ceratocystis lukuohia and C. huliohia* produce a disease that is new to science and new to Hawaiʻi – Rapid ʻŌhiʻa Death (ROD) (Hawaiʻi DOFAW 2017). This disease has killed hundreds of thousands of ʻōhiʻa trees across more than 34,000 acres of the Big Island. It was first discovered in Lower Puna. The ʻōhiʻa trees on the project corridor are regularly monitored and appear to be healthy at present, but ROD has affected trees in the Parker Ranch Shopping Center. Projects that harm or relocate ʻōhiʻa trees can spread the disease, and mitigation measures are recommended, although it is important to recognize that treatment protocols are evolving. These are discussed below, in the findings and recommendations section.

Threatened and Endangered Plant Species

No listed or proposed threatened or endangered plant species were found. Given the current context, in an urban corridor devoted to transportation, it is unlikely that one would be found. We did not observe any individuals of the endangered maʻo hau hele tree (*Hibiscus brackenridgei* subsp. *brackenridgei*), although it is very commonly cultivated in Waimea.

Fauna and Native Animal Species Habitat

Birds

Only a few species of birds were detected during the survey, most of them non-native and typical of those found in urban habitats near pastures: Japanese white-eye (*Zosterops japonicus*), mourning dove (*Zenaida macroura*), zebra dove (Geopelia striata), scaly-breasted munia (*Lonchura punctulata*), common myna (*Acridotheres tristis*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), African silverbill (*Lonchura cantans*) and domestic chicken (*Gallus gallus domesticus*). The migratory resident Pacific golden-plover was observed walking and flying low over grassy areas in and particularly adjacent to the right-of-way. It is likely that repeated or extended observations at different times of the day and year would generate a much larger list of non-native birds, including cattle egrets (*Bubulcus ibis*) and even a few native birds such as Hawaiian hawks.

As stated previously, the elevation of the land at 2,650 feet above sea level is at the lower end of the range of many native forest birds, including the Hawaiʻi ʻamakihi, ʻelepaio, ʻiʻiwi, ʻapapane, and

ʻōmaʻo. However, the lack of native forest cover means that such birds are unlikely to be found, and several bird observations at different times of the day did not detect them.

The seabirds discussed in the previous section may be present in this part of Kohala may overfly, roost, nest, or utilize resources here, including the endangered Hawaiian petrel and band-rumped storm petrel, and the threatened Newell's shearwater. No advanced seabird detection technologies (e.g., radar) were employed, and it is unknown whether these seabirds overfly the project corridor. Recent radar and acoustic monitoring on Mauna Kea indicates that at least some seabirds may be nesting there and utilizing a flyway over Waimea, among other paths (Dr. Patrick Hart, pers. comm. to author, August 2019).

Hawaiian Hoary Bat

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is ubiquitous throughout the Island of Hawaiʻi, and they are thus presumed to be present on the project corridor. These bats are known to favor habitat near water bodies and forest/pasture interfaces, although they are also observed in villages and small cities. Bats may roost and forage for flying insects near the large groves of trees that are present *mauka* of the project corridor on the foothills of the Kohala Mountains. It is even possible that they could roost in some of the trees and shrubs taller than 15 meet within the project corridor itself. In addition to unaided visual detection in the dawn and dusk hours, Hawaiian hoary bats can be detected by night vision binoculars and goggles using available light; thermal infrared scopes and cameras; sound detectors using high-frequency ultrasonic microphones with a range above 20 kilohertz; and modified marine surveillance radar. Our visual-only surveys took place in daylight, and none of these techniques were employed, because the bats are presumed to be present and no critical information for a biological reconnaissance of this urban project corridor would be obtained by employing the technologies.

Introduced Mammals, Reptiles, and Amphibians

The only live mammals seen during the survey were wild small Indian mongooses, domestic cats and domestic dogs. Other mammals, including rats, mice and pigs, are probably occasionally present in the project corridor. No reptiles and amphibians were detected during the survey, although night survey might have detected coqui frogs. As stated above, none of these animals have conservation value and all are deleterious to native flora and fauna.

Invertebrates and Aquatic Fauna

No systematic survey of invertebrates was conducted, given the low probability of the presence of T&E or rare species, and the low likelihood that project activities would adversely affect them.

No individuals within Solanaceae family, including the known host for the endangered Blackburn's sphinx moth, tree tobacco, were found. It is very unlikely that the moth utilizes the corridor as habitat.

The stream surveys for insects cited above in the habitat discussion indicate that the riparian environment present around Waikōloa Stream is unlikely to house the endangered orangeblack damselfly or other endangered damselflies. The stream does have at least some value for transiting o‘opu ‘alamo‘o fish. It is thus important to ensure that the stream area is not affected by project activities and that standard best management practices that keep construction runoff out of streams are fully implemented, as discussed below.

Findings and Recommendations

No threatened or endangered plant species were detected on or near the project corridor, and there is no plant critical habitat nearby. Nonetheless, the vegetation of the project corridor has more conservation value than the typical urban roadway, because of the attention paid to native landscaping and the resulting large number of native trees and shrubs that line the road, both in and out of the right-of-way. Although this vegetation is neither a native forest nor important native animal habitat, it has value for scenic, educational, civic pride, and cultural reasons. There is minimal habitat value for native birds, bats or terrestrial invertebrates, but there is some possibility that bats roost in trees in the project corridor and Waikōloa Stream is a transiting habitat for a somewhat rare native goby fish.

To avoid impacts to the Hawaiian hoary bat:

- We recommend that woody vegetation taller than 15 feet not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

To avoid impacts to threatened or endangered seabirds:

- If any permanent or temporary outdoor lighting is incorporated in the project, it may attract endangered seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these seabirds through interaction with outdoor lighting, we recommend no construction lighting or unshielded equipment maintenance lighting after dark between the months of April and October. All permanent lighting should be shielded in strict conformance with the Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

To avoid impacts related to the spread of Rapid ‘Ōhi‘a Death, the following mitigation protocol is proposed, which should be refined after review by DLNR-DOFAW and the U.S. Forest Service:

- Decontaminate boots and work tools before and after working in an area with ‘ōhi‘a trees;
- Any ‘ōhi‘a trees that planned for removal should be stacked and removed of by onsite chipping conducted according to the latest protocol and then disposed of in such a way that it does not spread ROD; to the greatest extent feasible, do not remove from project site.
- Professionally treat any unavoidable scars on ‘ōhi‘a trees that result from project activities to prevent infestation of the fungus.

During construction, efforts should be made to minimize impact on water quality of Waikōloa Stream. U.S. Fish and Wildlife Service-recommended standard practices to minimize degradation of water quality include the following:

- Turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and curtailment of work during rainy weather conditions.
- No project related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (stream channels, wetlands, etc.).
- No contamination (trash or debris disposal, non-native species introductions, attraction of non-native pests, etc.) of adjacent aquatic environments (stream channels, wetlands, etc.) should result from project-related activities. This should be accomplished by implementing a litter-control plan and developing a Hazard Analysis and Critical Control Point Plan to prevent attraction and introduction of non-native species.
- Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed.
- Any under-layer fills used in the project should be protected from erosion with stones (or core-loc units) as soon after placement as practicable.
- Any soil exposed near water as part of the project should be protected from erosion (with plastic sheeting, filter fabric, etc.) after exposure and stabilized as soon as practicable (with native or non-invasive vegetation matting, hydroseeding, etc.).

Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. The findings of this survey must therefore be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species.

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Xerxes Society: https://xerces.org/orangeblack-hawaiian-damselfly/

Figure 1 Project Corridor

Figure 2a Project Improvements

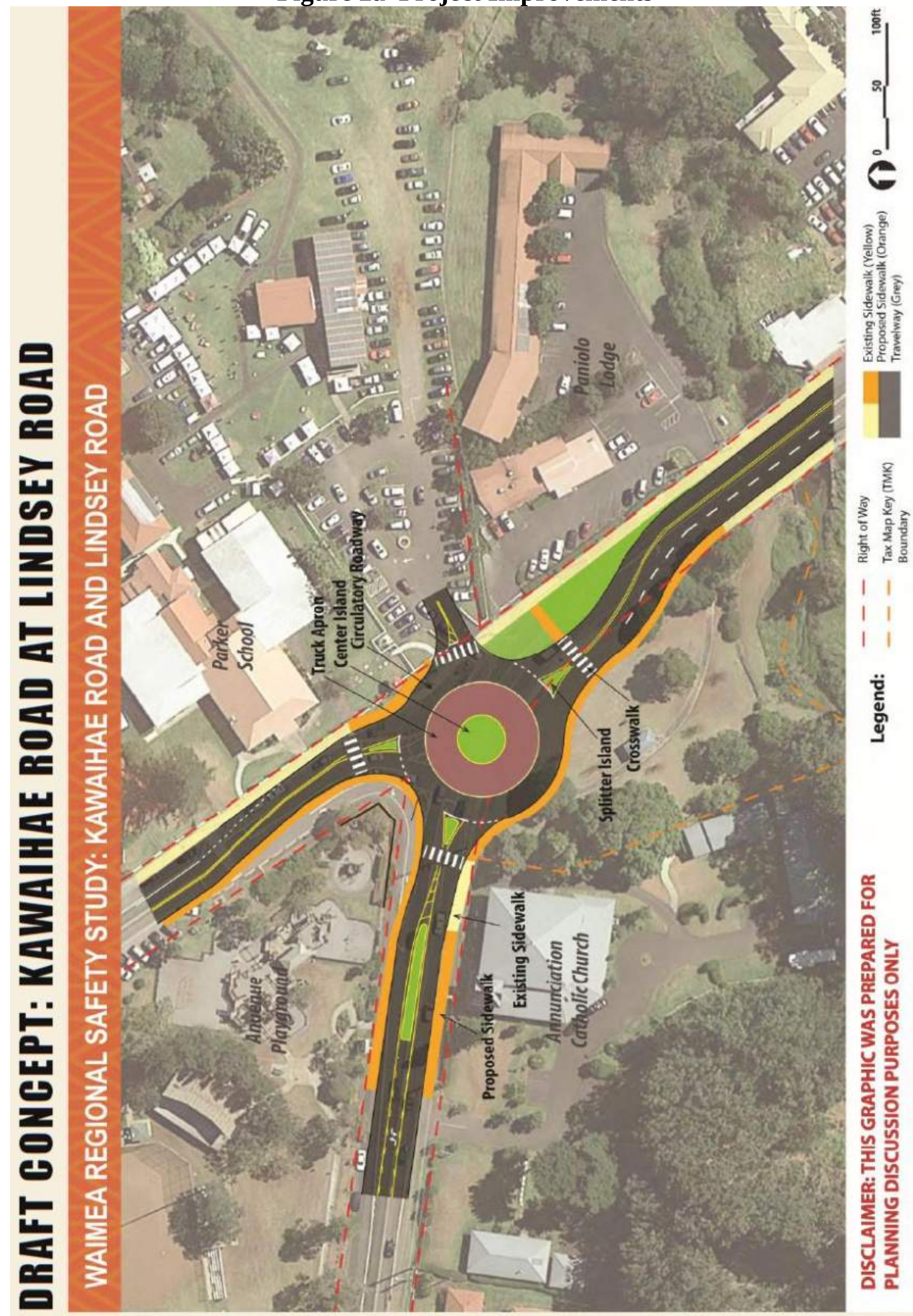

Figure 2b Project Improvements

Figure 2c Project Improvements

Source: SSFM International Inc.

Figure 3. Project Site Photos

3a. ‘Ōhi‘a trees line the project corridor for much of its length ▲
▼ 3b. Most ‘ōhi‘a trees are just outside ROW; some inside, as here

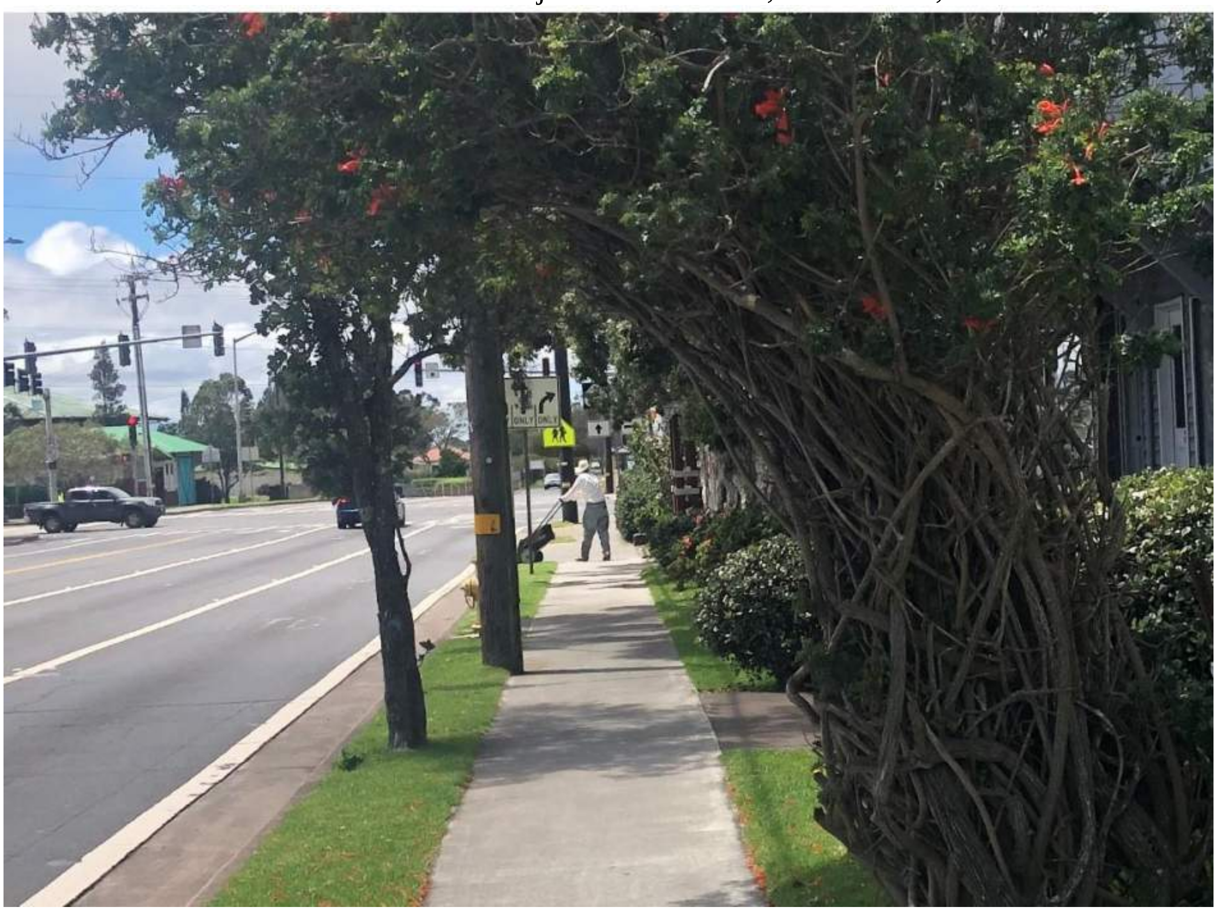

Figure 3. Project Site Photos

3c. Landscaping with native white hibiscus just off ROW ▲

▼ 3d. Native pōhinahina in landscaping just off ROW

Figure 3. Project Site Photos

3e. The treasured yellow-flowered ʻōhiʻa has been planted in many areas ▲

▼ 3f. Non-native coral tree is typical of scenic street trees that extend into ROW

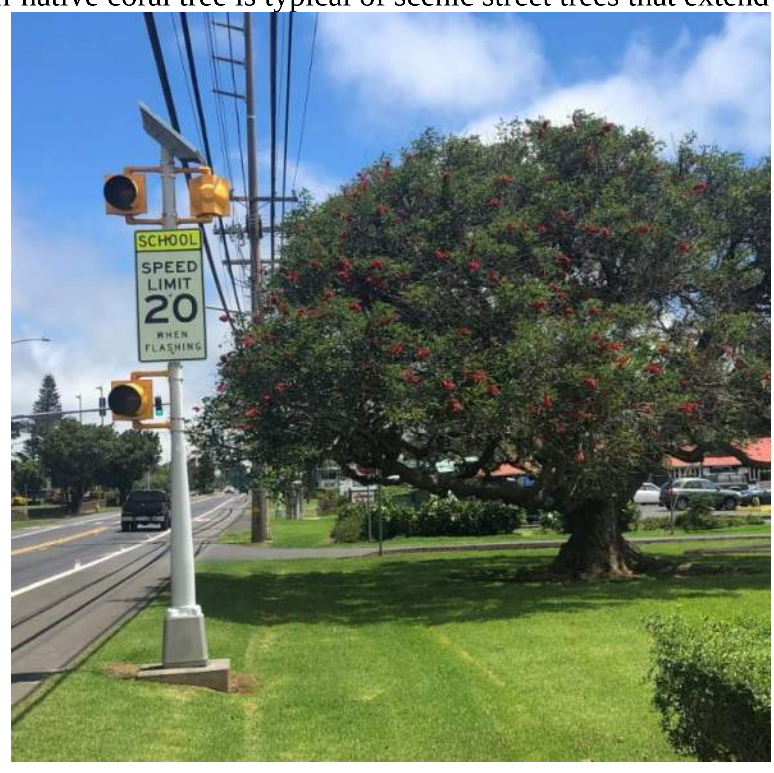

Figure 3. Project Site Photos

3g. Riparian environment at Waikōloa Stream ▲

▼ 3h. Native koa and koaiʻa trees at Ānuenue Playground

Figure 3. Project Site Photos

3i. Koa and koaiʻa trees just off ROW near Waimea School ▲

▼ 3j. Scenic cypress street trees

Figure 4. Critical Habitat in Vicinity of Project Corridor

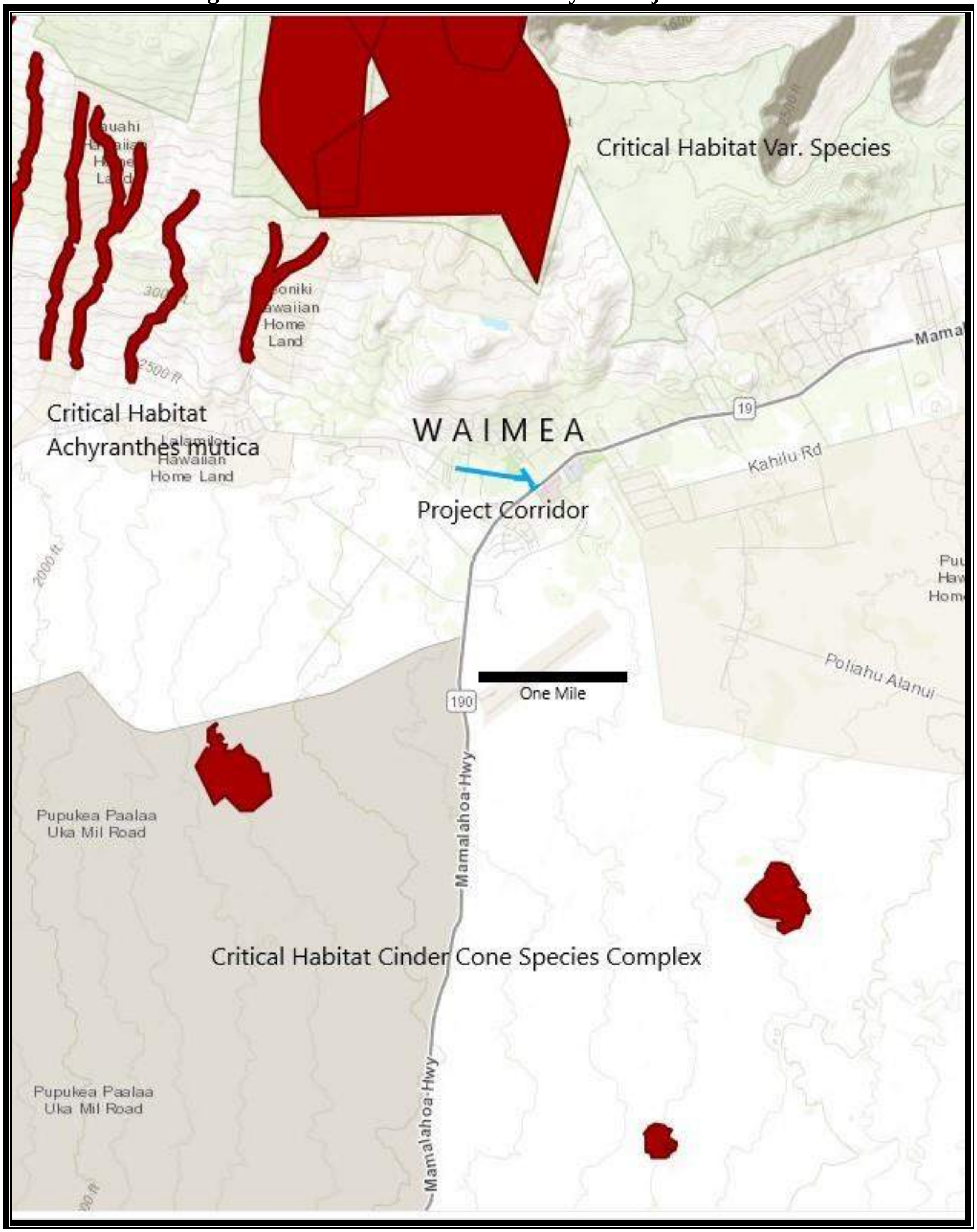

Table 1
Native/Polynesian-Introduced Plants Observed on/near Project Corridor

Scientific Name	Family	Common Name	Life Form	Status*
NATIVES				
Acacia koa	Fabaceae	Koa	Tree	E
*Acacia koaia**	Fabaceae	Koaiʻa	Tree	E
Cibotium menziesii	Cibotiaceae	Hapuʻu iʻi	Fern	E
Cyperus polystachyos	Cyperaceae	Pycreus	Sedge	I
Hibiscus waimeae subsp. *waimeae*	Malvaceae	Kokiʻo keʻokeʻo	Shrub	E
Metrosideros polymorpha	Myrtaceae	ʻŌhiʻa	Tree	E
Nephrolepis cordifolia	Lomariopsidaceae	Kupukupu	Herb	I
Vitex rotundifolia	Lamiaceae	Pōhinahina	Herb	I
Psilotum nudum	Psilotaceae	Moa	Fern Ally	I
Sida fallax	Malvaceae	Ilima	Shrub	I
Sphenomeris chinensis	Lindsaeaceae	Palaʻa	Fern	I
POLYNESIAN INTRODUCTIONS				
Aleurites moluccana	Euphorbiaceae	Kukui, Candlenut	Tree	P
Colocasia esculenta	Araceae	Kalo, Taro	Shrub	P
Cordyline fruticosa	Agavaceae	Ki, Ti	Shrub	P
Ipomoea batatas	Convolvulaceae	ʻUala, Sweet potato	Vine	P
Saccharum officinarum	Poaceae	Ko, Sugar cane	Herb	P

* Usually considered a subspecies of Acacia koa.
E = endemic I = indigenous P = Polynesian introduction

Notes on native and Polynesia plant locations:

Parker Ranch Center – 5 ʻŌhiʻa trees on sidewalk and within landscaped apron
Bank of Hawaiʻi – 8 ʻŌhiʻa on Mamalahoa and 4 on Lindsey Road side; *Psilotum nudum* in planters
Lindsey Road Māmalahoa Highway corner (SW corner) – Large Koaiʻa Tree
Firehouse Gallery – 4 ʻŌhiʻa trees
Waimea Elementary – Kō planted, large Koa tree
Shell Gas station – 6 ʻŌhiʻa trees in surrounding lot
Stream Crossing (west side) – Koa tree at bridge approximately 35' from sidewalk
Annunciation Catholic Church – 5 ʻŌhiʻa trees in front; 6 ʻŌhiʻa trees in parking area within 25' of sidewalk
Longs – 50-60 Kokiʻo keʻokeʻo planted near sign and parking lot border
Redwater Café – One ʻIlima in planter box near restaurant
HPA - 3 ʻŌhiʻa trees; 20 + Kokiʻo keʻokeʻo planed on interior of rock wall; Hāpuʻu; Kupukupu
Isaacs Art Center – Hāpuʻu in front; Koaiʻa to the north on the east boundary
County Park – 12 ʻŌhiʻa trees along Kawaihae Road near soccer fields
Ānuenue Park – 5 large Koaiʻa trees; 4 ʻŌhiʻa trees; 2 Koa trees within park on Lindsey Road side
Parker School – Hāpuʻu, Kalo, ʻUala planted near buildings

APPENDIX E

Cultural Impact Assessment

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A Cultural Impact Assessment for the Waimea Roadway Improvements Project

TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.)

Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

Prepared For:

SSFM International, Inc.
99 Aupuni Street
Hilo, HI 96720

May 2020

ASM affiliates
Archaeology • History • Anthropology • Architectural History
Hilo Office: (808) 969-6066 Fax: (808) 443-0065
507-A E. Lanikaula Street, Hilo, HI 96720
Honolulu Office: (808) 439-8089 Fax: (808) 439-8087
820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 34580.00

A Cultural Impact Assessment for the Waimea Roadway Improvements Project

TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.)

Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

Prepared by:
Lokelani Brandt, M.A. and Lauren Kepaʻa, B.A

ASM affiliates

CHAPTERS

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1. INTRODUCTION

At the request of SSFM International, Inc., on behalf of the State of Hawai‘i Department of Transportation (HDOT), ASM Affiliates (ASM) has prepared this Cultural Impact Assessment (CIA) for the proposed Waimea Roadway Improvements Project (referred to hereafter as the “proposed project”). The proposed project includes improvements to existing State-owned roadways in Waimea Town, South Kohala District, Island of Hawai‘i and on portions of Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-004:027, 6-5-005:021, 6-5-005:025, and 6-5-007:001 shown in Figures 1, 2, and 3.

The expenditure of state funds qualifies the proposed project as an endeavor subject to the Hawai‘i Environmental Policy Act (HEPA) as codified in Hawai‘i Revised Statutes (HRS) Chapter 343. This CIA study is intended to inform an Environmental Assessment (EA) conducted in compliance with HRS Chapter 343; and is conducted pursuant to Act 50 and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (OEQC 1997). Act 50, which was proposed and passed as Hawai‘i State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, specifically acknowledges that State’s responsibility to protect native Hawaiian cultural practices. Act 50 further states that “environmental assessments . . . should identify and address effects on Hawaii’s culture, and traditional and customary rights” and that “native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the ‘aloha spirit’ in Hawai‘i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.”

The current report is divided into four main sections, beginning with an introduction and general description of the proposed project area. To provide the physical and cultural context of the proposed project area, section two of this report includes a detailed culture-historical background, which includes background information for Lālāmilo Ahupua‘a, Waimea Town and at times the greater South Kohala District. This section also includes a presentation of prior archaeological and cultural studies conducted within the vicinity of the proposed project area. The methods and results of the consultation process are presented in section three of this report and section four includes a discussion of potential cultural impacts as well as appropriate actions and strategies to mitigate any such impacts.

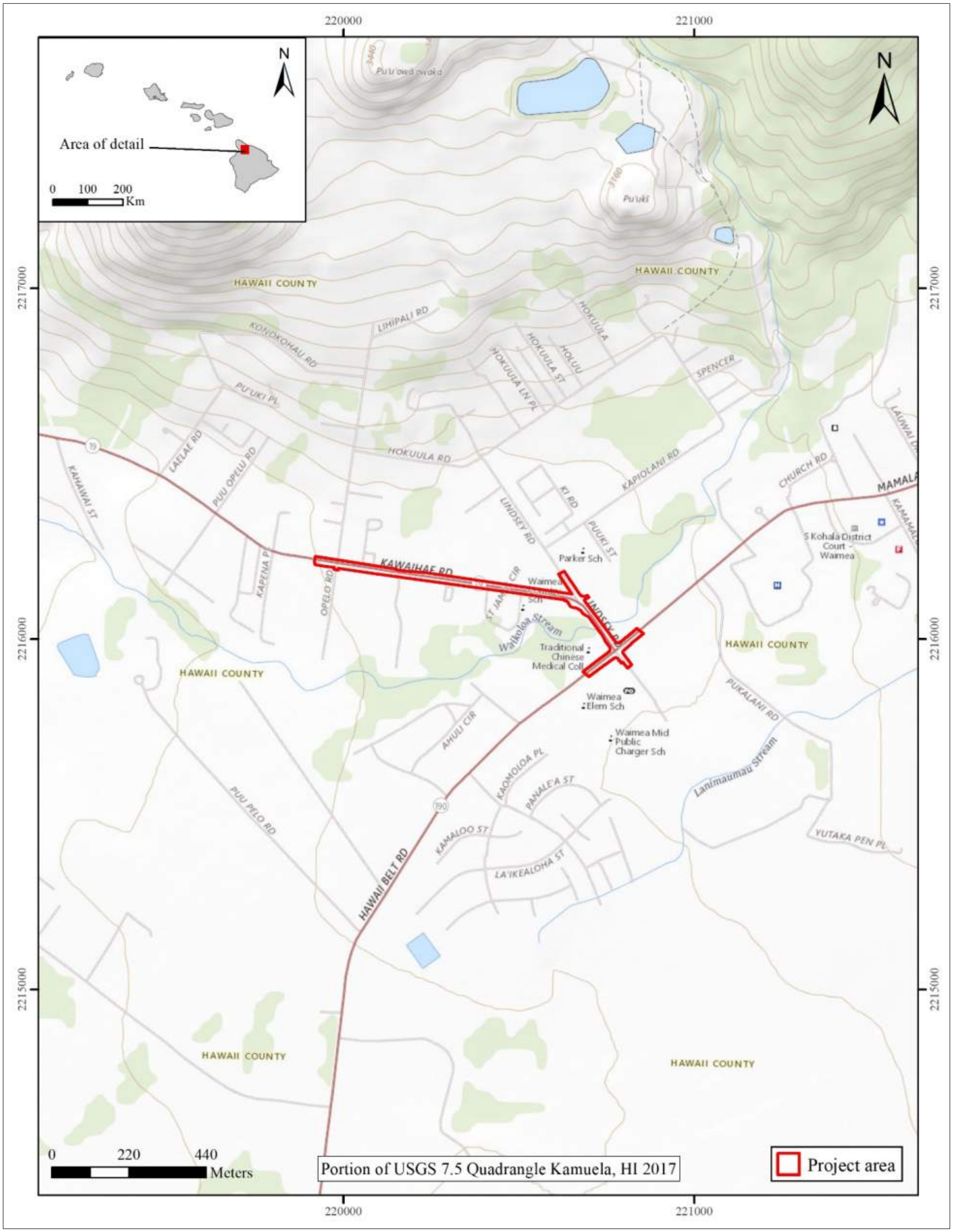

Figure 1. Project area plotted on a portion of the 2017 U.S.G.S. Kamuela quadrangle.

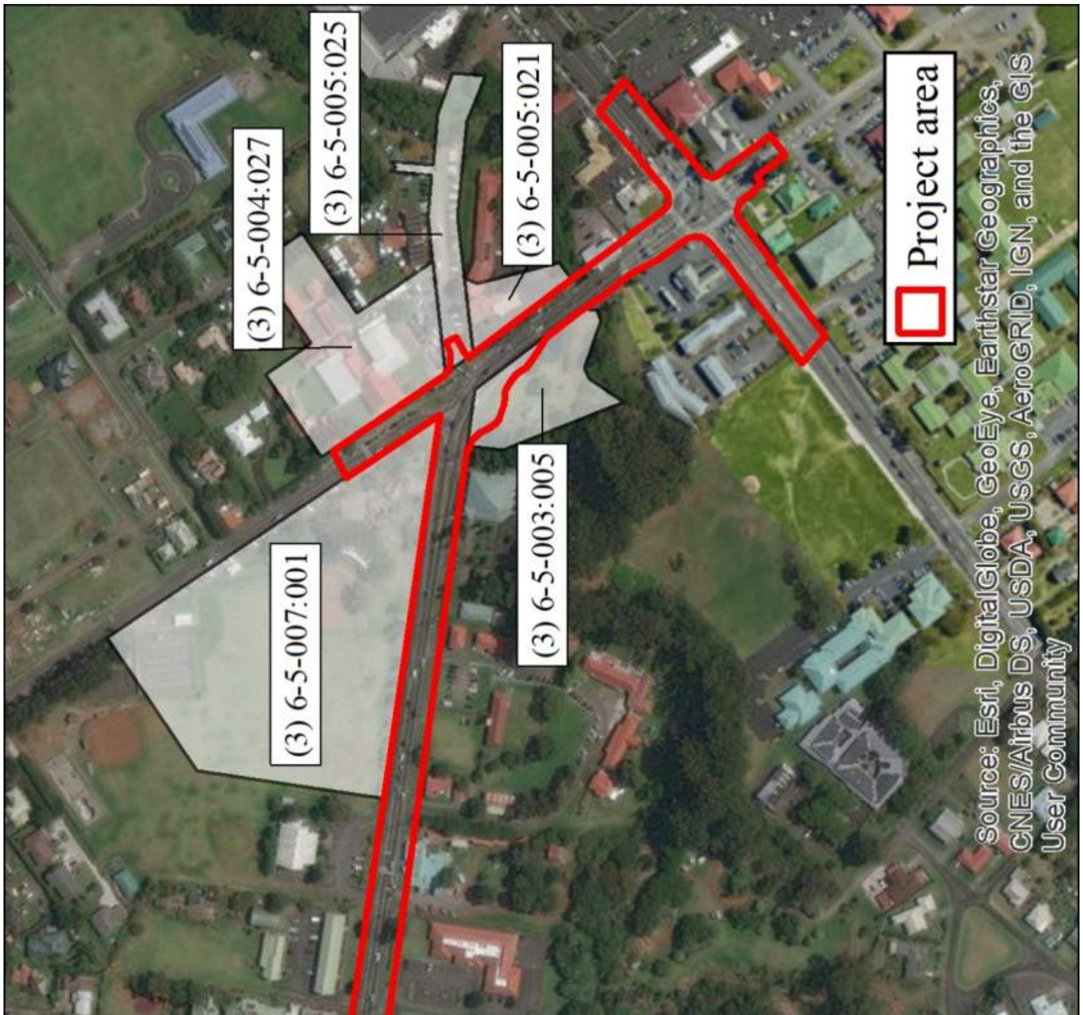

Figure 2. County of Hawaiʻi Tax Map Key parcels included in the project area.

Figure 3. Google Earth™ satellite image showing the project area.

PROPOSED DEVELOPMENT ACTIVITY

HDOT Highways Division plans to implement safety and operational improvements along existing State-owned roadways in Waimea. Improvements would include installation of a roundabout at the intersection of Kawaihae Road and Lindsey Road and multimodal treatments to Kawaihae Road between Lindsey Road and Opelo Road, and also to the Māmalahoa Highway and Lindsey Road intersection. The roundabout (Figure 4) would be a 125-foot inscribed circle and would include sidewalks, bikeways, and crosswalks. The sidewalk and bikeway would be combined into a single raised sidewalk. The north leg of Lindsey Road would handle the transition into the existing travelway with Parker School‘s drop-off lane. Improvements to Kawaihae Road between Lindsey Road and Opelo Road (Figure 5) would include the installation of a center turn lane, sidewalks, and bikeways on both sides of the road, marked crosswalks with a rectangular rapid flash beacon at Opelo Road, and a gateway feature west of Opelo Road. Recommended improvements to the Māmalahoa Highway and Lindsey Road intersection (Figure 6) include the installation of raised pedestrian islands with bollards, reconfigured lanes, and bicycle facilities, as well as optimizing signal timing. The project is currently in the design phase, and the extent and depth of ground disturbance are not yet determined. Ground disturbance, however, is not expected to exceed previous ground disturbance within the State-owned right of way or within portions of adjacent parcels that will be acquired for the project. Māmalahoa

Figure 4. Kawaihae Road and Lindsey Road roundabout conceptual plan.

Figure 5. Kawaihae Road and Opelo Road conceptual plan.

Figure 6. Māmalahoa Highway and Lindsey Road conceptual plan.

PROJECT AREA DESCRIPTION

The current project area consists of approximately 4.0 acres comprising portions of the State-owned right of way for Lindsey Road, Kawaihae Road, and Māmalahoa Highway, along with portions of five TMK parcels (Table 2, see Figure 2) adjacent to the current right of way that will be acquired for the project. The project area is located at elevations ranging from 2,635 to 2,675 feet above sea level on the Waimea Plain, approximately 15.9 kilometers (9.8 miles) from the coast at Kawaihae (to the west) and 13.7 kilometers (8.6 miles) from the coast at Waipiʻo (to the northeast). Surface geology in the current project area is mapped as Hāmākua lava flows of alkali and transitional basalt (labeled as "Qhm" in Figure 7) dating between 64,000 and 300,000 years old. Soils in the current project area (Figure 8) are primarily derived from a parent material of volcanic tephra formerly referred to as "Pahala Ash" (Sato et al. 1973:100). In the current USGS soil survey (Soil Survey Staff 2018), the Phase 1 portion and most of the Phase 2 portion of the project area are mapped as Waimea medial very fine sandy loam, 0 to 6 percent slopes (labeled as "383" in Figure 8). The far eastern side of the Phase 2 portion of the project area is mapped as Kikoni medial silt loam, 0 to 3 percent slopes (labeled as "493" in Figure 8). These soils are highly erodible, susceptible to high seepage loss, and have unstable slopes (Sato et al. 1973), which Burtchard and Tomonari-Tuggle (2005:7) note are "hardly the kind of soils that should be associated with extensive and long-term irrigation." The climate on the Waimea Plain is generally cool and moist year-round. Mean annual temperatures range between 60 and 70 degrees Fahrenheit, with low temperatures in the winter months reaching the freezing point (Giambelluca et al. 2014). The mean annual rainfall is 833.9 millimeters (32.83 inches), with heavier rain the winter. Waikōloa stream is the prominent hydrological feature near the current project area (Figure 9).

Table 1. Tax Map key Parcels included in the project area.

TMK	*Owner(s)*	*Notes*
(3) 6-5-003:005	Parker Land Trust	Lanakila Park
(3) 6-5-004:027	Parker School	
(3) 6-5-005:021	Kanilehua Traders LLC, Owyhee Trading Company	
(3) 6-5-005:025	Parker School	
(3) 6-5-007:001	State of Hawaiʻi	Waimea Park

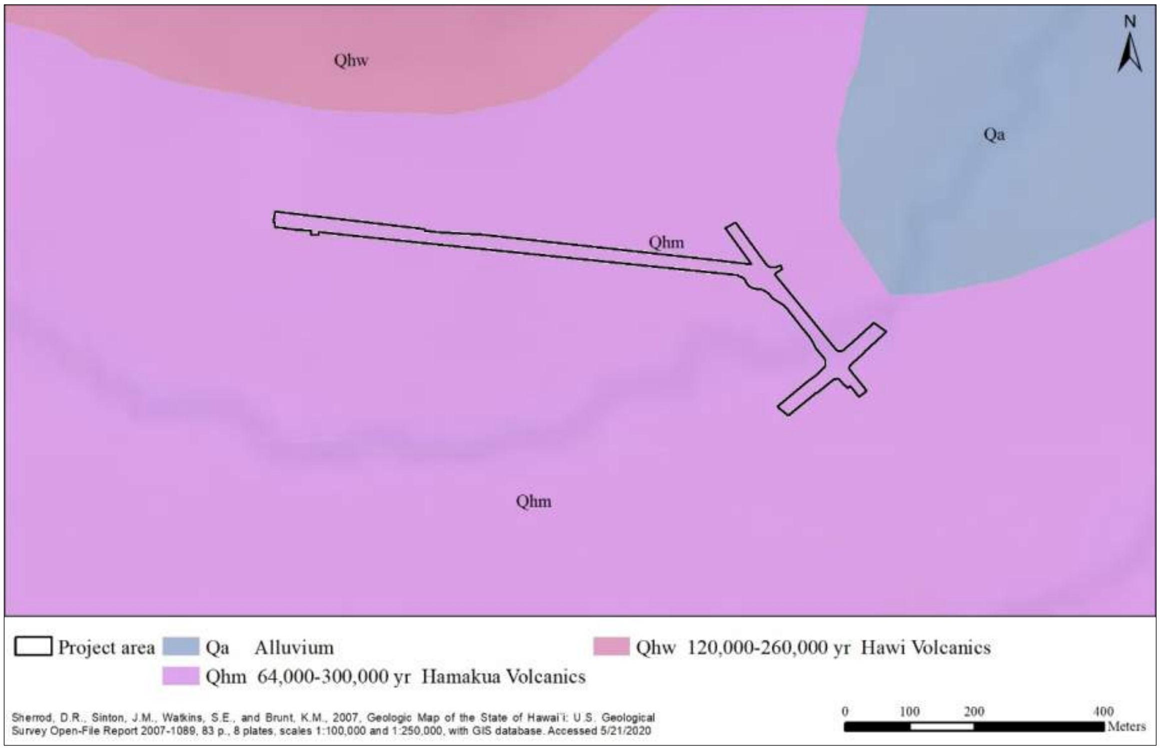

Figure 7. Geology in the current project area.

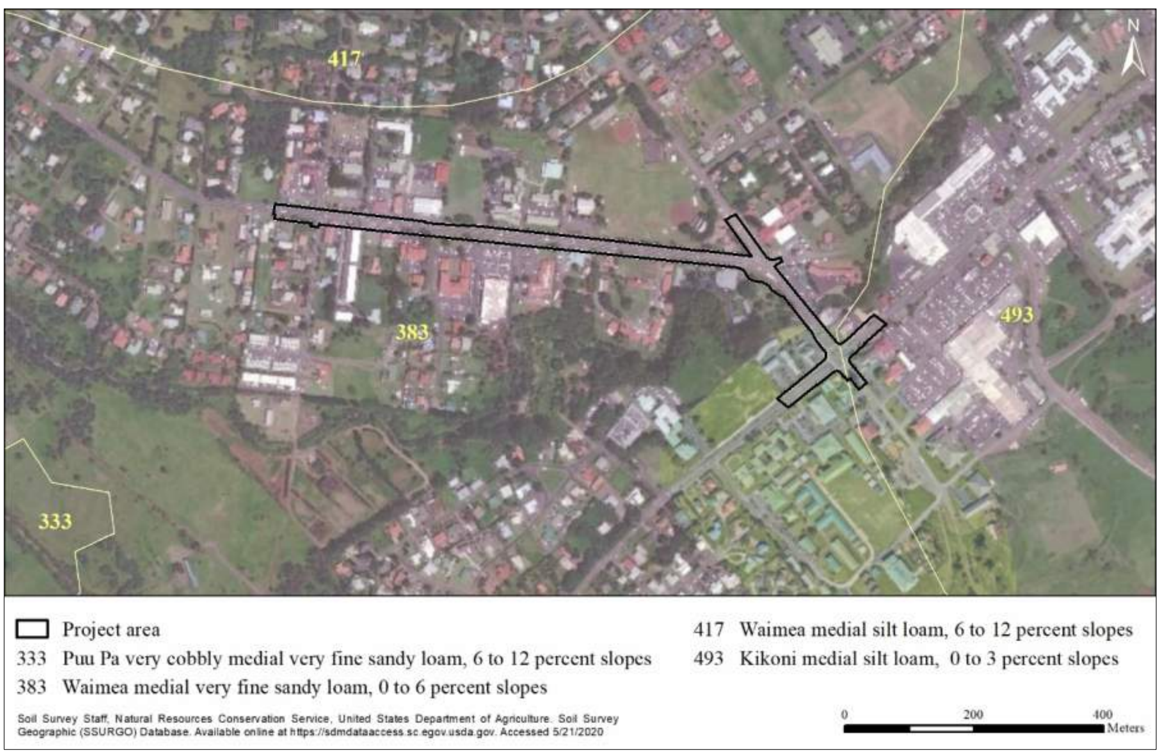

Figure 8. Soils in the project area.

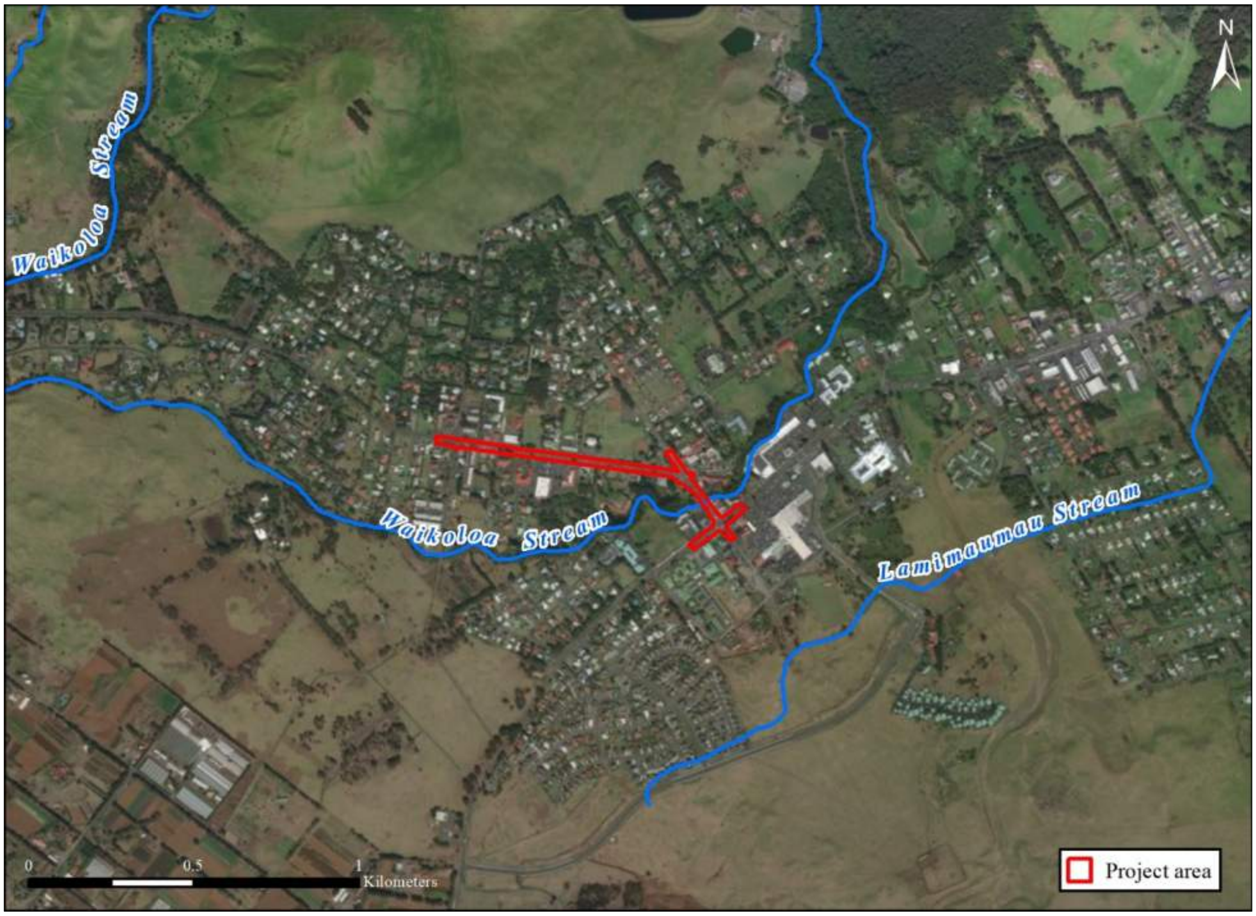

Figure 9. Streams within the project area (outlined red) and the nearby vicinity.

The entire project area has been previously developed. The majority of it contains sixty-foot wide asphaltic concrete (AC) paved roads. Outside of the paved travel lanes on Lindsey Road and Kawaihae Road/Māmalahoa Highway (Figures 10, 11, 12, and 13), there are concrete sidewalks for most of the project area's length. At the Lindsey Road-Kawaihae Road intersection, the concrete sidewalks transitions into an asphalt paved road shoulder of various widths and continue as such west of the Kawaihae Road-Opelo Road intersection (Figures 14, 15, and 16). Portions of the shoulder lanes along the Kawaihae Road portion of the study area are bordered by lawns and paved driveways. A portion of the project area on Lindsey Road crosses Waikōloa Stream over Waikōloa Bridge (see Figure 12), which was widened to its current configuration in the 1970s.

A portion of the project area that could contain the roundabout at the intersection of Lindsey Road and Kawaihae Road extends into Lanakila Park (Figure 17), located on TMK: (3) 6-5-003:005. A portion of the aforementioned TMK is also part of the roughly 0.42-acre Land Commission Award number 3785 awarded to Olepau in the mid-19th century. Within the park, the terrain is flat, apparently graded during the landscaping. Ground cover consists of a manicured grass lawn, with native and introduced ornamental trees planted throughout the park. A concrete and rock wall surrounds the park. There is a cobble-paved walkway that crosses the park, connecting a wooden rest area and concrete benches to park entrances on Lindsey Road and Kawaihae Road.

Figure 10. Kawaihae Road-Lindsey Road intersection, view to the view to the northwest.

Figure 11. Kawaihae Road-Lindsey Road intersection with Hokūʻula and Puʻu ʻOwaʻowaka in the background, view to the north from Lanakila Park.

Figure 12. Lindsey Road at the Waikōloa Stream bridge with Lindsey Road-Māmalahoa Highway intersection in the background, view to the southeast.

Figure 13. Lindsey Road-Māmalahoa Highway intersection, view to the east.

Figure 14. Westbound on Kawaihae Road, west of the Opelo Road-Kawaihae Road intersection, view to the east.

Figure 15. Westbound on Kawaihae Road, east of the Opelo Road-Kawaihae Road intersection, view to the east.

Figure 16. Kawaihae Road-Opelo Road intersection, view to the north.

Figure 17. Lanakila Park adjacent to Kawaihae Road-Lindsey Road, view to the southwest.

2. BACKGROUND

This section of the report includes a discussion of the culture-historical background for the current study area and a synthesis of relevant prior archaeological and cultural studies for Lālāmilo Ahupuaʻa, Waimea Town, and the greater South Kohala District. This information is presented to provide a comprehensive understanding of the cultural significance of the study area and general vicinity and to establish an analytical basis from which to assess any potential cultural impacts. The ability to assess the cultural significance of the study area is contingent upon developing (at a minimum), a comprehensive understanding of the *ahupuaʻa* (traditional land division spanning from the mountains to the sea) in which the study area is located. As will be demonstrated in the ensuing section, a consideration of the broader region and island landscape may also be required.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to Lālāmilo and Waimea and a discussion of the general settlement patterns for South Kohala. The discussion of prehistory is followed by a summary of historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in South Kohala after contact. The summary includes a discussion of the changing lifeways and population decline during the Early Historic Period, a review of land tenure in the study *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and the subsequent transition into the ranching industry during the last quarter of the 19th century and the first three-quarters of the 20th century.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, radiometric). With advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter (c.f., Kirch 2011). However, these theories are not universally accepted. What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establishing a uniquely Hawaiian culture. The initial migration to Hawaiʻi is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long-distance voyages occurring fairly regularly through at least the 13th century. It has been generally reported that the sources of the early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). This was a period of widespread environmental modification when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; and the concepts of *puʻuhonua* (places of refuge), *ʻaumakua* (ancestral deity), and *mana* (divine power).

For generations following initial settlement, communities were clustered along the watered, windward (*Koʻolau*) shores of the Hawaiian Islands. Along the *Koʻolau* shores, streams flowed and rainfall was abundant, and agricultural production became established. The *Koʻolau* region also offered sheltered bays from which deep-sea fisheries could be easily accessed, and nearshore fisheries, enriched by nutrients carried in the freshwater, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found (McEldowney 1979). In these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and the population began expanding to the *Kona* (leeward side) and more remote areas of the island (Cordy 2000).

As the population continued to expand so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawaiʻi occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well; as Hommon (1976) argues, kinship links between coastal settlements disintegrated as those links within the *mauka*-*makai* (upland-coastal) settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupuaʻa* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary habitation, to the permanent dispersed habitation of both coastal and upland areas.

Overview of Traditional Hawaiian Land Management Strategies

Adding to an already highly-complex society was the development of the traditional land division system, which included the *ahupuaʻa*—the principal land division that functioned for both taxation purposes and furnished its residents with nearly all of the fundamental necessities. *Ahupuaʻa* are land divisions that typically incorporated all of the ecozones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupuaʻa* land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). In summarizing the types of ecozones that could be found in a given *ahupuaʻa*, Hawaiian scholar and historian, Samuel Kamakau writes:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*ʻano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ʻeiwa*, and makai of that the *wao maʻukele*. Makai of the *wao maʻukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *ʻamaʻu*, fern belt, and makai of the *ʻamaʻu* the *ʻapaʻa*, grasslands.
>
> A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and mauka of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest.
>
> Makai of the *ʻapaʻa* are the *paheʻe* [*pili* grass] and *ʻilima* growths and makai of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge.
>
> That is the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8-9)

The *makaʻāinana* (commoners; lit. people that attend the land) who lived on the land had rights to gather resources for subsistence and tribute (Jokiel et al. 2011). As part of these rights, the *ahupuaʻa* residents were also required to supply resources and labor that supported the royal communities of regional and/or island kingdoms. The *ahupuaʻa* became the equivalent of a local community, with its own social, economic, and political significance, and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During this annual procession, the highest chief of the land sent select members of his retinue to collect *hoʻokupu* (tribute and offerings) in the form of goods from each *ahupuaʻa*. The *makaʻāinana* who resided in the *ahupuaʻa* brought their share of *hoʻokupu* to an *ahu* (altar) that was symbolically marked with the image of a *puaʻa* (pig). *Ahupuaʻa* boundaries, in most instances, were established along rational lines, following mountain ridges, hill, rivers or ravines, however, Chinen (1958:1) reports that "oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division." *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land (Malo 1951). *Ahupuaʻa* residents were not bound to the land nor were they considered the property of the *aliʻi*. If the living conditions under a particular *ahupuaʻa* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. *Ahupuaʻa* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord, who oversaw and coordinated stewardship of an area's natural resources (ibid.). In some places, the *poʻo lawaiʻa* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011). When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of the area's resources from physical and spiritual depletion.

Many *ahupua'a* were further divided into smaller land units termed *'ili* and *'ili kūpono* (often shortened to *'ili kū*). *'Ili* were created for the convenience of the *ahupua'a* chief and served as the basic land unit, which *hoa'āina* (native tenants) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As the *'ili* themselves were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with it. The right to use and cultivate *'ili* was maintained within the *'ohana*, regardless of any change in title of the *ahupua'a* chief (Handy et al. 1991). Malo (1951), recorded several types of *'ili*: the *'ili pa'a,* a single intact parcel and the *'ili lele*, a discontinuous parcel dispersed across an area. Whether dispersed or wholly intact, the *'ili* land division required a cross-section of available resources, and for the *hoa'āina*, this generally included access to agriculturally fertile lands and coastal fisheries. While much of the same resource principles applied to the *'ili kūpono*, these land units were politically independent of the *ahupua'a* chief. This designation was applied to specific areas containing resources that were highly valued by the ruling chiefs, such as fishponds (Handy et al. 1991).

The *ali'i* who presided over the *ahupua'a* (*ali'i-'ai-ahupua'a*), in turn, answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire *moku or* district) (Malo 1951). On Hawai'i Island, six *moku* (districts) make up the entirety of the island, namely Kona, Ka'ū, Puna, Hilo, Hāmākua, and Kohala. Although *moku* comprises multiple *ahupua'a*, they were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the *ahupua'a* land division was the most common and fundamental unit within the multitiered traditional Hawaiian land management structure, within South Kohala there existed another unique land unit that was termed *kalana*. By definition, *kalana* was a division of land that was smaller than a *moku* and this term was sometimes used interchangeably with the term *'okana* (Lucas 1995; Pukui and Elbert 1986). Kamakau (1976), however, equates a *kalana* to a *moku* and states that *'okana* is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that *kalana* were comprised of several *ahupua'a* and *'ili 'āina*.

This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. As knowledge of place developed over the centuries and passed down intergenerationally by direct teaching and experience, detailed information of an area's natural cycles and resources were retained and well-understood. Decisions were based on generations worth of highly informed knowledge and sustainably adapted to meet the needs of a growing population. This highly complex land management system mirrors the unique Hawaiian culture that coevolved with these islands.

Evolution of Hawaiian Land Stewardship Practices

Their ancient and ingrained philosophy of life tied Hawaiians to their environment and helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and *'āina* (land), Hawaiian historian and cultural specialist, Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture and and nature begins.
>
> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *'āina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001)

The Hawaiian *'ōlelo no'eau* (proverbial saying) "*Hānau ka 'āina, hānau ke ali'i, hānau ke kanaka*" (Born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land including *kanaka* (humans) were literally born (*hānau*), and are thus connected through kinship links that extend beyond the immediate family (Pukui 1983:57). *'Āina* or land, was perhaps most revered, as another *'ōlelo no'eau* notes, "*He ali'i ka 'āina; he kauwā ke kanaka,*" which has been translated by Pukui (1983:62) as "[t]he land is a chief; man is its servant." The lifeways of early Hawaiians, which were derived entirely from the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an adaptable management system that integrated the watershed, freshwater, nearshore fisheries, all of which are connected through the many unique ecosystems that extend from the mountains to the sea (Jokiel et al. 2011).

Kilo or astute observation of the natural world became one of the most fundamental stewardship tools used by the ancient Hawaiians. The vast knowledge acquired through the practice of *kilo* enabled them to observe and record the subtlest of changes, distinctions, and correlations in their natural world. Examples of their keen observations are evident in Hawaiian nomenclature, where numerous types of rains, clouds, winds, stones, environments, flora, and fauna, many of which are geographically unique, have been named and recorded in centuries-old traditions such as *oli* (chants), *mele* (songs), *pule* (prayers), *inoa ʻāina* (place names), *ʻōlelo noʻeau* (proverbial sayings), all of which were transmitted orally through the ages. Other traditional Hawaiian arts and practices including, but not limited to *hula* (traditional dance), *lapaʻau* (traditional healing), *lawaiʻa* (fishing), *mahiʻai* (farming) further reinforced knowledge of the natural environment.

Their exclusive dependency on a thriving natural environment led Hawaiians to develop a sophisticated and comprehensive system of land stewardship that was reinforced through the strict adherence to practices that maintained and enhanced the *kapu* and *mana* of all things in the Hawaiian world. In Hawaiian belief, all things natural, places, and even people, especially those of high rank, possessed a certain degree of *mana* or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). *Mana* is believed to be derived from the plethora of Hawaiian gods (*kini akua*) who were embodied in elemental forces, land, natural resources, and certain material objects and persons (Crabbe et al. 2017). Buck (1993) expanded on this concept noting that *mana* was associated with "the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.)" (c.f. Else 2004:244).

To ensure the *mana* of the resources, certain places, and people remained protected from over-exploitation and defilement, *kapu* of various kinds were implemented and strictly enforced. Elbert and Pukui (1986:132), defined *kapu* as "taboo, prohibitions; special privilege or exemption..." Kepelino notes that *kapu* associated with the gods applied to all social classes, while the *kapu* associated with the chiefs were applied to the people (Beckwith 1932). As the laws of *kapu* dictated social relationships, it also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). Juxtaposed to the concept of *kapu* was *noa*, translated as "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Some *kapu*, particularly those associated with maintaining social hierarchy and gender differentiation were unremitting, while those *kapu* placed on natural resources were applied and enforced according to seasonal changes. The application of *kapu* to natural resources ensured that such were resources remained unspoiled and available for future use. When the *aliʻi* or the lesser chiefs (including *konohiki* and *poʻo lawaiʻa*) determined that a particular resource was to be made available to the people, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa*. Although transitioning a resource from a state of *kapu* to *noa* allowed for its use, people were still expected to practice sustainable harvesting methods and pay tribute to the ruling chief and the gods and goddesses associated with that resource. *Kapu* were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Violators who managed to escape death sought refuge at a *puʻuhonua*, a designated place of refuge or sometimes were freed by the word of certain chiefs (Kamakau 1992). After completing the proper rituals, the violator was absolved of his or her crime and allowed to reintegrate back into society.

In summary, the layering and interweaving of beliefs, land stewardship practices, and the socio-political system forms the basis of the relationship shared between the Hawaiian people and the land. It is through the analysis of these elements that we develop an understanding of a place.

LĀLĀMILO AHUPUAʻA AND THE GREATER SOUTH KOHALA DISTRICT

The proposed project area is situated within the southern portion of the *moku* of Kohala on Hawaiʻi Island, within the *mauka* portion of the *ahupuaʻa* of Lālāmilo (Figure 18). In the *moku* of Kohala, the long ridge of the Kohala Mountains extends perpendicular to the predominant northeasterly trade winds, creating a orographic rainfall pattern that separates the district into two distinct environmental zones, a wetter windward zone distinguished by its lush green valleys on the eastern side, and a drier leeward zone on the western side. Traditional poetical expressions for this district also identifies other geographical designations. Once such saying derived from an ancient chant titled *Kū e hoʻopiʻo ka lā* states:

ʻO Kohala-iki, ʻo Kohala-nui	lesser Kohala, greater Kohala
ʻO Kohala-loko, ʻo Kohala-waho…	inner Kohala, outer Kohala…
(Pukui and Korn 1973:188)	(Pukui and Korn 1973:190)

While the above names are noticeably absent from historical maps, Maly (1999:25) explains that "the lands from Kawaihae to ʻAnaehoʻomalu are within the region called Kohala waho (outer Kohala) or Kohala makahi ʻĀpaʻapaʻa (Kohala of the ʻĀpaʻapaʻa wind)". Another Hawaiian proverbial saying recorded by Pukui (1983:196) specifies the extent of the Kohala District, "*Kohala, mai Honokeʻā a Keahuolono*," which has been translated as "Kohala, from Honokeʻā [a valley in the northeast of the district] to Keahualono [an alter constructed on the district's southern boundary near ʻAnaehoʻomalu]."

In their publication titled *Native Planters in Old Hawai'i: their Life, Lore, and Environment*, Handy et al. (1991) provided the following description of Kohala:

> The district of Kohala is the northernmost land area of the island of Hawaii. ʻUpolu Point, the northwesterly projection, fronts boldly out into the Alanuihaha [*sic*] Channel towards the southeastern coast of Maui, and is the nearest point of communication between the two islands. To the south, along Hawaii's western coast, lies Kona; to the east the rough coast of Hamakua District unprotected from the northerly winds and sea. Kohala was the chiefdom of Kamehameha the Great, and from this feudal seat he gradually extended his power to embrace the whole of the island, eventu ally gaining suzerainty of all the Hawaiian Islands. (Handy et al. 1991:528)
>
> The rugged central area of the district is formed by the mountainous remains (elevation 5,505 feet) of the Kohala dome, the oldest of the island's volcanoes, now long regarded as extinct. The high table land between Mt. Kohala and the vast northern slopes of Mauna Kea, known as Waimea, has one of the finest and most salubrious mountain climates in the Hawaiian Islands, and also offers excellent grazing for cattle. In post-European times it became the seat of the Parker Ranch, one of the largest ranches in the world. (Handy et al. 1991:528)

Like the other districts, Kohala is comprised of multiple land divisions, one of which includes the subject *ahupuaʻa* of Lālāmilo (see Figure 18), literally translated by Pukui et al (1974:128) as the "*milo* tree branch." While Pukui offers a more literal take on the meaning of Lālāmilo, Maly (1999) expands upon the naming of this area through information which he gathered from the *moʻolelo* (account, story, history) titled *Kaʻao Hoʻoniua Puʻuwai no Ka-Miki.* With respect to the naming of this land division, Maly related the following:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert *lawaiʻa hī-ʻahi* (deep sea tune lure fisherman) and Piliamoʻo, a powerful priestess and *ʻōlohe*. Kanakanaka and Piliamoʻo were the parents of Nēʻula (a fishing goddess), and she married Puʻu-hīnaʻi a chief of the inlands. Nēʻula and Puʻu-hīnaʻi were the parents of Lālāmilo. (Maly 1999:27)

Lālāmilo is bound on the north by ʻŌuli Ahupuaʻa, on east by the Pacific Ocean and the coastal area of Puakō, on the south by Waikōloa Ahupuaʻa, and the east by several land divisions situated at the base of the Kohala Mountains, including (from north to south) Lanikepu, Keoniki, Kauniho, Waiʻaka, Haleʻaha, Waiʻauia, Keanuʻiʻomanō, and the upper reaches of Waikōloa (see Figure 18). While Lālāmilo is referred to today as an *ahupuaʻa*, traditionally it was one of several *ʻili* that made up the *kalana* of Waimea ("Reddish water") (Pukui et al. 1974:226). An 1866 map from S. C. Wiltse shown in Figure 19 illustrates the many land divisions that constituted the Waimea *kalana*. Additionally, Puakō, the coastal portion of Lālāmilo, was also identified as a distinct *ʻili* of the Waimea *kalana.* As a *kalana*, Waimea was treated as a subdistrict of the greater *moku* of Kohala and was comprised of several other lands divisions (Maly and Maly 2002). The lands subject to the *kalana* of Waimea were those that form the southern limits of the present-day South Kohala District including the lands of ʻŌuli, Waiʻaka, Lālāmilo, Puakō, Kalāhuipuaʻa (Lāhuipuaʻa), ʻAnaehoʻomalu, Kanakanaka, Alaʻōhiʻa, Paulama, Puʻukalani (Pukalani), Puʻukapu, and Waikōloa. In ancient times, Lālāmilo was referred to as Waikōloa Iki (lit. little Waikōloa), while Waikōloa Ahupuaʻa proper was known as Waikōloa Nui (lit. great Waikōloa) (Maly 1999). In describing the extent of the *kalana* of Waimea, a former librarian at the Hawaiian Mission Children's Society, Bernice Judd, explained that:

> In the early days Waimea meant all the plateau between the Kohala Mountains and Mauna Kea, inland from Kawaihae. This area is from eight to ten miles long and from three to five miles wide. There was no running water on Mauna Kea, so the inhabitants lived at the base of the Kohala Mountains, where three streams touched the plain on their way towards the sea. . . The middle stream, which was famous for wild ducks, was named Waikoloa, or Duckwater. This and the most westerly stream, called Kahakohau, went towards Kawaihae, but neither reached the sea, except in times of flood. (Judd 1932:14)

While the traditional name of this region is Waimea, it is also referred to as Kamuela (Samuel), named either for postmaster Samuel Spencer or for the famed rancher Samuel Parker (Pukui et al. 1974). However, most of the references describing the Precontact history and the celebrated cultural landscape refer to this area as Waimea.

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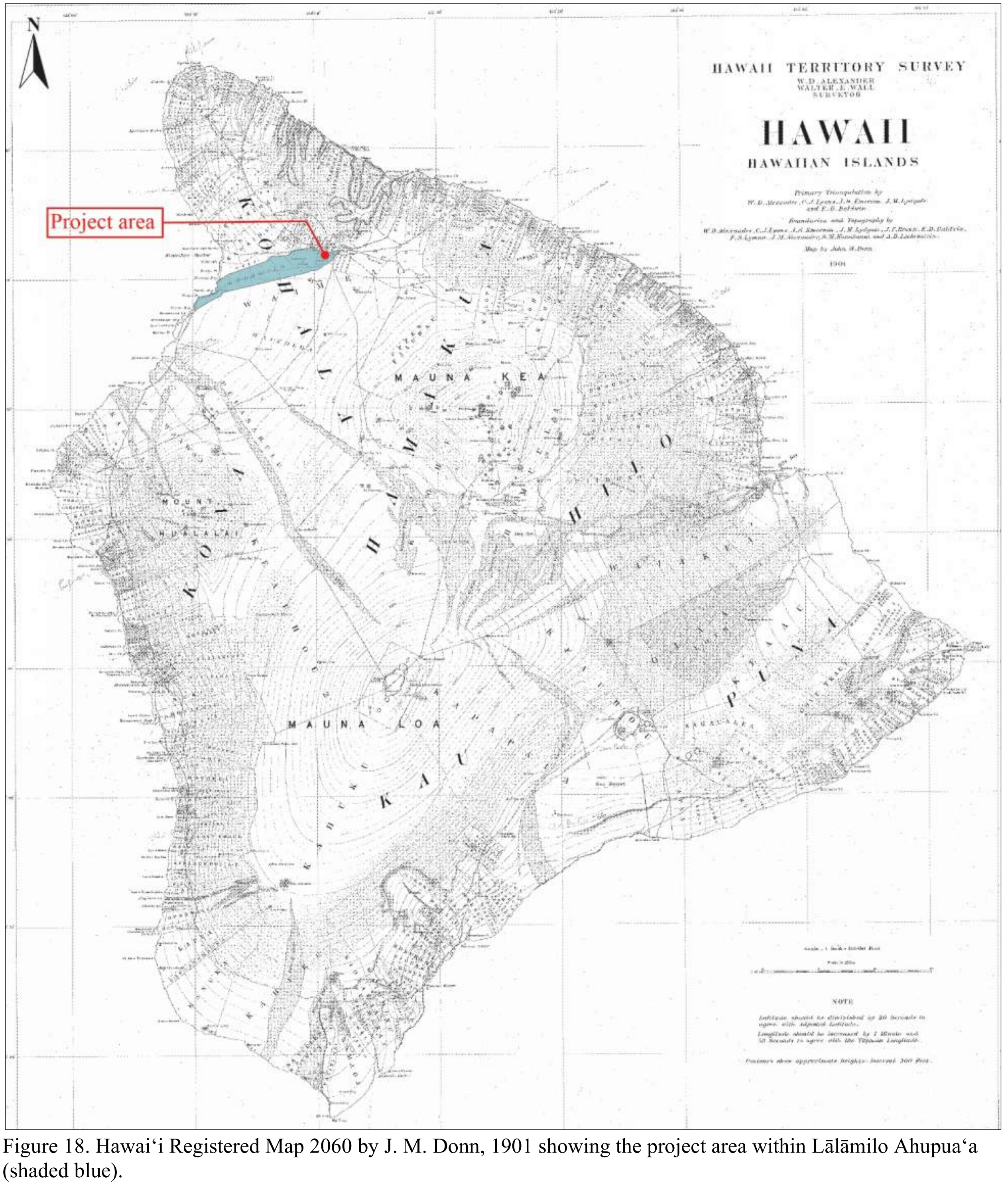


Figure 18. Hawai‘i Registered Map 2060 by J. M. Donn, 1901 showing the project area within Lālāmilo Ahupua‘a (shaded blue).

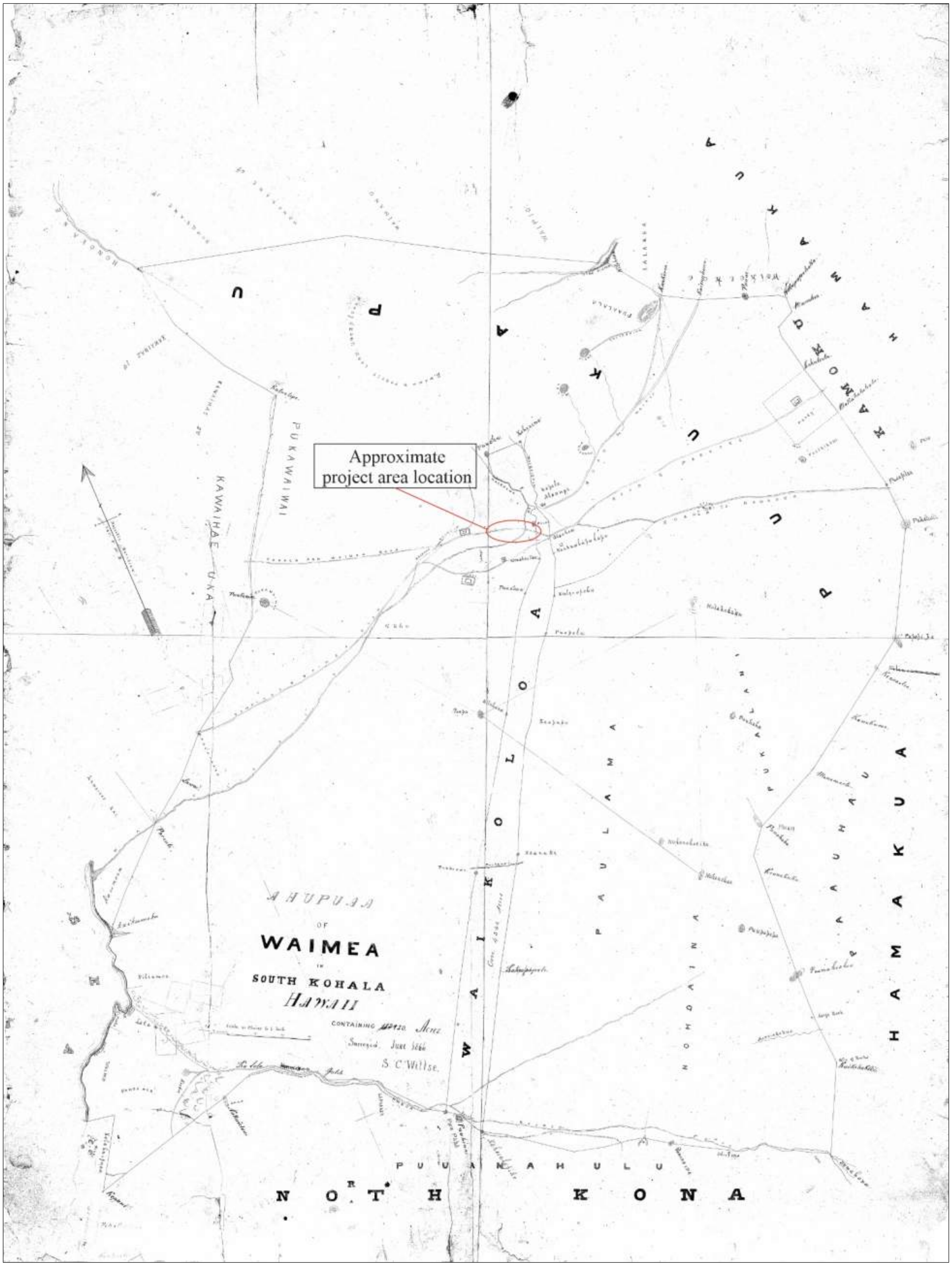


Figure 19. Hawai'i Registered Map No. 0712 by S. C. Wiltse, 1866 showing the various lands of Waimea.

Celebrated Cultural Landscape

Nestled between the plateau of two shield volcanoes (Kohala Mountains and Mauna Kea) Lālāmilo Ahupuaʻa along with the greater South Kohala region boasts stunning views of its wind-swept landscape dotted with rolling and jutting hills (*puʻu*). As noted by Plunkett (2018), "More than just aesthetically pleasing, the puʻu of Waimea as landscape fabric, functions culturally as definers of place." While there are many *puʻu* in Waimea, those most visible from the project area includes Hōkūʻula—noted as the battle site between Lonoikamakahiki and Kamalālāwalu, and the name given to the *kānoa* (*ʻawa* mixing bowl) of Laninuikuʻiamamaoloa—Puʻu ʻOwāʻowaka, and Puʻu Kī (Wilkinson et al. 2012). Furthermore, the *kānoa* of Hōkūʻula was said to belong to Lono and associated with rituals connected to the agricultural god (Wilkinson et al. 2012). Souza et al. (2003:7) explain:

> The association of the bowl, or *kānoa* of the god Lono (a provider of abundant crops and rain-laden clouds) with Hōkūʻula may refer to the agricultural lands of the region; i.e., (1) the bowl or container could symbolize a land of agricultural abundance; (b) the sprinkling of waters from the bowl could refer to the waters of the streams that flow from the uplands and spread across the plains; and (c) the importance of the rituals of Lono in agricultural endeavors, particularly in the areas of Kohala where large field systems have been archaeologically documented.

The *puʻu* noted above are situated to the north of the project area at the base of the Kohala Mountains (see Figure 11). While the *puʻu* are a culturally celebrated natural feature of Waimea, so to are the winds. The variety of winds found in Kohala are numerous and several Hawaiian proverbs recorded by Pukui (1983) capture the name and characteristics of some of these winds including the famous *ʻĀpaʻapaʻa* winds:

> *Ka makani ʻĀpaʻapaʻa o Kohala.*
> The ʻĀpaʻapaʻa wind of Kohala.
> Kohala was famed in song a story for the ʻĀpaʻapaʻa wind of that district. (Pukui 1983:157)
>
> *Kahilipulu Kohala na ka makani.*
> Kohala is swept, mulch and all, by the wind.
> Kohala is a windy place. (Pukui 1983:143)
>
> ʻ*Opeʻope Kohala i ka makani.*
>
> Kohala is buffeted by the wind. (Pukui 1983:277)

While some of the proverbs noted above poetically describe Kohala as a windy place, other winds such as the one that sent clouds racing across the sky were seen as omens that foretold impending trouble.

> *Makani luna ka lele ʻino mai lā ke ao.*
> There is wind from the upland, for the clouds are set a-flying.
> Signs of trouble are seen. This saying originated shortly after the completion of Puʻukoholā heiau by Kamehameha I. He sent Keaweahuulu to Kaʻū to invite Keōuakūʻahuʻula to Kawaihae for a peace conference between them. Against the advice of his own high priest, Keōuakūʻahuʻula went, taking his best warriors along with him. When outside Māhukona, he saw canoes come out of Kawaihae and realized that treachery awaited him. It was then that he uttered the words of this saying. His navigator pleaded with him to go back, but he refused. Arriving in Kawaihae, Keōuakūʻahuʻula stepped off the canoe while uttering a chant in honor of Kamehameha. One of the latter's war leaders stepped up from behind and killed him. All of his followers were slaughtered except for Kuakahela, who hid a later found his way home, where he wailed the sad story. (Pukui 1983:228)

Another important natural feature of the Waimea area that is celebrated in traditional Hawaiian text includes its many rains. One such rain named *ʻĀpuʻupuʻu*, also known by other epithets including *Kīpū*, *Kīpuʻu*, and *Kīpuʻupuʻu*, is a cold wind-driven rain that creates bumps on the skin (Akana and Gonzalez 2015). The play on the word *puʻu* (hill) may also refer to the hilly land of the Waimea area (Akana and Gonzalez 2015). Pukui (1983) adds that when the *aliʻi* Kamehameha of Kohala organized his army of spear fighters and runners from Waimea, they referred to themselves as the *Kīpuʻupuʻu* after the cold rain of their homeland. Pukui (1983:188) documented the following poetical expression for the Kīpuʻupuʻu rain "*Ke Kipuʻupuʻu hoʻanu ʻili o Waimea*" literally translated as "The Kipuʻupuʻu rain of Waimea that chills the skin of people." Doyle's (1953:44) description of the *kīpuʻupuʻu* relates it to a certain wind, "This is the piercing wind that suddenly meets the traveler who makes his upward way from the heat of Kawaihae; and as he nears Waimea he comes upon a region once held sacred."

Another rain, the *ʻEʻelekoa*, also knows as *Mālana, Mālanalana*, and *Mālanaʻeʻelekoa* is another famed rain of the area that is associated with storms. According to Akana and Gonzalez (2015) the *ʻEʻelekoa* is also a wind name of Waimea. The *Kokoʻula* and *Leikokoʻula* rain of Waimea which accompanies a red-hued rainbow are said to be associated with royalty. Sweeping down from the cliffs of Kapaliloa is the *Paliloa* rain and the *Peʻepākaiaulu* is a fierce rain squall that arises suddenly giving the area residents little time to take shelter, thus forcing them to *peʻe* (hide) to prevent from getting soaked. Other rain names for this area include the *ʻĀkōlea*, *Kīnehelehua*, *Kulaʻikanaka*, and the *Leihaʻakolo* rain (Akana and Gonzalez 2015).

Agricultural Practices of the Lālāmilo-Waimea Area

The natural landscape found in the upper Lālāmilo-Waimea area set the foundation for highly productive agricultural pursuits during the Precontact and early Historic periods. As described by Kirch (1985:215), "Hawaiians were first and foremost cultivators of the land" and over the generations, they adapted and intensified their agricultural production to levels unseen elsewhere in greater Oceania. Evidence of their adaptive agricultural endeavors is still visible today in the Kohala District. While the central and *makai* (coastal) areas of Lālāmilo and the greater *kalana* of Waimea are generally characterized as hot and dry and inhospitable to major agricultural pursuits, in the uplands of the Waimea-Lālāmilo area, at elevations ranging from roughly 750 and 900 meters (2,460 to 2,950 feet) above sea level, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes, taro, and other crops (Kirch 1985). Early archaeological investigations conducted by Barrera and Kelly (1974) identified a dense concentration of sites in the uplands of Lālāmilo. Subsequent studies conducted by Bishop Museum staff (Clark 1981b, 1983) identified remnants of an agricultural field system in the Lālāmilo-Waimea area. These early investigations ultimately concluded, "that the present town of Waimea was at the center of a large and intensively cultivated field system, which was in operation by at least the seventeenth century…" (c.f. Kirch 1985:177).

With respect to the Precontact use of the general project area within the various land divisions of Waimea, Clark (1987) offered a regional settlement pattern model that includes four elevational delineated environmental zones. The Coastal Zone extends up to about 150 feet elevation and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with the associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops and was a locus for the collection of wild floral and faunal resources. The current project area, situated at elevations ranging from 2,635 to 2,675 feet, is perhaps at the interface of Clark's (1987) Kula and Wilderness Zones.

Ultimately the increased upland population resulted in the creation of what archaeologists have dubbed the Waimea Field System found at elevations ranging from roughly 2,460 to 2,950 feet (750 and 900 meters) above sea level. The Waimea Field System is at least one of two major field agricultural field systems in the Kohala District. Each field system is vastly different in size and has its own distinguishing feature composition, however, unlike the expansive Kohala Field System, found along the leeward slopes of the Kohala Mountains, that relied almost exclusively on rainfall, the Waimea Agricultural System was also supported by small irrigation channels (*ʻauwai*) that may have intermittently carried water across the sloping landscape (Kirch 1985). Subsequent archaeological studies conducted on the Waimea Agricultural System throughout the 1990s and early 2000s yielded additional information about the agricultural system. The results from Burtchard (2002:iii) study of the field system concluded that:

> …short-term, temporary, agriculturally supported residence began on the upper Waimea Plain, possibly as early as the AD 1400s. The agricultural system, however, appears to have been substantially smaller than previously believed, and was limited to non-irrigated cultivation. Elongated earthen ridges are most plausibly remnant dunes that formed at the base of floral windbreaks sheltering fields. Limited irrigation may have begun in the late AD 1700s in support of military undertakings by Kamehameha at Kawaihae on the leeward Hawaiʻi coast. Most of the extensive irrigation system on the upper Waimea Plain was developed in the 19th century in association with commercial agriculture. In more recent times, the project area was used for the cultivation of corn and hay, a World War II military camp, and pasture for livestock.

At these elevations, located in Clark's (1987) Kula Zone, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Clark and Kirch (1983) identified four field complexes shown in Figure 20 in the Waimea area, each containing an extensive network of fields fed by a system of irrigation ditches that drew water from the Waikōloa and Kahakohau streams (see Figure 9). Kirch (1985:231) surmises that the fields were perhaps intermittently irrigated with "simple furrows" that were used to "direct water across the sloping field surfaces.” Recent modelling of water flow in a portion of Field Complex 3 (located west of the current project area) by McIvor and Ladefoged (2018) suggests that intermittent irrigation there may have been used to grow a variety of crops. In addition to staple crops such as *‘uala* (sweet potatoes) and *kalo* (taro), crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, *mai‘a* (bananas), *kō* (sugarcane), *niu* (coconuts), and *hala* (pandanus) (Haun et al. 2003). According to Barrère (1983:27), “the cultivating places at Waimea were first expanded to supply the chiefs’ needs while sojourned there and at Kawaihae”. The closest documented portion of the Waimea Field System to the current project area is Field Complex 4, which extends south of Māmalahoa Highway between the Parker Ranch racetrack and the Pu‘ukapu Homesteads. This complex contains spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along Waikōloa Stream at the eastern margins of the system (Burtchard and Tomonari-Tuggle 2005).

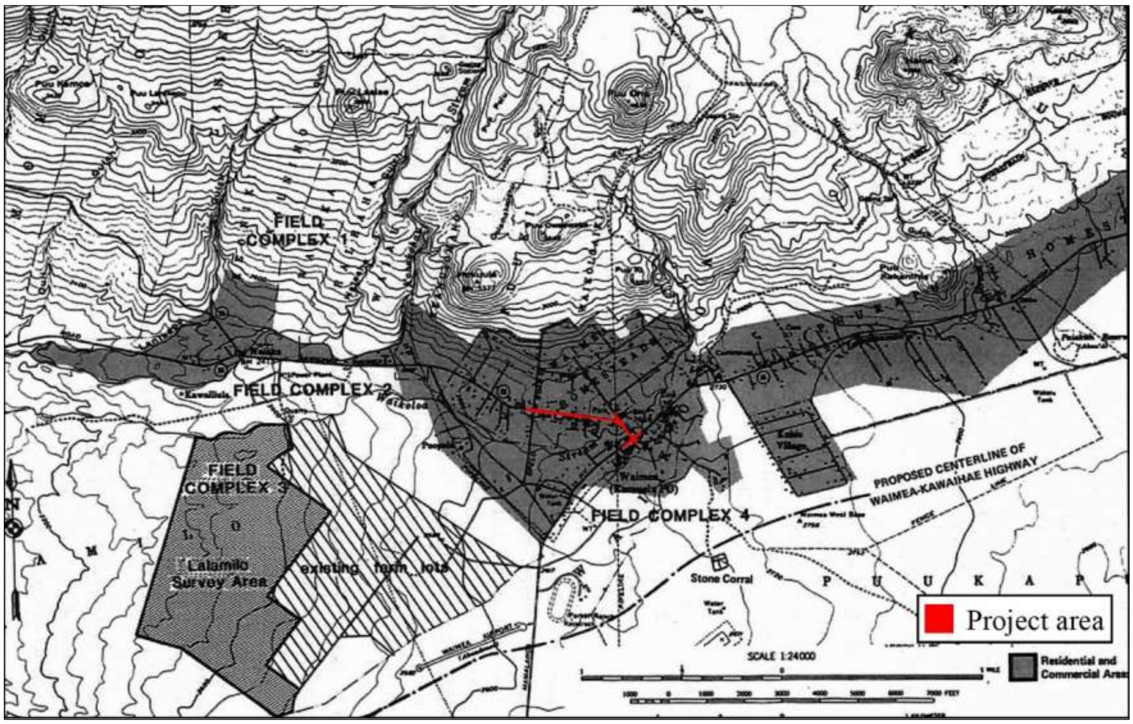


Figure 20. Waimea Field System complexes identified by Clark and Kirch (1983).

In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, bananas, sugarcane, coconuts, and *hala* (Haun et al. 2003). While most of the taro and sweet potato fields of South Kohala were located in the rainier uplands near the present-day town of Waimea (where there was also a sizeable permanent population), Handy et al. (1991:532) relate that “the coastal section of Waimea, now called South Kohala, has a number of small bays with sandy shores where fishermen used to live, and where they probably cultivated potatoes in small patches . . . Puako near the Kona border was a sizable fishing village at one time where there were undoubtedly many sweet potato patches.” The name of the village of Puakō, which literally translates as “sugarcane blossom” (Pukui et al. 1974:191), suggests that sugarcane was grown there. In fact, it was the A.D. 1880 discovery of wild sugarcane growing near the village of Puakō that would eventually lead to the establishment of the short-lived Puakō Sugar Plantation (Puakō Historical Society 2000).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction that served a variety of important uses. The *kō kea,* or white cane, was the most common and was usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy et al. 1991). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children’s teeth by chewing on it (ibid.). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903). Pukui (1983) cites two proverbs that liken the toughness of sugarcane to the warriors of Kohala. She explains that Hawaiian proverbs have layers of meaning (*kaona*) that are best left to the imagination of the reader:

> *I ʻike ʻia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.*
> One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed. When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong. (Pukui 1983:127)
>
> *He pāʻā kō kea no Kohala, e kole ai ka waha ke ʻai.*
> A resistant white sugar cane of Kohala that injures the mouth when eaten.
> A person that one does not tamper with. This was the retort of Pupukea, a Hawaiʻi chief, when the Maui chief Makakūikalani made fun of his small stature. Later used in praise of the warriors of Kohala, who were known for valor.(Pukui 1983:95)

Early European explorers who visited the Waimea area also described extensive agricultural fields, plantations, and a sizable population. In 1793, after landing at Kawaihae, Scottish surgeon and botanist Archibald Menzies, accompanied by two native guides traveled inland towards Waimea and recorded the following observation:

> A little higher up, however, than I had time to penetrate. I saw in the verge of the woods several fine plantations, and my guides took great pains to inform me that the inland country was very fertile and numerously inhabited. Indeed, I could readily believe the truth of these assertions, from the number of people I met loaded with the produce of their plantations and bringing it down to the water side to market, for the consumption was now great, not only by the ship, but by the concourse of people which curiosity brought into the vicinity of the bay. (Menzies 1920:56)

Nearly thirty years after Menzies' visit, early missionary, William Ellis penned his version of the journey taken by fellow missionaries Messrs. Bishop and Goodrich, both of whom passed through Waimea on their way to Kawaihae. Ellis reported that after leaving:

> Kapulena, and, taking an inland direction, [Bishop and Goodrich] passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, through but few inhabitants.
>
> About noon they reached the valley of Waimea, lying at the foot of Mouna-Kea [sic], on the northwest side. Here a number of villages appeared on each side of the path, surrounded with plantations, in which plantains, sugar-cane, and taro, were seen growing unusually large. (Ellis 1917:265)

Select *Moʻolelo* for Lālāmilo-Waimea Area

Before first contact with Europeans in the late 18th century and the development of a written Hawaiian language, the history of ancient Hawaiʻi was transmitted orally from one generation to the next. After the arrival of the first missionaries in 1820, Hawaiian culture underwent major transformations, one of which included the adoption of the written language. Although oral traditions were still maintained, many natives and foreigners began inscribing generations' worth of knowledge onto paper. As such, these writings provide us with invaluable insight into Hawaiʻi's past as they describe elements of Hawaiian culture such as historical figures, beliefs, traditions, *wahi pana* (legendary places), *inoa ʻāina* (place names), and *moʻolelo* (legendary accounts, stories, and myths), *mele* and *oli* (songs and chants), and *ʻōlelo noʻeau* (proverbs and sayings); all of which contribute to an in-depth understanding of the people, their culture, and their relationship to place. One of the hallmarks of traditional legendary accounts is their ability to transcend place and time, all while bringing cohesion to landscapes that have been subjected to artificial divisions and boundaries.

Kaʻao Hoʻoniua Puʻuwai No Ka-Miki (The Heart Stirring Story of Ka-Miki)

One such account that refers explicitly to Lālāmilo is told in the narrative *Kaʻao Hoʻoniua Puʻuwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki), which originally appeared in the Hawaiian language newspaper *Ka Hōkū O Hawaiʻi* between 1914 and 1917. This *moʻolelo* was likely authored during the late 1800s through the early 1900s by noted Hawaiian scholars John Wise and J.W.H.I Kihe. Maly, who translated their story noted:

> While "Ka-Miki" is not an ancient account, the authors used a mixture of local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations…While the personification of all the identified individuals and their associated place names may not be entirely "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (Maly 1999:23-24)

The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe,* and their travels around Hawaiʻi Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *ʻōlohe.* The two brothers were born to Pōhaku-o-Kāne (male) and Kapaʻihilani (female), who were the *aliʻi* of the lands of Kohanaiki and Kaloko, North Kona. Upon the mysterious and premature birth of Ka-miki, he was placed in the cave of Pōnahanaha and given up for dead. He was eventually saved and raised by his ancestress, Ka-uluhe-nui-hihi-kolo-i-uka, a manifestation of the goddess Haumea, at Kalamaʻula, an area located on Hualālai. Ka-miki was later joined by his elder brother Makaʻiole where their ancestress Ka-uluhe-nui trained her grandsons into *ʻōlohe*, or experts skilled in fighting, wrestling, debating, riddle solving, and running, and taught them how to use their supernatural powers. Given the lengthy nature of this account, special attention is given to that portion of the story which makes explicit reference to Lālāmilo and the surrounding lands and other natural features including *puʻu* (hills) and the coastline.

As previously noted in the early part of the background section of this study, the lands of Lālāmilo was named in honor of the chief, Lālāmilo. His grandfather was Kanakanaka, an expert *ʻahi* fisherman and his grandmother was Piliamoʻo, a powerful priestess and *ʻōlohe*. To this pair was born Nēʻula, a fishing goddess who later married Puʻu-hīnaʻi, chief of the inlands. From this union was born Lālāmilo. Maly continues thusly:

> Kanakanaka was an expert *lawaiʻa hī-ʻahi* (deep sea tuna lure fisherman), and his sister was the windgoddess Waikōloa. Lālāmilo also gained famed as an expert *ʻōlohe* and fisherman. Through his wife Puakō, Lālāmilo came to possess the supernatural *leho* (cowrie octopus lure) which had been an *ʻōnohi* (cherished) possession of Haʻaluea, a goddess with an octopus form…How this octopus lure came to rest on the reefs fronting this land remains a mystery. (Maly 1999:27)
>
> The *leho* was so powerful that if it was only shown to the *heʻe* (octopus), they would climb upon the canoe and be caught. Lālāmilo carefully guarded this lure and even slept with it. When Lālāmilo did leave the lure, he stored it in the *hōkeo aho hī-ʻahi* (tuna lure and *olonā line storage gourd*) of his grandfather Kanakanaka, and this was hidden, tied to the ridge pole of his house. (ibid.)

The story of how Lālāmilo came into possession of this magical lure is further described. The day after Lālāmilo wed Puakō, the young maiden from Puna who had an insatiable appetite for *heʻe* (octopus), she traveled to the shore at Waimā to gather fish and seaweeds. The tide was low and she walked about the reef flats where she came upon a large *heʻe* (octopus) spread about the reef. She speared it and struggled to carry it ashore. Nēʻula, her mother-in-law saw her carrying the enormous *heʻe* and asked who had given it to her, to which Puakō replied that she had indeed caught the large *heʻe*. With a sense of suspicion, Nēʻula replied that as a native of this place, she had never seen such an octopus in this area. As the two women were talking, Lālāmilo approached them and saw Puakō holding a large octopus. Assuming that another man had given the octopus to his wife, Lālāmilo asked where she got the octopus from and she proceeded to relate the events to him. Accusing his wife of lying, Lālāmilo struck Puakō with a hard blow causing her skin to darken. Nēʻula interjected and suggested that the couple go look about the reef to see for themselves the place where Puakō had retrieved the large *heʻe*.

As Lālāmilo walked intently about the reef, he investigated the site where Puakō had found the massive *heʻe*, to which he discovered a small hole with something red hidden within. Peering into the hole, he saw a beautiful *leho* (cowrie) tucked within, which had attracted the *heʻe*. Without hesitation, Lālāmilo broke the reef and retrieved the *leho* and it is said that after he had taken this *leho,* no more *heʻe* appeared on the reef flats of this area. Lālāmilo took his possession home, cleaned it and prepared himself a lure, which he kept a close watch over. He would keep the lure in a container and when he went out to the *heʻe* fishing grounds he would retrieve the lure from the container and hold it in his hand. Without delay, *heʻe* would climb into his canoe and within a short time, he would be able to retrieve several hundred of these slippery animals with little effort. Lālāmilo, however, noticed that when his lure was covered in the container, the *heʻe* stopped climbing into the canoe. Amazed at his catch, Lālāmilo showed his wife Puakō and mother Nēʻula, to which the latter recommended that he take the lure and an offering of *heʻe* to Piliamoʻo, his grandmother. When Piliamoʻo had seen what Lālāmilo had brought she explained to her grandson:

> …that this was no ordinary cowrie lure, but a god, the *ʻōnohi* (favorite or cherished one) of Haʻaluea the mysterious supernatural octopus being of the ocean depths. Haʻaluea and her family came from Kāne-hūnā-moku (The hidden land of Kāne) and settled at Makaīwa in the land of Kapaʻa, Kauaʻi. Haʻaluea was the wife of the wind and ocean god Halulu-koʻakoʻa, and grandmother of ʻIwa-nui-kīlou-moku (Great ʻIwa the island catcher). (Maly 1999:30)

Piliamoʻo consecrated the *leho* and the *heʻe*, which it attracted and instructed Lālāmilo to always bring the first *heʻe* that he caught to her as an offering. Having learned that her grandson had this magical lure, Piliamoʻo instructed Lālāmilo to extinguish anyone who inquired about the lure. Because of its mystical powers, word about the cowrie lure quickly spread throughout Hawai‘i and soon caught the ear of Pili-a-Ka‘aiea, the chief of Kona, who had a great love for octopus fishing. Pili-a-Ka‘aiea sent messengers to inquire about the lure and each was killed by Lālāmilo and Piliamo‘o. While engaged in a contest at Hinakahua, a playing field in Puapua‘a, North Kona, the young and adept Ka-Miki agreed to fetch the lure for Pili-a-Ka‘aiea with the hopes of becoming the foremost favorite of the Kona chief. One day, Lālāmilo decided to visit his father Pu‘u-hīna‘i, his sister Pu‘u‘iwa‘iwa, and his grand-aunt Waikōloa, who was the guardian of Pu‘u‘iwa‘iwa.

> Lālāmilo arose and told his wife Puakō, and his mother Nē‘ula that he was going to the uplands to visit his father, sister, and the people who worked the upland plantations. Lālāmilo desired to eat the sugar cane and bananas, and drink the *‘awa* which grew on the hill of Po‘opo‘o. Po‘opo‘o was also the name of a seer (*makāula*) who saw to the continued peaceful dwelling of the people. Lālāmilo placed the lure in Kanakanaka’s gourd and secured it near the ridge pole of his house. Lālāmilo then asked Puakō and Nē‘ula to go and look after the gourd in which the *‘ōnohi* (eyeball or cherished possession) of Ha‘aluea was kept. (ibid.:38)

Lālāmilo left his home and headed for the settlements and agricultural lands of Pu‘u-hīna‘i, however, as he got closer to his intended destination, his thoughts became consumed by his precious lure. Unable to curb his thoughts, Lālāmilo returned to the coast without paying a visit to his father and sister. In the meantime, while Lālāmilo was on his journey to the uplands, the adept Ka-Miki traveled to Lālāmilo’s home and met with a man from the area, Nīheu. Ka-Miki inquired about the whereabouts of Lālāmilo only to find that he was not at home. Ka-Miki gazed into the home of Lālāmilo and confirmed that it was unoccupied, however, a gourd container caught his eye and Ka-Miki proceeded to fetch the container tucked away in the rafters of the house. Without incident, Ka-Miki lowered the gourd and departed with the magical lure.

Because of his premonition, Lālāmilo returned home to find that his prized *leho* had been stolen. Lālāmilo then went to visit his grandmother and upon seeing that her grandson had arrived empty-handed, she payed him no attention. The saddened Lālāmilo then called out in chant to his grandmother to inform her of the stolen lure. After hearing the cries of her grandson, Piliamo‘o commanded that Lālāmilo retrieve a white rooster, *‘awa* from Po‘opo‘o; an *‘āhuluhulu* fish; and a red *malo* (loincloth) before the setting of the sun. Lālāmilo quickly retrieved all of the prescribed items and returned to his grandmother’s home which overlooked the shore of Kauna‘oa.

> Pili-a-mo‘o told Lālāmilo to release the pig and chicken, and both of them entered the canoe which Pili-a-mo‘o had prepared as the path on which Lālāmilo would travel to Kaua‘i-o-Kamāwaelualani, where he could find ‘Iwa at Makaīwa, Kapa‘a. (Maly 1999:31-32)
>
> Pili-a-mo‘o called to Lālāmilo saying, “The gods have approved your offerings, and here is your path (canoe) to present the offerings to ‘Iwa, the mysterious cascal of the land which snares the sun, ‘Iwa the sacred ward of Halulu-ko‘ako‘a.” With the offerings set in the canoe, and the sail raised, Pili-a-mo‘o then prepared, an *‘awa* ceremony.
>
> The pig was at the mast, the *‘awa* and fish were set on the platform, the rooster sat on the outrigger end, and the *malo* was placed at the stern of the canoe. After Pili-a-mo‘o and Lālāmilo drank *‘awa* they slept and when half the night passed the rooster crowed. Pili-a-mo‘o arose and went out of the house where she saw the navigator’s star high above. Pili-a-mo‘o then called to Lālāmilo, :”Arise great shark of the sea, o offspring of Hulihia-ka-lani, o flippers of the turtle Kamilo-holu-o-Waiākea. Awaken for the light of the star Hīki‘i-maka-o-Unulau, the *Kualau* (shower bearing wind) blows and the traveler will touch Kaua‘i.” Lālāmilo arose, entered the canoe and prepared to sail to Kaua‘i. (August 2, 1917). (Maly 1999:32)

Piliamo‘o then gave specific instruction to her grandson on how to find and how to use the various items to solicit the help of ‘Iwa, the rascal lad of Kaua‘i. Heeding the instruction of Piliamo‘o, Lālāmilo sailed to Kaua‘i and just as his grandmother had described, Lālāmilo found the young ‘Iwa. After an exchange, ‘Iwa consented to Lālāmilo’s request and the two men set sailed for Kohala, passing along the north side of the Hawaiian Islands, before turning south along the Kohala coast and sailing to Pālau‘eka in Hōlualoa, Kona. Here they met with Ka‘aha‘aha and Kapakapaka, the two fishermen for the chief Pili-a-Ka‘aiea. After a brief exchange of words, ‘Iwa asked the fishermen “…what fish the chief was after today, and Kapakapaka said *he‘e*” (Maly 1999:34). Having learned of this, ‘Iwa set in motion a plan to retrieve the prized cowrie lure of Lālāmilo and described the nature of retrieving the largest octopus that dwelled in the deep sea to the two fishermen. While Kapakapaka did not believe ‘Iwa, Ka‘aha‘aha was more than willing to investigate the claims made by ‘Iwa.

Together, the four men sailed in the fishing canoe into the deep sea, passing the *‘ōpelu,* and *kāhala* fishing grounds. ‘Iwa took his prized cowrie lure Mulali-nui-makakai and tossed it overboard and called out in chant to his grandmother Ha'aluea asking for her assistance. As 'Iwa closed his chant, he felt a tug on his lure line. He quickly pulled the line up and a large *he'e* slipped into the canoe. Amazed at the sight of the large *he'e*, 'Iwa proceeded to killed it then turned to the two fishermen and told them this is not biggest octopus. He again casted his lure into the deep sea but this time, the lure held fast in the ocean, as though it was stuck. At this time, the chief Pili-a-Ka'aiea drew near the men in his large double-hauled canoe.

> 'Iwa suggested that Kapakapaka *mā* asked Pili to use his lure at this site, so he could secure the largest octopus. Pili's lure was set into the water and 'Iwa called once again to Ha'aluea…
>
> A large *he'e* rose and embraced Pili's canoe, this *he'e* was killed and Pili set the lure into the ocean again. This time the goddess Ha'aluea rose in her octopus form and held tight to the canoe and lure. 'Iwa dove into the ocean and swam along Ha'aluea's tentacles, he found the lure and and secured it in the folds of his *malo*. 'Iwa then tied the chiefs' line to a coral outcropping and returned to the surface where he joined Lālāmilo. Ha'aluea let go of Pili's canoe, and 'Iwa told Lālāmilo to paddle the canoe towards Maui. In a short time, they arrived along the shore of Waimea (also called Kauna'oa), where they were greeted by Pili-a-mo'o. (Maly 1999:35)

Pleased with the outcome of their journey, 'Iwa, Lālāmilo, and Piliamo'o feasted on food and *'awa* and 'Iwa returned to his home on Kaua'i. As this portion of the story concludes, it is said that Lālāmilo divided his lure with his brother-in-law Puala'a who arrived from the Puna District. It is said that because the divided lure resempled baked taro, the lure came to be known as Kalo-kunu (broiled taro). This is how Lālāmailo reclaimed his prized lure.

An Account of Ka-holoi-wai-a-ka-nāulu, the Priest and Rainmaker

In addition to the account narrated above, Maly (1999) also translated and summarized the account of Ka-holoi-wai-a-ka-nāulu, a priest and rainmaker who's showers eased a famine that had spread over the land. Published in the September 2, 1914 edition of the Hawaiian language newspaper, Ka Hōkū O Hawai'i, under the title *Pu'uanahulu i ka uka 'Iu'iu, Kona mau Luhiehu Hihiu* (Pu'uanahulu of the Distant Uplands, with its Uncommon Beauty), J.W.H.I Kihe, coauthor of the story of Ka-Miki, reported the following:

> Ka-holoi-wai-a-ka-nāulu was an elder brother of the Pele priestess, Anahulu, when Anahulu and Wa'awa'a *mā* moved from Puna, to be closer to [their daughters] Anaeho'omalu and Puakō, Kaholoiwai followed as well. From his dwelling place at Kaho'opulu, a hill above Kawaihae, Kahoiwai cared for his sister, watching for her needs. When a period of dryness came upon the land, Kaholoiwai would send the *Nāulu* showers across the lands, reaching up to Pu'u Wa'awa'a. Thus, food plants were able to be grown upon the land. (Maly 1999:35-36)

Brief Account of a Several Heiau in Waimea with Reference to Hōkū'ula

In Emma Doyle's (1953) book *Makua Laiana The Story of Lorenzo Lyons*, she provided a brief account describing some *heiau,* their uses, and origins that were located along the Kohala Mountains slopes in the area north and northwest of the current project area. While the name of these *heiau* are not known, Doyle explains how Akua Makuakua met the beautiful Wao and how they settled on Hōkū'ula after their marriage. Doyle's account is detailed below:

> Vivid were the rainbows of the Lanikepu hills, and red the rain, uakoko, that fell upon their slopes, for in the forest that was then their background was a heiau—a women's heiau, the only one; and by these lovely tinted tokens the gods honored it, and signified their approval.
>
> Founded, dedicated and consecrated by the very high chiefess Hoapiliahae, it was attended exclusively by young virgins. There, in the sanctity of the cool highland forest, they performed the sacred ceremonies, learning also the science of healing so that they might eventually minister to others. And the names of the five rains of the heiau were given to the five children of Hoapiliahae.
>
> On a nearby ridge stood another heiau, builded there by the great Akua Makuakua who had come from far off Kahiki. He it was who, flying to a hillside to watch the rainbows, found there the beautiful goddess Wao, clad only in her long, silky hair. Love came swiftly and was mutual, and after glorious wedding festivities the couple went to live at Hokuula, the hill of the red planet.
>
> But to bear each of her children Wao returned to the Waimea hills, thereby made sacred. On these occasions a tabu was proclaimed, the forbidden ground extending down across the plains to whatever place a stone happened to stop rolling when started above by her servants. Stones they were themselves, these retainers, all through the night hours, for so Wao transformed them until daylight, when they became human again. (Doyle 1953:44)

Clark and Kirch (1983) elaborated on Hoopiliahae's connection to Hawai'i Island nobility. Clark and Kirch (1983:26) explain that the earliest recorded chiefs of Waimea descended from the Ulu-Hema genealogical line that led to Līloa, "the founder of the island dynasty." Clark and Kirch (1983) further relate that Līloa's grandson, Keawenuia'umi took Hoopiliahae as one of his wives and that she was the daughter of Līloa's *kahuna* (priest), Paeamolenole.

Chiefly Rule in South Kohala

Sometime during the 16th century, chief 'Ehuinuikaimalino (also referred to as 'Ehu) was appointed by his father Kūāiwa to rule over Kona, while a junior son, Hukulani ruled over Kohala. During 'Ehu's reign, four of the six *moku* on Hawai'i Island was ruled by an independent chief: Kulukulu'ā in Hilo, Hua'ā in Puna, 'Īmaikalani in Ka'ū, and it is believed that Līloa ruled over Hāmākua (Cordy 2000). In addition to 'Ehu, Kūāiwa had three sons from a previous wife, Kahoukapu, Hukulani, and Manauea, all of whom became the heads of Hawai'i's aristocratic families (Fornander 1880). Although the 'Ehu line of chiefs grew to be somewhat powerful, 'Ehu was ranked second to Līloa (Kelly 1983). According to Kamakau (1992), 'Ehu placed his son, Laea-nui-kau-manamana in Līloa'a royal court and for some time they both resided in Waipi'o in the Hāmākua District where Laea-nui assisted with the construction of the sacred stone slab known as *Ka paepae kapu o Līloa*. Upon the death of Līloa, his kingdom passed to his eldest son, Hākau, however, his mistreatment of the people led to Līloa's second son, 'Umi-a-līloa seizing the kingdom. However, the chiefs of Hilo, Puna, Ka'ū, and Kona withheld their allegiance to 'Umi. According to Kamakau (1992), by the time 'Umi sought to gain control over Kona and Kohala, 'Ehu was of old age, and therefore Kona and Kohala were easily seized by 'Umi.

'Umi eventually moved his royal court to Kailua, Kona and eventually took the daughter of 'Ehu, Moku-a-hua-lei-akea as his wife. She bore 'Umi a daughter named 'Akahi-'ili-kapu. 'Umi's reign is one that is often celebrated as it marked a time of peace and increased productivity and a move towards craft specialization. According to Kamakau,

> There was no kingdom like his. He took care of the old men, the old women, the fatherless, and the common people. Murder and thievery were prohibited. He was a religious chief, just in his rule…
>
> During 'Umi-a-Liloa's reign, he selected workers and set them in various positions in the kingdom. He separated those of the chiefly class (*papa ali'i*), of the priestly class, of the readers of omens (*papa kilo*), those skilled in the affairs of the land (*po'e akamai o ka 'aina*), farmers, fishermen, canoe builders, warriors, and other skilled artisan (*po'e pale 'ike*) in the work they were best suited for; and each one applied himself to his own task. . .
>
> 'Umi-a-Liloa did two things with his own hands, farming and fishing. He built large wet taro patches in Waipi'o, and farming was done on all the lands. Much of this was done in Kona. . . (1992:19)

Kamakau (1992) goes on to add that 'Umi was a skilled fisherman, and fishing for *aku*, his favorite fish, often brought him to the beaches of South Kohala from Kalāhuipua'a to Makaula, where he also fished for *'ahi* and *kala* with many other famed fishermen and all the chiefs of the kingdom. 'Umi's reign lasted until around a.d. 1620, and was followed by the rule of his son, Keawenui a 'Umi, who ruled over Kohala, Kona, and Ka'ū, and then his grandson, Lonoikamakahiki(Cordy 2000; Kamakau 1992). During this time, wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *ali'i*. By the late 17th century, large areas of Hawai'i Island were controlled by a few powerful *ali'i 'ai moku* (district chiefs). There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai'i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980).

The Reign of Lonoikamakahiki (ca. A.D.1300) to Kalani'ōpu'u (late 1700s)

Lonoikamakahiki was a celebrated ruling chief of Hawai'i Island and boasts lineage from the ancient Pili dynasty with a heritage rooted on Hawai'i Island, and likely Waipi'o Valley, since roughly A.D. 1300. He was the son of Keawenui a 'Umi, and the grandson of celebrated *ali'i nui* 'Umi a Līloa, and recognized as an accomplished and dexterous warrior. During the time of Lonoikamakahiki's rule, several battles transpired in the coastal portion of South Kohala, and also in the general vicinity of the proposed project area. One such battle was fought between Lonoikamakahiki and his older brother, Kanaloakua'ana, who rebelled against him. According to Fornander Kanaloakua'ana and his rebel forces were situated at:

> . . . land called Anaehoomalu ['Anaeho'omalu], near the boundaries of Kohala and Kona. The rebel chiefs were encamped seaward of this along the shore. The next day Lono marched down and met the rebels at a place called Wailea, not far from Wainanalii, where in those days a watercourse

> appears to have been flowing. Lono won the battle, and the rebel chiefs fled northward with their forces. At Kaunaoa [Kaunaʻoa], between Puako and Kawaihae, they made another stand, but were again routed by Lono, and retreated to Nakikiaianihau, where they fell in with reinforcements from Kohala and Hamakua. Two other engagements were fought at Puupa [Puʻupā; on the plain southwest of the project area] and Puukohola [Puʻukoholā], near the Heiau of that name, in both of which Lono was victorious. His brother Kanaloakapulehu was taken prisoner, slain, and sacrificed at the Heiau, but Kanaloakuakawaiea escaped with the scattered remnant of the rebel forces. The rebels now fled into Kohala, and were hotly pursued by Lonoikamakahiki. Several skirmishes were fought during the pursuit; at Kaiopae, where Kanaloakuakawaiea was slain; at Kaiopihi, and finally at Puumaneo [Puʻumaneʻo], on the high lands above Pololu [Pololū], where the last remnant of the rebel force was conquered and slain, and the island returned to its allegiance to Lono and Kaikilani.

Fornander (1916–1917) relates that a series of subsequent attacks were instigated and waged by Kamalālāwalu, the *aliʻi nui* of Maui, against Lonoikamakahiki. These battles occurred along the South Kohala coastline, the first of which ensued at Wailea, then Kaunaʻoa, and finally commenced at Puakō (the coastal section of Lālāmilo), where his brother and high chief Kanaloakuaʻana, was brutally tortured and eventually slaughtered. Thereafter, Kamalālāwalu and his army, upon the advice of two of Lonoikamakahiki's allies Kauhipaewa and Kihapaewa who had gained his trust and infiltrated Kamalālāwalu's camp, proceeded to Hōkūʻula in Waimea, a prominent *puʻu* just north of the current project area, in anticipation of the continuation of battle in which they assumed an automatic victory. Upon awakening the next morning, Kamalālāwalu was stunned to discover that a great constellation of men had amassed near the coast; what seemed like thousands of warriors from all of Hawaiʻi Island had gathered as far as the eye could see and were prepared to savagely wage war upon the intruder Maui chief. Realizing that he was vastly outnumbered, Kamalālāwalu attempted to reconcile differences with Lonoikamakahiki in an attempt to escape certain death, but the former, being enraged at the manner in which his ally Kanaloakuaʻana was slain, denied him. The supreme volume of Lonoikamakahiki's forces was incomparable to Kamalālāwalu's, especially when coupled with the latter's unfamiliarity with the battleground. According to Fornander (1916–1917:344), "the Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia, while those of Kohala guarded from Momoualoa to Waihaka." After just three days, Lonoikamakahiki reigned victoriously, and Kamalālāwalu and nearly all the invaders, with the exception of his son Kauhiakama, were executed.

> After Kama-lala-walu's warriors reached the grassy plain, they looked seaward on the left and beheld the men of Kona advancing toward them. The lava bed of Kaniku and all the land up to Huʻehuʻe was covered with the men of Kona. Those of Kau and Puna were coming down from Mauna Kea, and those of Waimea and Kohala were on the level plain of Waimea. The men covered the whole of the grassy plain of Waimea like locusts. Kama-lala-walu with his warriors dared to fight. The battle of Puoaoaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger for the slinging of stones that would fall like raindrops from the sky. The stones would fall about with a force like lightening, breaking the bones into pieces and causing sudden death as if by bullets.
>
> Maui almost won in the first battle because of Hawaii's lack of a strong champion. Maka-ku-i-ka-lani [representing Maui] was first on the field and defied any man on Hawaii to match strength with him. Maka-ku-i-ka-lani tore Hawaii's champion apart. When Puapua-kea arrived later by way of Mauna Kea, those of Hawaii rejoiced at having their champion. Maka-ku-i-ka-lani and Puapua-kea matched their strength in club fighting on the battle site before the two sides plunged into the fight. (Kamakau 1961:58-59)

Once he reached Waimea, Kamalālāwalu positioned himself on Hōkūʻula, the hill that he was told would serve as a refuge for him and his men (Fornander 1959). In Fornander's description, the battlefield would have extended to Puʻu Kakanihia:

> Kamalalawalu, upon arrival thereon, found on reconnoitering that there were neither stones nor trees, but only dirt [on Hōkūʻula]. While they were engaged in a conversation with Kumaikeau together with Kumakaia, at that time messengers were sent to summon Lonoikamakahiki and Pupuakea. At Kealakekua, in Kona, was the place where Lonoikamakahiki lived. When the messenger appeared before him, he said to Lonoikamakahiki: "Kamalalawalu and Makakuikalani have come to give battle to you both…When Lonoikamakahiki heard these things, he questioned

> the messenger: “Where is the battle to take place?” The messenger replied: “There, at Waimea, on top of that hill, Hokuula, where Kamalalawalu and all Maui are stationed.” (Fornander 1959:188)
>
> During that night and including the following morning the Kona men arrived and were assigned to occupy a position from Puupa to Haleapala. The Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia [Puukakanihia], while those of Kohala guarded from Momoualoa to Waihaka. (ibid.:229)

Puapuakea was the eventual victor of this fight, and the warriors of Maui were put to flight. After Kamalālāwalu was defeated, Hawai‘i was invaded by Alapa‘inui, the son of a former Kona war chief, who had been living on Maui since the death of his father (Kamakau 1961). Alapa‘inui waged war against the chiefs of Kona and Kohala and was eventually victorious, proclaiming those lands as his own (he also later gained control of the Hilo and Ka‘ū Districts). After gaining control of the Island, Alapa‘innui is said to have lived in Waimea for a time:

> Alapa‘i dwelt in Hilo for a year and then went to live in Waipi‘o. Shortly after, he and the chiefs moved to Waimea and others went by canoe to Kawaihae. From Waimea, he went to Lanimaomao, where he fell ill. (ibid.:77)

It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupua‘a* of Kokoiki, near the Mo‘okini Heiau (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (ibid.:67–68) places the birth event sometime between A.D. 1736 and 1758, and probably nearer to the later date. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley’s Comet (this is also controversial). Kamehameha’s ancestral homeland was in Halawa, North Kohala (Williams 1918).

Many of the chiefs who had been deprived of their lands by Alapa‘inui battled against Keawe‘ōpala, and he was soon defeated in South Kona by Kalani‘ōpu‘u, who then became the ruler of Hawai‘i Island (Kamakau 1992). Kalani‘ōpu‘u’s reign was marked by near-constant warfare as he invaded Maui and defended himself from rebellions by Maui and Hawai‘i *ali‘i* (Kamakau 1992). In A.D. 1775 Kalani‘ōpu‘u and his forces from Hāna, Maui, raided and destroyed the neighboring district of Kaupō, and then launched several more raids on Moloka‘i, Lāna‘i, Kaho‘olawe, and parts of West Maui. It was at the battle of Kalaeoka‘īlio that Kamehameha, a favorite of Kalani‘ōpu‘u, was first recognized as a great warrior and given the name of Pai‘ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalani‘ōpu‘u and Kahekili (1777–1779), Ka‘ahumanu and her parents left Maui to live on the island of Hawai‘i (Kamakau 1992). Kalani‘ōpu‘u was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

The Arrival of Europeans, Missionaries, and the Reign of Kamehameha

The arrival of foreigners in the Hawaiian Islands marked the beginning of drastic changes in Hawai‘i’s culture and political-economy. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas due to war and disease, yet an increase in others, with relatively little change in material culture. Some of the work of the *maka‘āinana* shifted from subsistence agriculture to the production of foods and goods which could be traded with foreign ships. There was a continued trend toward craft and status specialization, intensification of agriculture, *ali‘i* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influences were already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered O‘ahu, Maui, and Moloka‘i, in 1795, Hawai‘i saw the beginnings of a market system economy (Kent 1983).

Captain James Cook and his crew onboard the ships the *H.M.S. Resolution* and *Discovery* first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalani‘ōpu‘u, who was still at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting but chose not to participate (Jarves 1847). Although the expedition did not explore inland to Waimea, while sailing up the Kohala coast, Lt. King recorded his observations of that part of the countryside:

> Koaara [Kohala] extends from the Westernmost point to the Northern extremity of the island; the whole coast between them forming an extensive bay, called Toe-yah-yah [Kawaihae], which is bounded to the North by two very conspicuous hills. Toward the bottom of this bay there is foul, coraly ground, extending upward of a mile from the shore, without which the soundings are regular, with good anchorage, in twenty fathoms. The country, as far as the eye could reach, seemed fruitful and well inhabited, the soil being in appearance of the same kind with the district of Kaoo [Ka‘ū]; but no fresh water is to be got here. (King 1784:106)

After the death of Captain Cook at Kealakekua and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck the district and Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. While in Kohala, Kalaniʻōpuʻu proclaimed that his son Kīwalaʻō would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to his nephew Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kīwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication, Kalaniʻōpuʻu set out for Hilo to quell a rebellion by a Puna chief named ʻĪmakakoloʻa.

In 1790, John Young and Isaac Davis, sailors on board the ships *Eleanora* and *Fair American*, which were trading in Hawaiian waters, were detained by Kamehameha I and made his advisors. The story of their detention begins when the crew of the *Eleanora* massacred more than 100 natives at Olowalu, on the island of Maui, as retribution for the theft of a skiff and the murder of one of the sailors. The *Eleanora* then sailed to Hawaiʻi Island, where John Young went ashore and was detained by Kamehameha's warriors. The other vessel, the *Fair American,* was captured off the Kona coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1992). Kamehameha, with the aid of Young and Davis and their knowledge of the newly acquired foreign arms, then succeeded in conquering all the island kingdoms except Kauaʻi by 1796. It wasn't until 1810, when Kaumualiʻi of Kauaʻi gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically, initially through deforestation from the collection of sandalwood and then by the introduction of cattle (Rechtman and Prasad 2006). In 1792, Captain George Vancouver, who had sailed with Cook during his 1778-1779 voyages, arrived at Kealakekua Bay with a small fleet of British ships, where he met with Kamehameha. Vancouver stayed only a few days on this first visit but returned again in 1793 and 1794 to take on supplies. Vancouver introduced cattle to the Island of Hawaiʻi at Kealakekua during these latter two visits, gifting seventeen heads of steer to Kamehameha I, who at the request of Vancouver, immediately made the cattle *kapu*, thus preventing them from being killed and allowing their numbers to increase (Barrère 1983; Kamakau 1992; Vancouver 1984). Some of the offspring of these animals escaped the initial attempts to contain them and spread throughout Kohala, Kona, and the saddle region. In agricultural areas, they wrought havoc on crops and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes (Barrère 1983; Henke 1929).

Hawaiʻi's culture and the economy continued to change drastically during Kamehameha's rule as capitalism and industry established a firm foothold in the Islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810. Kamehameha, who resided on the Island of Oʻahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food, and fish (Kamakau 1992). This new burden contributed to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau (1992:204) indicates that, "this rush of labor to the mountains brought about a scarcity of cultivated food … The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ʻAmaʻu, or Hapuʻu, from the wild plants resorted to." Once Kamehameha realized that his people were suffering, he "declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land" (Kamakau 1992:202). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua-Kona, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade but also continued to enforce the *kapu* system.

When Kamehameha I died on May 8, 1819, the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate (Kamakau 1992). Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death, a period of *ʻai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered (Kamakau 1992). Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu, and rather than re-establish the *kapu*:

> Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai (Kamakau 1992:225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house, and did whatever he desired it was still during a time when he had not reinstituted the *'ai kapu* (eating taboo) but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kūkā'ilimoku, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was ultimately defeated in the battle of Kuamo'o in the North Kona District (Kamakau 1992). With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of Christian missionaries shortly thereafter, Hawai'i's culture and their spiritual beliefs continued to be transformed. By December of 1819, Liholiho had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Kamakau 1961; Oliver 1961). With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

In October of 1819, seventeen Protestant missionaries had set sail from Boston to Hawai'i. They arrived in Kailua-Kona on March 30, 1820 to a society whose spiritual system has just been overturned. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western-style and adopted their dress and religion. As missionaries began to introduce Christian concepts and beliefs they also set forth the process of rendering a once purely oral language into written form and literacy was quickly taken up as a national endeavor (Nogelmeier 2010). Soon many *ali'i* were rewarding these early missionaries with land and positions in the Hawaiian government. During this period, the demands of the *ali'i* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali'i* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade soon led to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, the missionary William Ellis described Waimea as a fertile, well-watered land "capable of sustaining many thousands of inhabitants" (Ellis 1831:399). The population was concentrated in three villages, Keaalii, Waikōloa, and Pu'ukapu, each located where major streams reached the plain (Figure 21). Ellis notes that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. In the time since Kamehameha I's death, the harvesting of sandalwood had once again been forced upon the *maka'āinana*. During his travels along the coast of Kohala, Ellis noted that most of the villages were empty as the men of the region had been ordered to the mountains by the King to collect sandalwood. He wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young… Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 1831:396-397)

Figure 21. A portion of “Map of Waimea” ca. 1830 with main villages (after Andrews et al. 1830) (Hawaiian Mission Houses Library and Archives Digital Collection)

The Early Development of Cattle Ranching in Waimea

Introduced to the island of Hawaiʻi is 1793-94 by Captain George Vancouver, cattle populations quickly grew and spread throughout the Kohala, Kona, and saddle region of the island. Ellis (1831:402) describes a journey by one of his traveling companions to Mauna Kea, and the early use of the herds of cattle that were by that time roaming the mountainside:

> Although there are immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the native vessels. But this is attended with great labour and expense. They first carry all the salt to the mountains. When they have killed the animals, the flesh is cut off their bones, salted immediately, and afterwards put into small barrels, which are brought on men’s shoulders ten to fifteen miles to the sea-shore.

In 1822 John P. Parker, originally of Newton, Massachusetts, was one of the early foreigners granted permission to hunt bullock for the Crown (Brennan 1974). The wild cattle were often captured in bullock pits seven to eight feet long by four feet deep that were covered over with sticks and a thin layer of dirt; they were also hunted with guns (Frost and Frost 1977; Wilkes 1845). By the 1830s, the unregulated population of livestock was cause for concern and under the administration of Kauikeaouli (Kamehameha III), *vaqueros* (cowboys of Mexican, Indian, and Spanish descent) from Central and South America were brought to Hawaiʻi to train Hawaiians in the handling of both horses and wild cattle (Bergin 2004). The cultural introduction made by the *vaqueros* added to the cultural tapestry of the island that resulted in the creation of Hawaiʻi *paniolo* (cowboy) culture.

By about 1830, Parker would go on to found Parker Ranch, which would eventually grow to become the largest cattle ranch on the island (Henke 1929). In that same year, the appointed governor of Hawaiʻi Island, John Adams Kuakini, moved to the town of Waimea to oversee and improve on the government cattle industry. He ordered the construction of corrals and had a twelve-mile stretch of trail between Waimea and Kawaihae widened (Escott 2008). In his annual report for 1834, Lorenzo Lyons (1834), the resident missionary reported that a road between Waimea and Hāmākua had been completed. The 1835 missionary census lists 6,175 people living in Kohala and another 1,396 people, including 500 men, 510 women, and 386 children, living in Waimea (Schmitt 1977). Despite the eventual prominence of ranching in Waimea (Figure 22), at the time Lorenzo Lyons (1837:1) reported that “The beef establishment has lost some of its charms; & the attention of the people is more directed to the cultivation of the soil - a great portion of Waimea is being surrounded by a stone wall – to form an extensive garden from which all graminivorous animals are to be excluded & which is to be cultivated by the people for their own benefit as well as that of the chiefs.” Foreigners appear to have been somewhat transient during this period, as Lyons notes:

> There was a time when the foreign population numbered about 70 - & their children 30. But the number has considerably diminished & it is always fluctuating - sometimes more & sometimes less. They belong to 6 or 7 different nations & are variously employed – beefcatchers - sugar manufacturers - shoemakers, merchants - tanners - lawyers - blacksmiths - -combmakers - masons - doctors - saddlers - farmers & what not. (Lyons 1841:13-14)

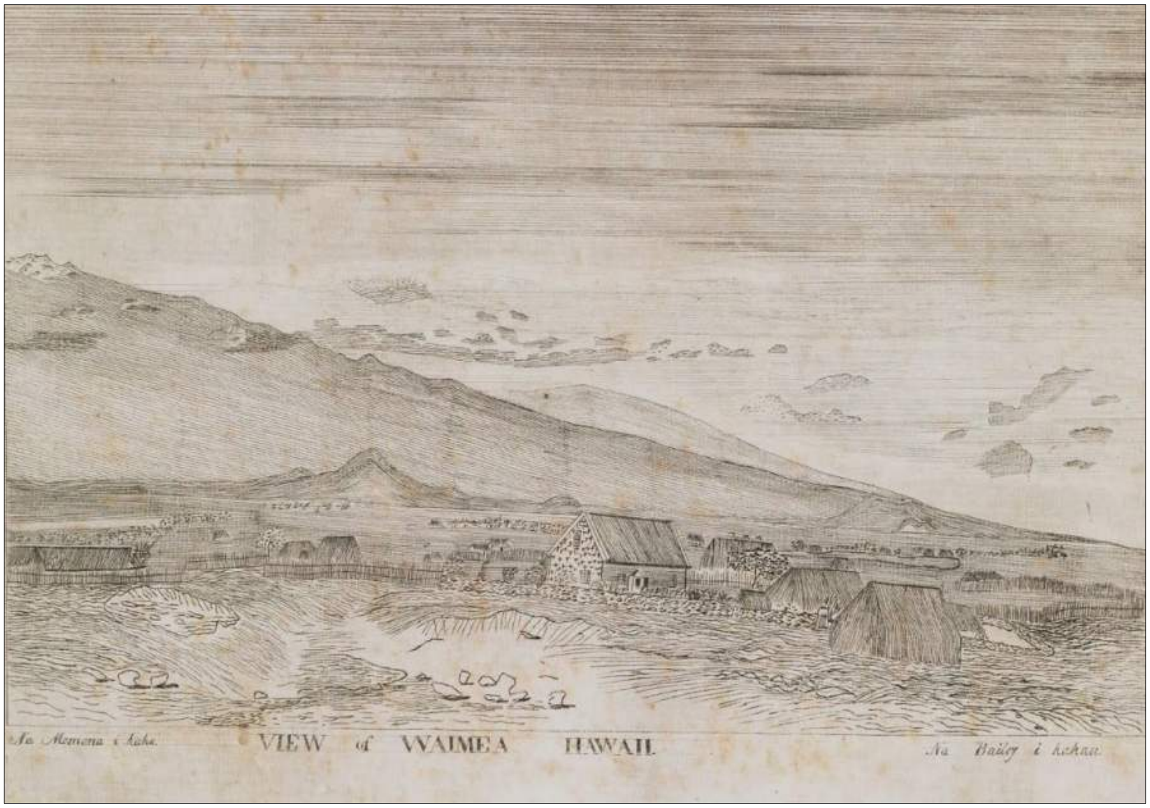


Figure 22. “View of Waimea Hawaii” ca. 1840 (Hawaiʻi Mission Houses Museum).

By 1840, bullock hunting had drastically reduced the population of wild cattle on Hawaiʻi Island, so much so that a five-year *kapu* was placed on hunting them solely for their hides and tallow (Bergin 2004). This led to further efforts to tame, brand, fence, and herd privately-owned cattle (Wilkes 1845). For a while, agricultural products from Waimea replenished the cargo ships at Kawaihae Harbor, and in the late 1840s many of the potatoes grown in the Waimea area were shipped to California to help feed those involved in the gold rush (Haun et al. 2003), but the decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, ultimately led to a period of economic hardship and population decline in the Waimea area (Escott 2008). At about this time, a Honolulu merchant named William French constructed his residence, currently known as the historic Spencer House, at Puʻuloa to the northeast of the Lindsey Road-Māmalahoa Highway portion of the current project area. French operated a store in Kawaihae and another, a “thatched hut” at Puʻuloa where he “employed a saddle-maker and operated a tannery” under the management of Parker, who “kept busy supervising this operation and collecting beef tallow, and leather to supply the needs of French’s growing business” (Wellmon 1973:50). Despite a lack of money in Waimea at the time, the store did well for both French and Parker, as Wellmon (1973:50-51) explains:

> There was no surplus of currency in Waimea at this time, and most of the business at the Puuloa store consisted of bartering for goods and services. Long-term credit and buying on time was the rule rather than the exception in these transactions. . . French supplied Parker with different goods in exchange for his services and produce. Parker used these goods himself or exchanged them with those who worked for French and those who paid the store in money or goods.

Francis Allyn Olmsted (1841:230), an American author, journeyed to Waimea in 1840 and described French's storefront and the colorful *vaqueros* and bullock hunters who frequented the store:

> About eight o'clock, we came up with a collection of thatched houses, towards the principal of one which we directed our steps, which was a store belonging to Mr. French of Honolulu. Here a novel scene presented itself to us. In front of the door, a bright fire was blazing in a cavity in the earthern floor, displaying in strong light the dark features of the natives congregated around it in their grotesque attitudes. Immediately back of these, a group of fine looking men, in a peculiar costume, were leaning against the counter of the store. Some of them were Spaniards from California, and they were all attired in the poncho, an oblong blanket of various brilliant colors, having a hole in the middle through which the head is thrust. The pantaloons are open from the knee downwards on the outside seam. A pair of boots armed with prodigiously long spurs completed their costume. They were bullock hunters, employed in capturing the wild bullocks that roam the mountains, and had just returned from an expedition of eight or ten days, in which they had been very successful.

Travel in and out of Waimea during this period was accomplished by one of four main roads (Figure 23), which connected the town to Kohala, Kawaihae, Hāmākua, and Parker's residence at Mānā. As the decade wore on, however, the population of Kohala began to decline, and settlement patterns changed significantly. Leeward inhabitants relocated to the wetter windward slopes of North Kohala and the Waimea plain, abandoning their agriculturally marginal areas in favor of wetter sugarcane lands more productive farmland. According to Tomonari-Tuggle (1988), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. Tomonari-Tuggle clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali'i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment. (Tomonari-Tuggle 1988:33)

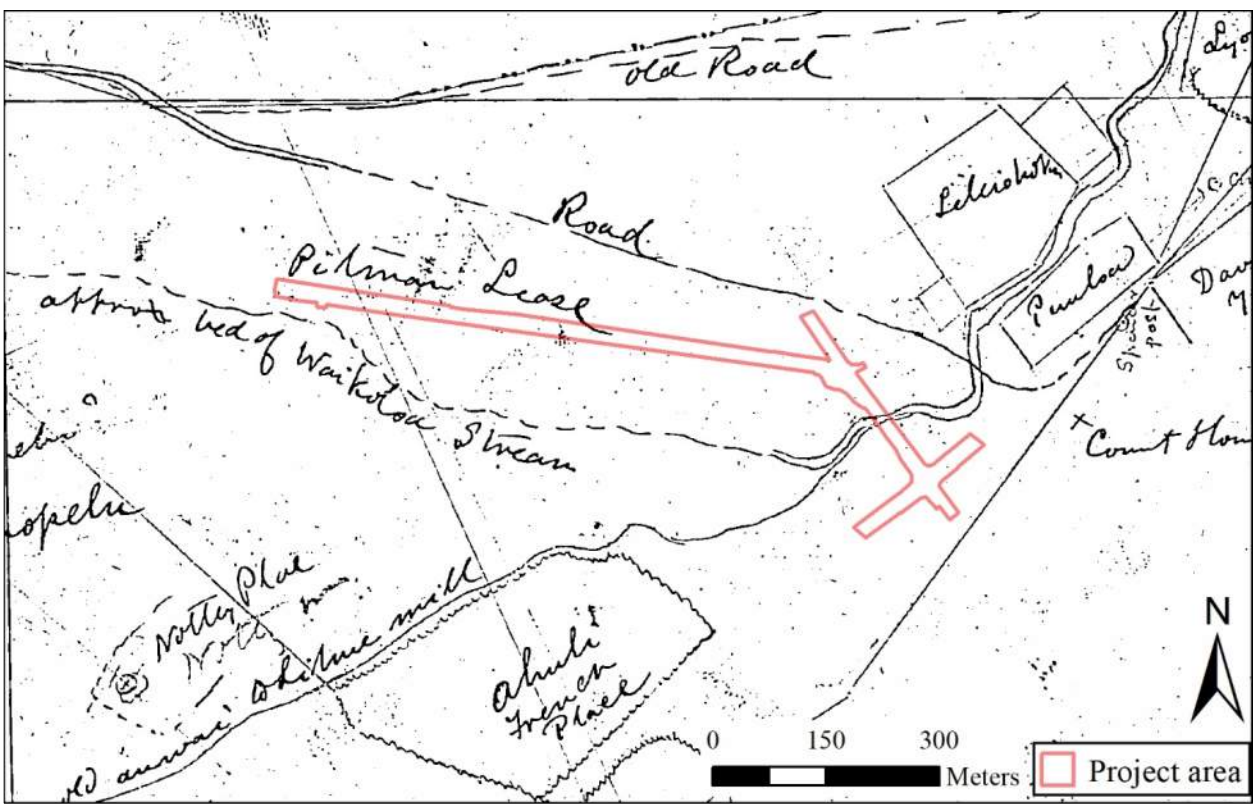


Figure 23. Detail of Hawai'i Registered Map No. 673 Part 1 showing roads in Waimea ca. 1887- note the approximate location of Waikōloa Stream (Wall and Lyons 1887).

These population shifts were accompanied by an overall decline in the number of people living in Kohala. Contemporary observers and modern scholars (Burtchard and Tomonari-Tuggle 2005) offer several explanations, including the decline of the whaling industry, a *kapu* on killing wild cattle (Wilkes 1845), dissatisfaction with William Beckley's (also known as Wilama Bekele) appointment as *konohiki* (Doyle 1953), and disease (HSA 1848), and epidemics that raged through the islands in 1848 and 1849. The population reduction in Waimea as documented by missionaries was tremendous, as the Rev. Lorenzo Lyons expressed, "if the decrease of local people continues the same, how many years before they are all dead, without any left?" (Schmitt 1973:29). Similarly, an 1848 description of the Waimea population cited by McEldowney (1983:432) laments that "it can scarcely be said that there is any native population at all."

The *Māhele ʻĀina* of 1848

By the mid-19th century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the *Mōʻī* (Kamehameha III) and his high-ranking *aliʻi* (chiefs) decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī*, the *aliʻi* and *konohiki* (land agents), and the *makaʻāinana* (the common people or native tenants).

In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission), first to adopt guiding principles and procedures for dividing the lands and granting land titles, and then to act as a court of record to investigate and ultimately award or reject all claims brought before them. All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the Land Commission Award (LCAw.) numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of their lands. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two-year term, and the deadline was extended several times, not for new claims, but for the Land Commission to finish its work. (Alexander 1920; Soehren 2005).

The *Mōʻī* and some 245 *aliʻi* (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the *Mōʻī* and his *aliʻi* accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848), and the names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*) of the Hawaiian Islands and the *aliʻi* who claimed them, were recorded in the *Buke Māhele* (also known as the *Māhele* Book) (Soehren 2005). As this process unfolded the *Mōʻī*, Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division when the name the last chief was recorded in the *Buke Māhele*, the *Mōʻī,* Kamehameha III commuted about two-thirds of the lands awarded to him to the Hawaiian Kingdom Government (King n.d.). Unlike the *Mōʻī*, the *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive their land awards (known as Land Commission Awards or LCAw). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the *Mōʻī* and *aliʻi* became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). Most importantly, all lands (Crown, Government, and *Konohiki* lands) identified and claimed during the *Māhele* were "subject to the rights of the native tenants" therein (Garavoy 2005:524). Finally, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission.

During the *Māhele*, *hoaʻāina* (native tenants) residing on lands that were divided up among the Crown, *Konohiki*, and Government they could claim, and acquire title to parcels that they actively lived on or farmed. The parcels awarded to *hoaʻāina* were and still are referred to as *kuleana*, using the Hawaiian term to describe the relationship of rights and responsibilities held among tenants, konohiki, and the land. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly and Maly 2002). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and further defined the process by which they could apply for fee-simple interest in their *kuleana*.

The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly and Maly 2002). The history of the *kuleana* claim and award process is summarized in an 1856 report by the Minister of Interior:

> …During the ten months that elapsed between the constitution of the Board and the end of the year 1846, only 371 claims were received at the office; during the year 1847 only 2,460, while 8,478 came in after the first day of January 1848. To these are to be added 2,100 claims, bearing supplementary numbers, chiefly consisting of claims which had been forwarded to the Board, but lost or destroyed on the way. In the year 1851, 105 new claims were admitted, for Kuleanas in the Fort Lands of Honolulu, by order of the Legislature. The total number of claims therefore, amounts to 13,514, of which 209 belonged to foreigners and their descendants. The original papers, as they were received at the office, were numbered and copied into the Registers of the Commission, which highly necessary part of the work entailed no small amount of labor…
>
> …The whole number of Awards perfected by the Board up to its dissolution is 9,337, leaving an apparent balance of claims not awarded of say 4,200. Of these, at least 1,500 may be ranked as duplicates, and of the remaining 2,700 perhaps 1,500 have been rejected as bad, while of the balance some have not been prosecuted by the parties interested; many have been relinquished and given up to the Konohikis, even after surveys were procured by the Board, and hundreds of claimants have died, leaving no legal representatives. It is probable also that on account of the dilatoriness of some claimants in prosecuting their rights before the Commission, there are even now, after the great length of time which has been afforded, some perfectly good claims on the Registers of the Board, the owners of which have never taken the trouble to prove them. If there are any such, they deserve no commiseration, for every pains has been taken by the Commissioners and their agents, by means of oft repeated public notices and renewed visits to the different districts of the Islands, to afford all and every of the claimants an opportunity of securing their rights… (c.f. Maly and Maly 2002:7)

The Disposition of Lands in Waimea and Lālāmilo at the time of the Māhele ʻĀina

The disposition and distribution of the lands of Waimea was a complicated issue and was a matter of much testimony and debate among Commissioners, *kamaʻāina* informants, and land petitioners. Waimea was a discrete land unit but considered by some to not be an *ahupuaʻa*; rather it was considered to be a *kalana* or *ʻokana*, a unit larger than an *ahupuaʻa*. To further complicate the issue, some of the land units within Waimea were considered *ahupuaʻa* and others *ʻili kupono*. As a result of the *Māhele* testimony and decisions rendered by the Boundary Commission Testimony, many smaller *ahupuaʻa* names were dropped and the relatively independent *ʻili kupono* were given *ahupuaʻa* status, and except for a portion of the Waikōloa Ahupuaʻa (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. Almost all of the smaller *ʻili ʻāina* located on the southern slope of Kohala Mountain became Government Land, with two exceptions. The lands of Waiaka 1 and 2, located west of Waiauia, were awarded to M. Kamaikui (LCAw. 8516-B:1) and G. Lahilahi (LCAw. 8520-B:2), respectively. Two *ʻili* given to Lunalilo (Pauahi and Lanikepu) were relinquished to the Government, and the rest, including Waiauia and the neighboring lands of Haleaha and Puʻu Kī, and the large *ahupuaʻa* of Lālāmilo, in which the current project area is located, also became government land. Which of the *aliʻi* relinquished these lands were not recorded in the *Buke Māhele* (Soehren 2005).

Over 140 claims for Land Commission Awards (LCAw.) were made by native tenants within the Waimea area. Nearly all of these claims were for house lots or cultivated sections (Haun et al. 2003). Of the land commission awards reviewed by Kelly and Nakamura (1981:30), over twenty percent were issued to persons with non-Hawaiian surnames. Seventeen *kuleana* were claimed within Lālāmilo (Haun et al. 2003). Four located at the coast (listed as within Puakō) were not were awarded, but thirteen in the uplands were. The current project area includes one of these *kuleana* parcels and likely encroaches on another (Figure 24). LCAw. 3785 was awarded to Olepau on February 11, 1851. The award consisted of a 0.42-acre *pāhale* (house lot) located at what is now the intersection of Lindsey Road and Kawaihae Road, within Lanakila Park. According to native testimony, Olepau's *pāhale* contained two houses. William Beckley, the *konohiki* of Waimea at this time, provided testimony in Hawaiian on September 16, 1848, in support of Olepau's claim:

> *Hoohikiia o W. Bakle [Bakele; Hawaiianized version of Beckley]. A olelo maila. Ua ike no au aia i ka ili aina i Kanakanaka, he Pahele, ua paa i ka pa, elua hale maloko, owau wale no na pelana a puni, no'u aku no kona, ua lohe au he wahikahiko ia nona mamua a i ka makahiki 1848 noi mai oia ia'u, ae aku no au nona ia wahi, me kuu keakea ole aku.* (Native Testimony Volume 4:40)
>
> English translation:
>
> W. Bakle [William Beckley] sworn and stated. I have seen in the ili land at Kanakanaka a house-lot which has been enclosed, with two houses in it. The surrounding boundaries are mine only and his [Olepau] interest is from me. I had heard that was an old land belonging to him and when he had asked me in 1848, I consented to let him have that place without any objections.

Land Commission Award 3915 is located adjacent to the east side of Lindsey Road, north of Waikōloa Stream (see Figure 24). This parcel was awarded to Nahoena in 1877 and consisted of a house lot encompassing 6 5/100 acres. According to Native Testimony (Volume 4:9), the awarded parcel was one of three *'apana* claimed. Testimony provided on September 12, 1848, by Hano and supported by Kanuue reads:

> *Hoohikiia o Hano. A olelo maila. Ua ike no au i ka pahale a me ka aina o Nahoena ma ka ili Ohia i Waikoloa ma Waimea Hawaii. Elua [ekolu] apana. Apana mua, mauka he wahi waiho wale no ke konohiki, ma Walaohia [Alaohia] ke kahawai o Waikoloa, makai he wahi waiho wale no ke konohiki a he no mea Kohala.Ua paa i ke pa laau, hookahi hale o Nahoena maloko. Apana elua he mau kihapai mahi elua, mauka no ke konohiki, pela no ma palena a pau. Apana ekolu elua kihapai, o ko ke konohiki wale no na palena a pau, no Manua mai kona, loaa ia Nohoena 1822 mailaila mai a hiki i keia la. Aole mea keakea iaia.*
>
> *Hoohikiia o Kanuue. A olelo maila. Ua ike au i kahi o Nahoena aina Waikoloa. Ua like loa ko'u ike me ka Hano i hai ae nei.*
>
> English translation:
>
> Hano sworn and stated. I have seen the house lot and land of Nohoena on the ili Ohia in Waikoloa, Waimea, Hawai'i. Three parcels. The first parcel bounded on the *mauka* by *konohiki* land, on Walaohia [Alaohia] Waikōloa Stream, *makai* and Kohala sides are *konohiki* lands. It is enclosed by a wood fence with one house in it belonging to Nohoena. Parcel two contains two *kīhāpai* which are cultivated and the lands surrounding it belong to the *konohiki*. Parcel three has two *kīhāpai* and is surrounded by *konohiki* lands. The land was received from Manua and Nohoena received it in 1822 and continues to hold it. No one has objected.
>
> Kanuue sworn and stated. I have seen Nohoena's Waikoloa land. My knowledge is the same as Hano's.

Although Nohoena appears to have laid claim to three parcels, he was awarded only one, which is described as the first parcel in the testimony based on the testifiers' mention of Waikōloa Stream on the Ala'ōhi'a (south) side of the parcel. Similar to Olepau's claim, the *kuleana* parcels awarded in this area were for house lots both of which were enclosed. While the LCAw. issued to Olepau and Nohoena are the only two known awards situated within the project area boundaries, a map of the Waimea Homesteads produced by W. R. Rowell and J. T. Taylor in 1908 (Figure 25) shows the location of other LCAw. within the vicinity of the project area and a summary of each of the depicted LCAws. are detailed in Table 2 below.

Table 2. *Kuleana* awards in the project area vicinity

LCAw/	*Claimant*	*'Ili Name*	*Year Awarded*	*Land Use*
3674	Barenaba	Kalapupu	1851	House lot
3738	Waiahole	Puuki	1851	House lot
3785	Olepau	Kanakanaka	1851	House lot, two houses
3844	Pauhala	Waikōloa	1851	House lot, two houses
3915	Nohoena	Waikōloa	1877	House lot with one one, enclosed by wooden fence
4038	William Beadle	Waikōloa 2	1879	Wood and stone enclosure, three houses
4505	Manuwa	Waikōloa	1879	House lot
4885	William French	Ahuli	1850	Houselot
4886	William French	Puuloa	1850	Enclosed houselot and leather shop (*hale lole bibi*) and slaughter house (*wahi pepehi bibi*)
8505	Kipikane	Waikōloa	1876	Partially enclosed hosue lot, two houses
9971:58	William Pitt Leleiohuku	n/a	1875	House lot

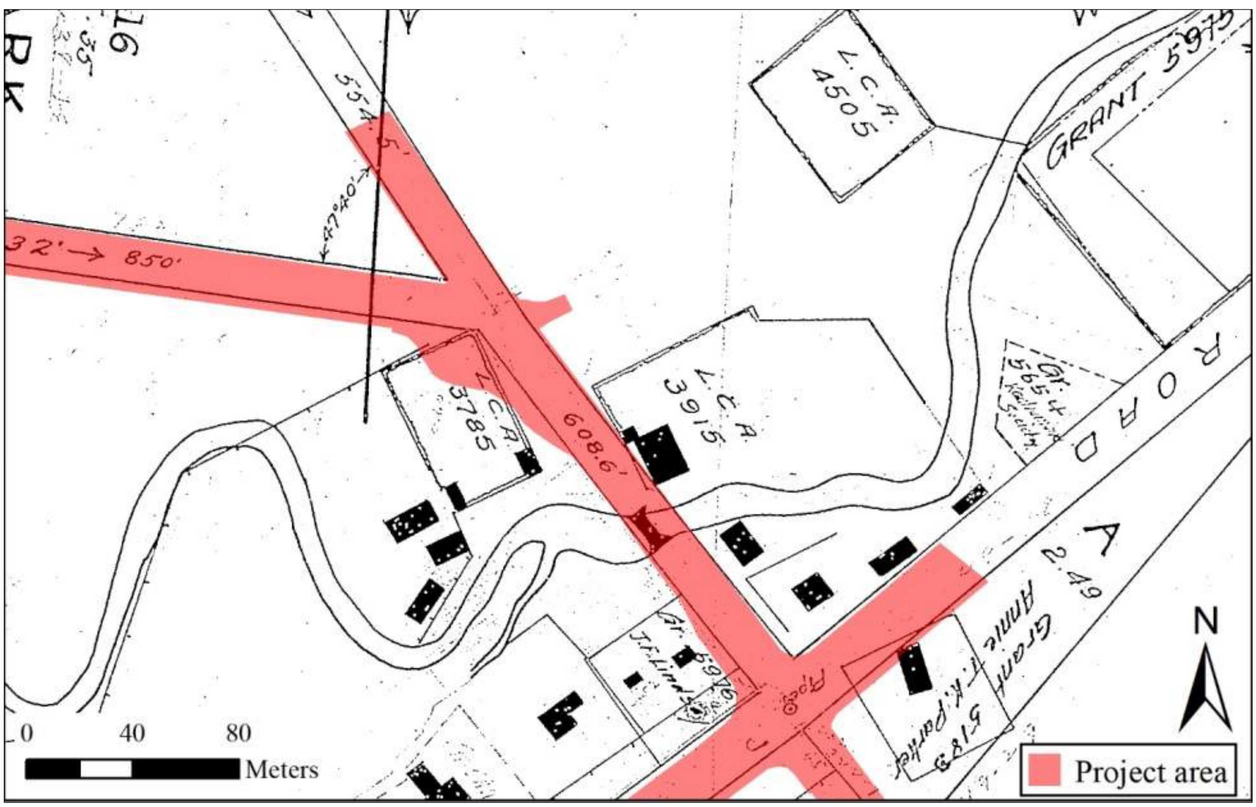


Figure 24. A portion of Hawai'i Registered Map No. 2470 from 1908 by Rowell and Taylor, showing Land Commission Award parcels in the proposed project area.

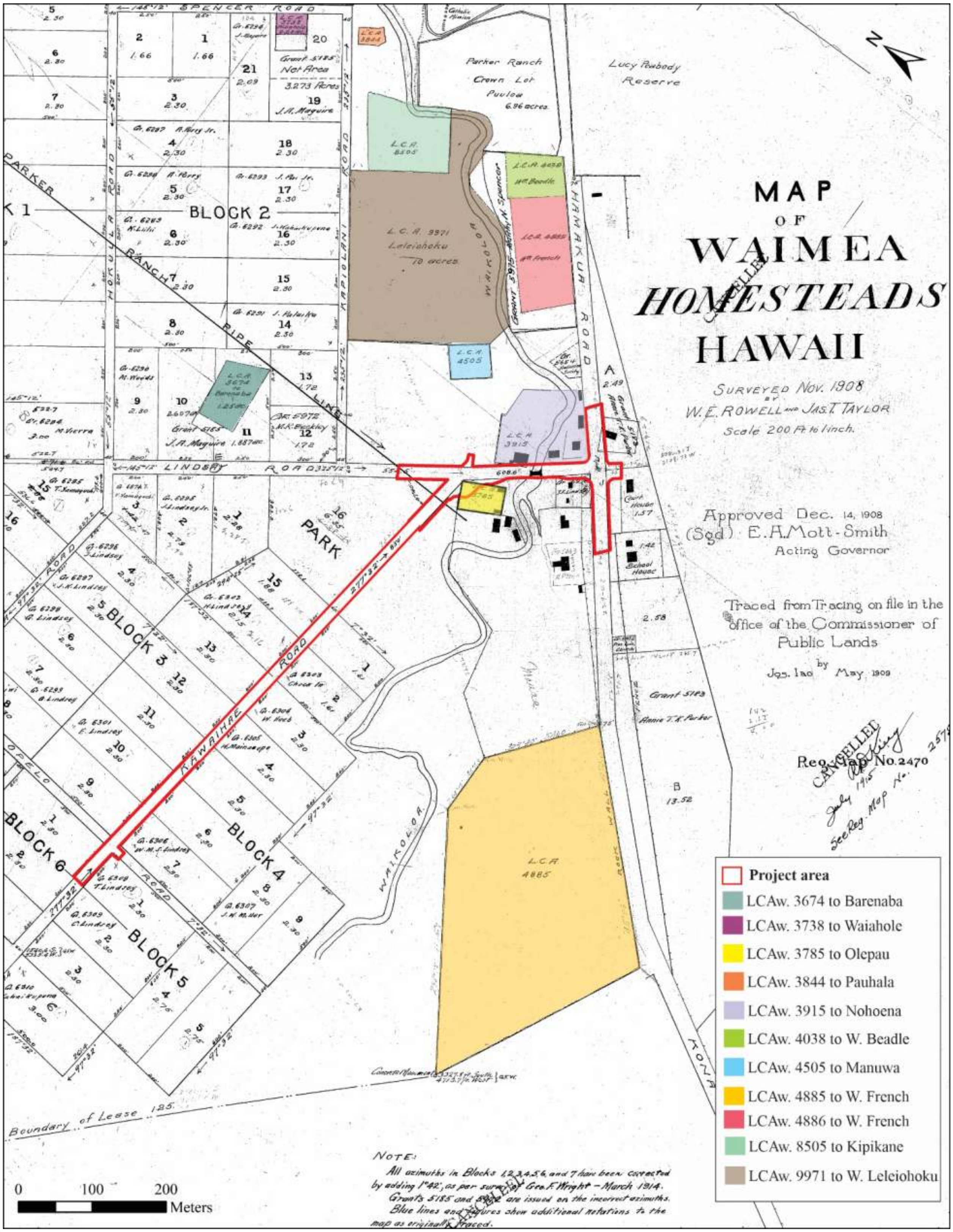


Figure 25. Detail of Hawai'i Registered Map No. 2470 showing project area (outlined red) and other Land Commission Awards within the project area vicinity.

Government Land Program and the Expansion of Ranching in Waimea

In conjunction with the *Kuleana Act*, the King authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the *Māhele ʻĀina*. These Land Grants were generally larger than those awarded by the Land Commission. The Act resolved that portions of Government Lands should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of the program was to enable native tenants, many of whom were insufficiently awarded or not awarded land through the *Kuleana Act* to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of Government lands.

During the middle to late 1800s Western businessmen established a number of diverse industries on these newly available lands. Letters written at the time of the *Māhele* indicate that by 1848 George Davis Hūʻeu had already established a cattle corral, a goat corral, and house lots on lands adjacent to his roughly 95,000-acre Waikōloa award (Maly and Maly 2002). By 1848, John Palmer Parker, founder of the Parker Ranch, had received two acres of land at Mānā where he built a family house and the first ranch buildings (Bergin 2004). In 1850 Parker purchased 640 acres surrounding his Mānā lands, and in 1851 he purchased another 1,000 acres. The next year, Kamehameha III granted Parker a lease on the lands of Waikōloa (presumably Lālāmilo and neighboring lands to the north and east), some of which would eventually be deeded to the ranch by outright purchase. By the middle of the decade, Parker had turned most of the day to day operations of Parker Ranch over to his son, John Palmer Parker II. When John Palmer Parker, died on August 20, 1868, the ranch controlled about 47,000 acres of land in the region (Bergin 2004). These lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr.

The decades following the *Māhele* of 1848 were characterized by a growing detraction from traditional subsistence activities as the population along the Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up by the burgeoning ranching industry. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements or into dispersed upland habitations where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect their homes and gardens from cattle and other free-ranging animals but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. The economy also transitioned, becoming cash-based, and taxes were collected. Foreigners controlled much of the land and most of the businesses, and the native population was largely dependent on these foreigners for food and money (Haun et al. 2003). The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region (McEldowney 1983). Parker Ranch continued to expand its operations in the Waimea area throughout the 1870s and 80s, eventually acquiring the lease to roughly 95,000 acres of Waikōloa that had formerly belonged to the Waimea Agricultural and Grazing Company. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship new managers were brought in to oversee the day to day operations at the ranch.

By the early 1900s, the Parker Ranch headquarters were located near what is now the corner of Lindsey Road and Māmalahoa Highway, in the same building as the old store, post office, and restaurant (Maly and Maly 2005). The ethnic makeup of Waimea at this time was primarily of Hawaiian and part-Hawaiian, Japanese, Portuguese, Chinese, and a small number of *haole* (Euro-American descent); and most of the residents were employed by Parker Ranch or were independent farmers (Paniolo House Committee Friends of the Future 2005). At this time, Parker Ranch was under the direction of Alfred W. Carter, who had been chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. By this time Parker Ranch was operating on several large leased parcels, but the fee simple holdings amounted to only 34,000 acres (Bergin 2004). Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. In 1903, with only a short period left on its lease, Carter acquired nine-tenths interest in the Waikōloa lands from Ms. Lucy Peabody for $112,000, securing important grazing lands for the ranch (Bergin 2004). Soon thereafter, Carter purchased the adjacent lands of ʻŌuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines *makai* of Waimea Town. He also acquired the Puʻuloa Sheep and Stock Company, encompassing over 3,700 acres and including the Keʻāmuku Sheep station in Waikōloa, which he converted to cattle ranching over the next decade. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humuʻula, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

The Waimea Homesteads

Large scale commercial agriculture and the creation of homesteads were enabled by land tenure changes that were implemented after the overthrow of the Monarchy in 1893. Article 95 of the Republic's constitution expropriated the Crown lands from the deposed Queen, and the 1895 Land Act reclassified Crown lands and Government lands into a single category of "Public Lands." This act repealed much of the previous land-related laws and made some Public Land available to citizens of the Republic through homestead leases, right of purchase leases, and cash freehold agreements. Between the overthrow and Annexation, 46,594 acres of former Crown Lands were sold by the government (Van Dyke 2008).

In 1908, the Waimea Homesteads (to the north and southwest of the current project area) was created by the Territory of Hawai‘i and sold as grants for house lots (see Figure 25). Kawaihae Road was realigned and incorporated into the homestead lots, and Opelo Road was laid out about 600 meters southwest of Lindsey Road. Blocks 3, 4, 5, and 6 of the Waimea Homesteads are located adjacent to the Kawaihae Road-Opelo Road portion of the current project area. At the time that these lots were created, two houses/structures were present on Olepau‘s parcel (LCAw. 3785) with one in the southeast corner and another on the southwest corner, outside the current project area (see Figure 24). With respect to Nohoena‘s parcel (LCAw. 3915) six houses/structures are depicted, two of which appear to extend into the northeastern portion of Lindsey Road (see Figure 24). In addition to the sale of the Waimea Homestead lots on the western side of the project area, a small government-owned lot sandwiched between the LCAw. 3785 parcel and Lindsey Road (Figure 26) was sold as Land Grant 7224 to Mrs. Minnie Lonohiwa on March 26, 1919 for $66.50 (Rivenburgh 1917).

With respect to the naming of Lindsey Road, Elizabeth Kimura who was born in 1921 in Waimea and is a descendant of the Lindsey family explained that many members of the Lindsey family had homes along Kawaihae Road and near the current Waimea Park, thus the name was in honor of the Lindsey family who had long-standing ties to Waimea and Parker Ranch's beginnings (Paniolo House Committee Friends of the Future 2005). Figure 25 above shows a number of the Waimea Homestead lots awarded to various members of the Lindsey family. Bergin (2004) provided an overview of the origins and proliferation of the Lindsey family in Waimea noting that their genealogy can be traced to two English brothers, Thomas John Weston Lindsey and George Kynaston Lindsey both of whom had married Mary Ka‘ala Fay, a part Hawaiian woman. Fay had her first son from John Lindsey but after becoming ill, Lindsey returned home to England and sent his brother George Lindsey to Hawai‘i to care for his son and wife. Fay and George Lindsey married on October 7, 1853, and went on to produce ten children many of whom went on to work for Parker Ranch.

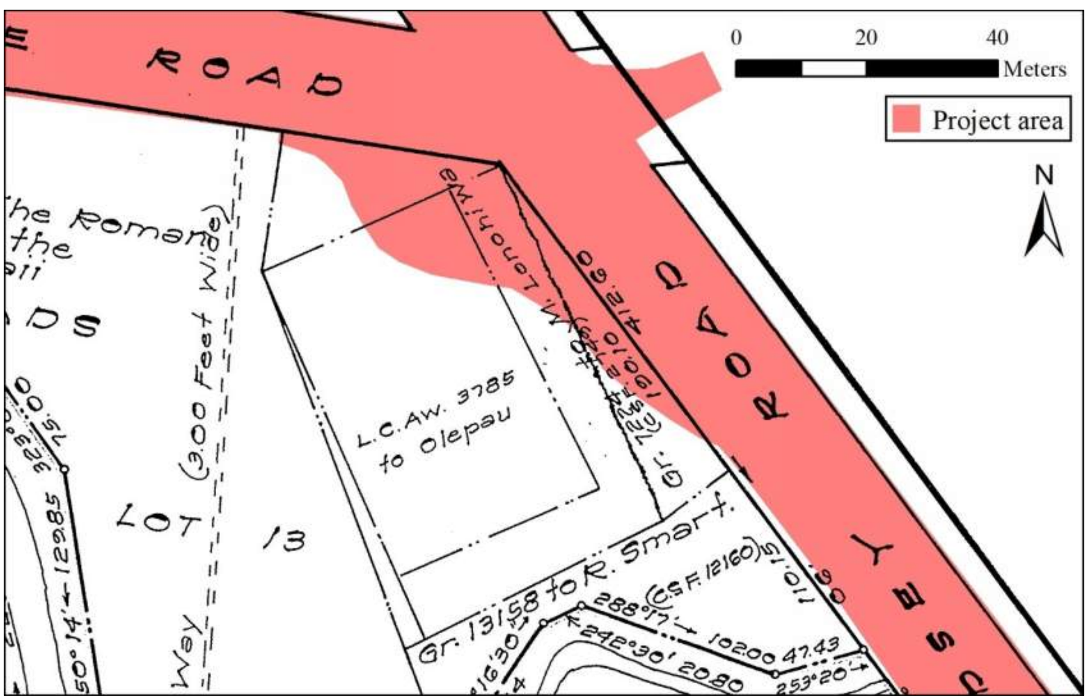


Figure 26. A portion of a map accompanying C.S.F. 12932 showing the approximate extent of the current project area within Grant 7224 and LCAw. 3785 to Olepau (Hashimoto 1959).

Parker Ranch Water Rights Case

Not long after in 1914, Alfred W. Carter, on behalf of Parker Ranch, filed a petition against the Territory of Hawai‘i and sixty-two other individuals over the appurtenant water rights to Waikōloa Stream for the purposes of irrigation (Haun et al. 2003). Carter, in an effort to protect the ranch's water-rights, claimed that the Territory had wrongly diverted waters from the stream in 1905 when they dammed it and ran pipes to Waimea Village, lessening the flow of water to the Parker Ranch lands in Waikōloa, Lālāmilo, and ‘Ōuli. While the courts ruled that the Territory of Hawai‘i was the legal owner of the waters of the stream, they also decided that the residents of the *ahupua‘a* had the right to use such water for domestic purposes. These purposes included watering livestock and irrigation gardens. Testimony in this case was extensive and indicated that from time immemorial Waikōloa Stream had been tapped by a number of ditches or ‘*auwai,* and that the inhabitants of the area relied heavily on the water from Waikōloa Stream for the continued traditional existence. The stream's significant role in the traditional lifestyle of Waimea natives is evident in the *Māhele* records with the prevalence of house lots and houses in the areas surrounding Waikōloa Stream and in the vicinity of the current project area.

The firsthand accounts provided in the testimonies of the residents of the lands describe the Waikōloa Stream *‘auwai* system and turn of the century agricultural practices in the Waikōloa-Lālāmilo area (Haun et al. 2003). All surplus of the stream waters beyond that needed for domestic use was granted to Carter and the Parker Ranch as landowners. A map of Waimea prepared in 1914 and 1915 (Hawai‘i Registered Map No. 2575; Figure 27) illustrates the *‘auwai* network in the greater Waikōloa, Lālāmilo and Pu‘ukapu areas. While Hawai‘i Registered Map No. 2576 (see Figure 27) shows that these ditches are located south of the current project area, it also includes the names of individuals who purchased Waimea Homestead lots in the vicinity of Opelo Road, many of whom were members of the Lindsey family.

With the Parker Ranch water rights clarified by the courts, Carter began improving the ranch's range management practices by adding fence lines for controlled grazing and an improved water distribution system (Bergin 2004). Weed control measures, including the mechanical clearing of pasture and the planting of new grasses for better forage, were also implemented. Throughout the first quarter of the twentieth century, Waimea town remained fairly small, as depicted on an aerial photograph taken in 1925 (Figure 28). By the time Carter acquired the Kohala Ranch Co., comprised of Pu‘uhue and Puakea Ranches in North Kohala in 1932 and 1946, Parker Ranch had grown to include roughly 327,000 acres of fee lands (Bergin 2004), with its main store and restaurant located near the corner of Lindsey Road and Māmalahoa Highway (Figure 29).

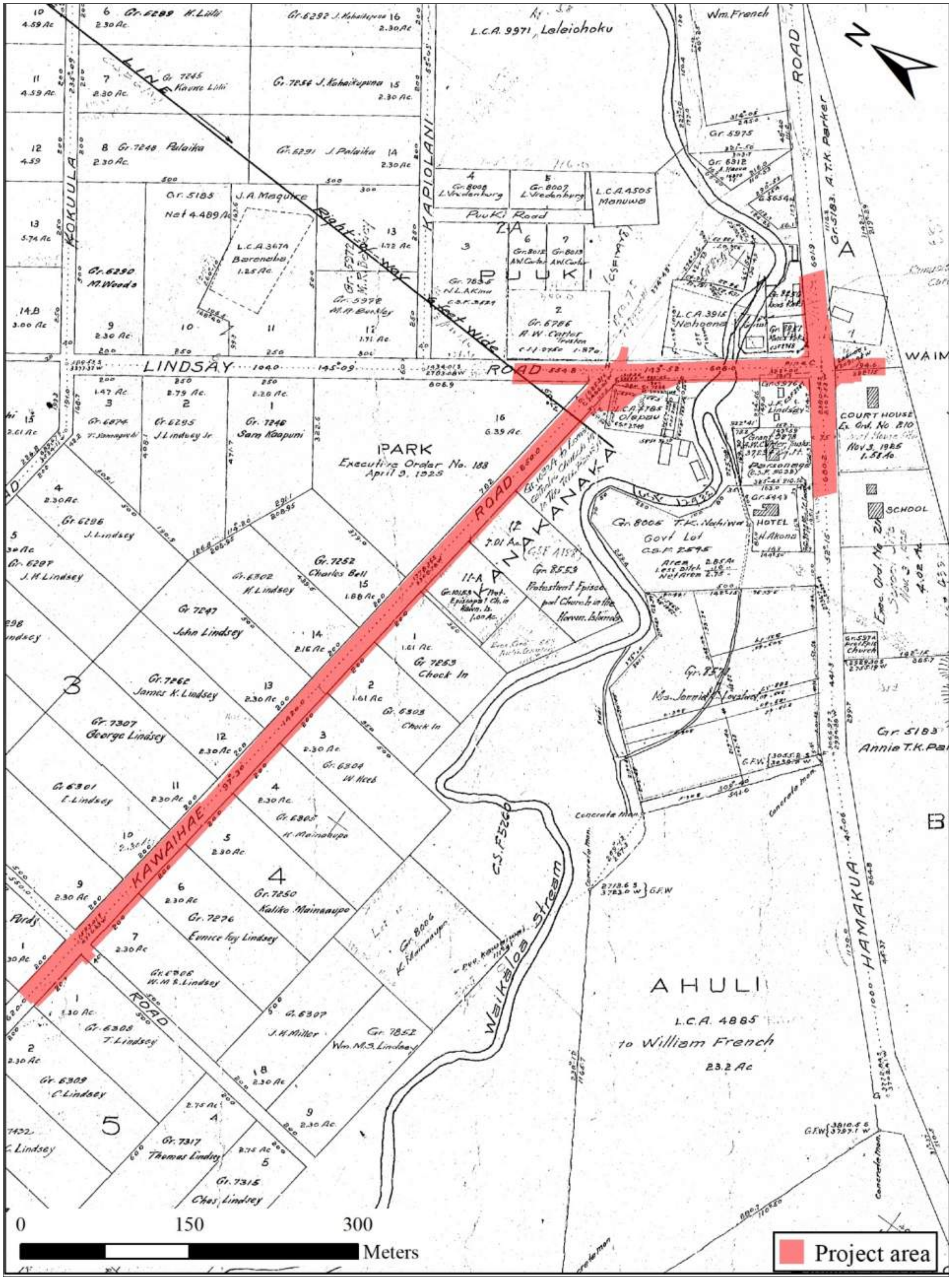


Figure 27. A portion of Hawai‘i Registered Map 2575 dated 1915 showing land grants in the vicinity of the project area (Wall 1915).

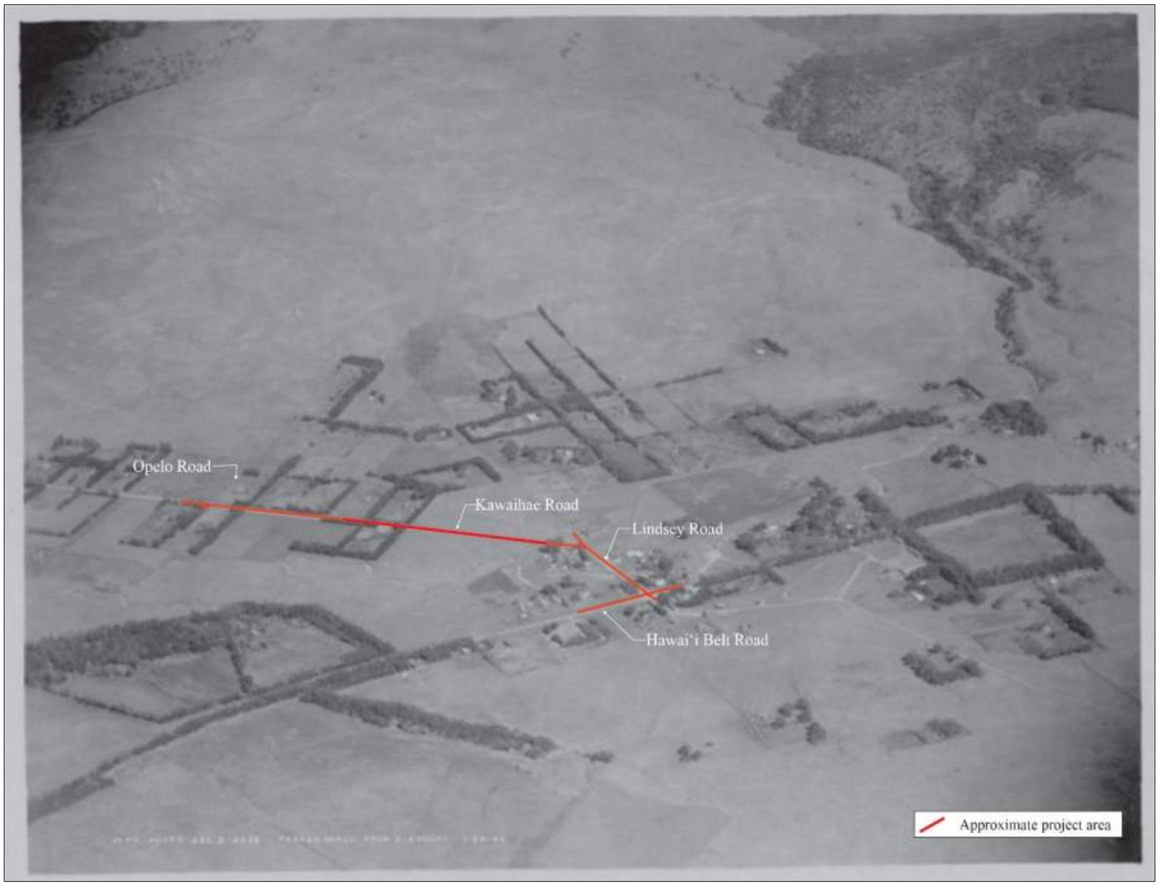


Figure 28. January 28, 1925 aerial photograph of Waimea Town (USAAF 1925).

Figure 29. Entrance to the former Parker Ranch store and restaurant ca. the 1930s (photo courtesy of the Kō Education Center, Honokaʻa).

World War II and Post-War Changes

With the onset of World War II, the population of Waimea would drastically expand. Beginning in 1941, months before the bombing of Pearl Harbor, the United States Army established an infantry headquarters in the Puʻukapu area of Waimea (Bergin 2006) located west of the current project area (Figures 30 and 31). After the United States formally entered WWII, the earlier Army presence in Waimea expanded into one of the largest multi-force (adding the Navy and Marines) U.S. military camps (Camp Tarawa) and training bases in the Pacific. Large areas of the town and the surrounding pastures were turned over to the U.S. Government for campsites (see Figure 30) that housed approximately 20,000 soldiers and as firing ranges for training U.S. Marines (Brundage 1971). Maps and photos of Camp Tarawa the extent of the camp (see Figure 30 and 31). Pipelines to provide water to the camp were installed along all three roads in the project area as shown in Figure 32. Several U.S. Army installations were located immediately adjacent to the project area, including a recreation field at the current location of Waimea Park, a main hospital in the converted Waimea Ranch Hotel building, and a hospital school at the junction of Lindsay Road and Māmalahoa Highway (see Figure 32). Armory Hall built earlier was renamed Barbara Hall, and the current Parker School Theater Building was built as an attached structure in 1942. Within a year of the Japanese surrender, the U.S. Military had all but left the town, and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry. However, the small town grew throughout the rest of the 20th century. Figure 33 captures some of the growth that had occurred by 1954. Near Opelo Road, almost all of the homestead lots appear to have been built on by that time. The former LCAw. 3785 parcel (by then consolidated with the Grant 7224 parcel and an adjacent parcel owned by Parker Ranch) contained a large main building (the Magnolia Lunch Rooms) surrounded by trees that obscure four other buildings. The northernmost outbuildings, an outhouse and storage, and a photography studio (Figure 34), appear to have been inside the current project area, but the others do not.

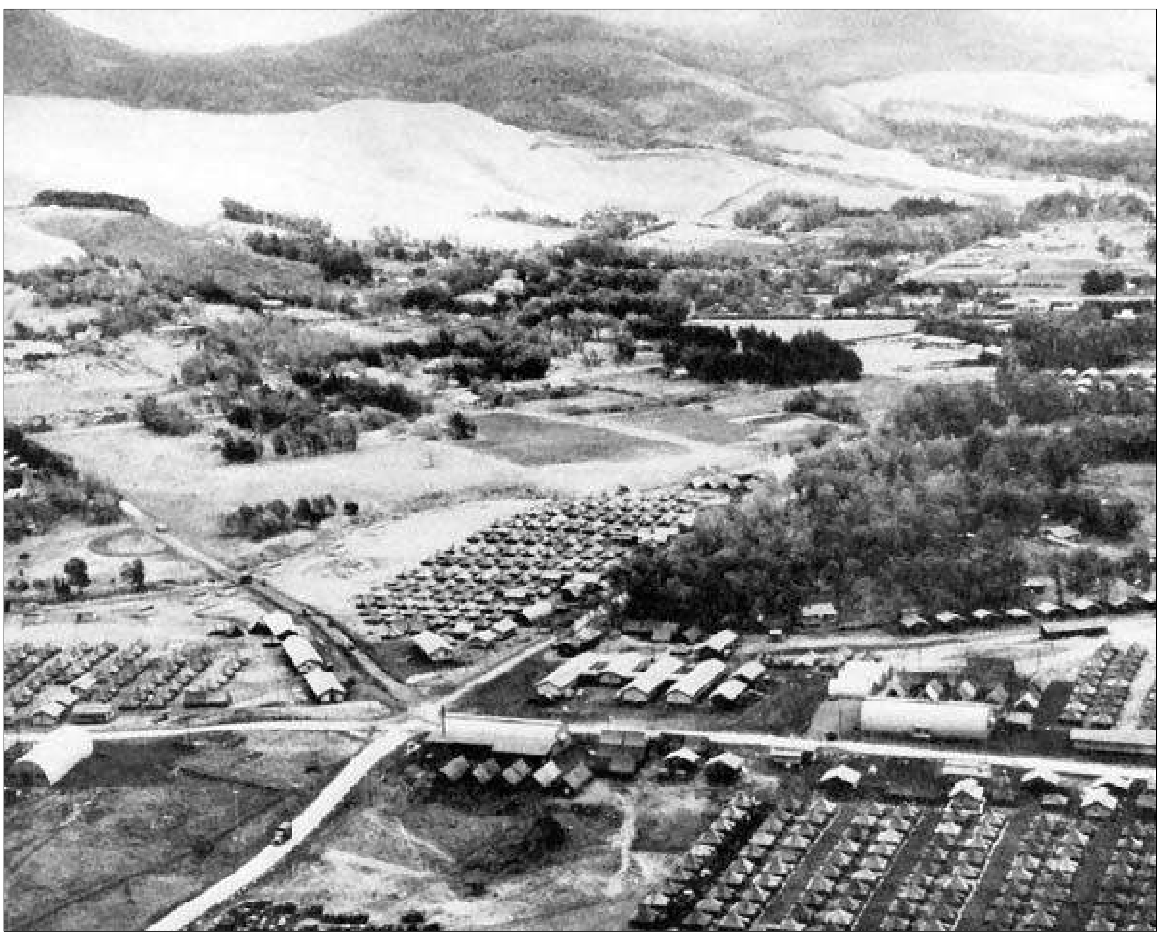


Figure 30. Camp Tarawa training camp in Waimea (http://pacificworlds.com).

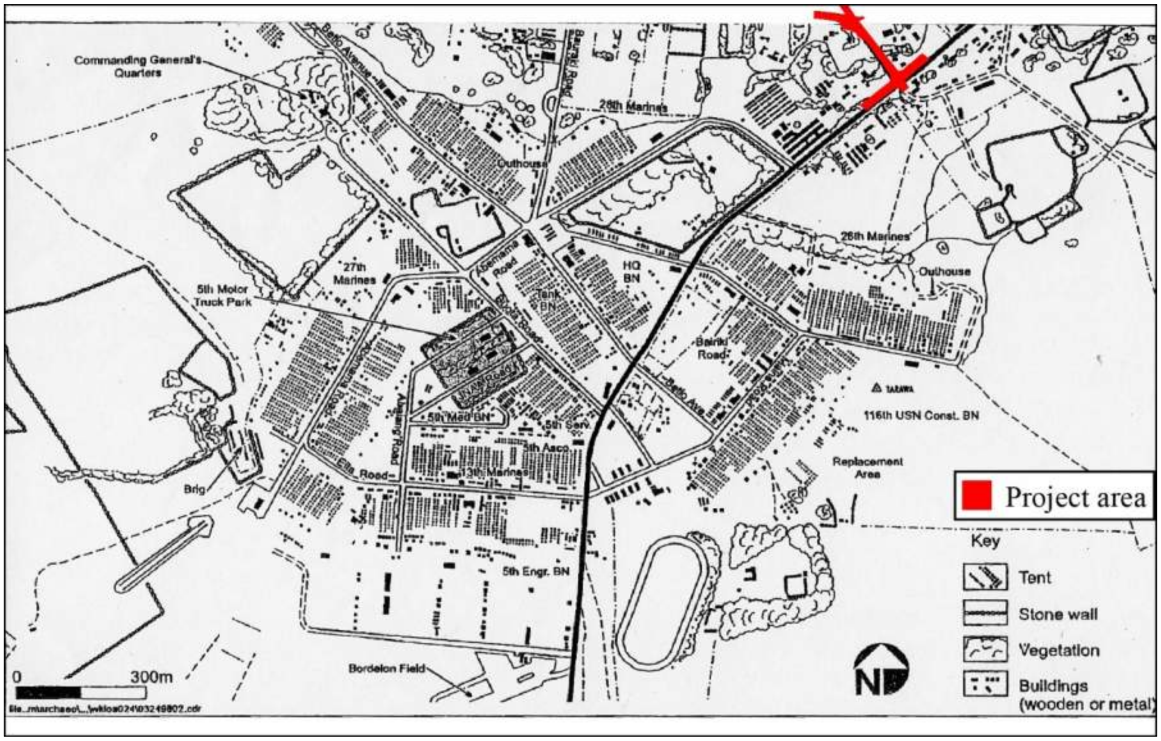


Figure 31. Map of Camp Tarawa ca. 1944 with the current project area shaded red (after Nees and Williams 1998:17).

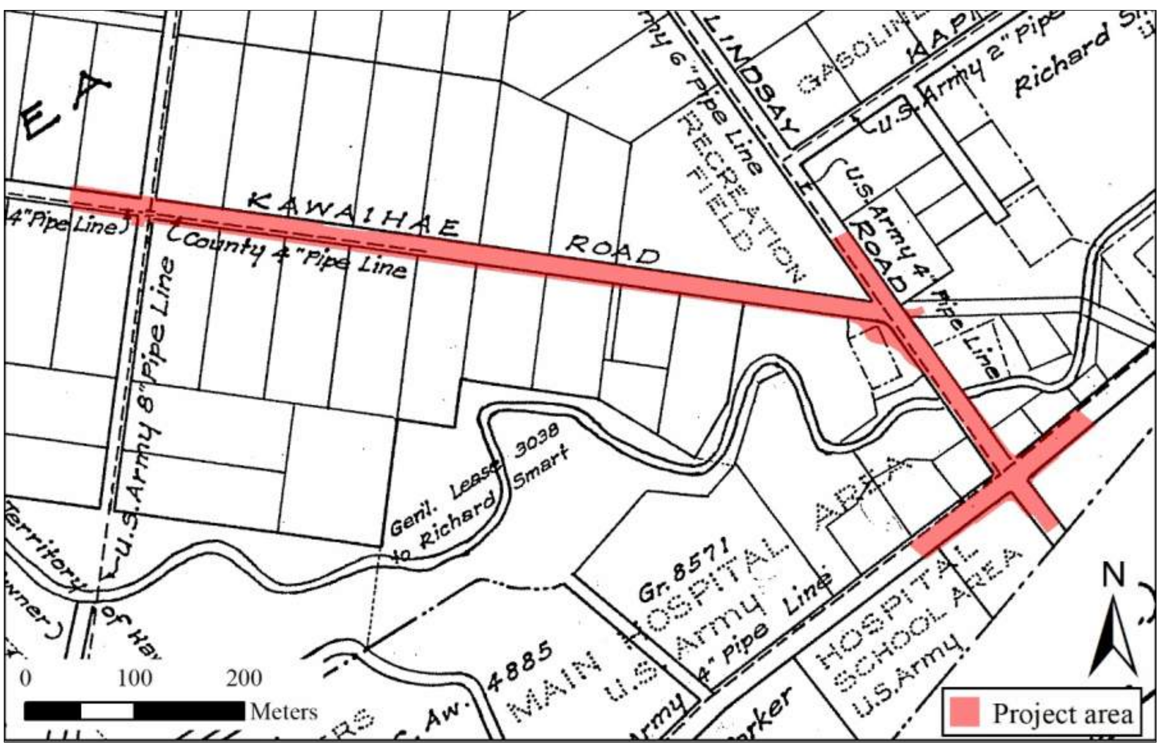


Figure 32. Detail of HTS Plat 411 showing Camp Tarawa Infrastructure (Lane 1945).

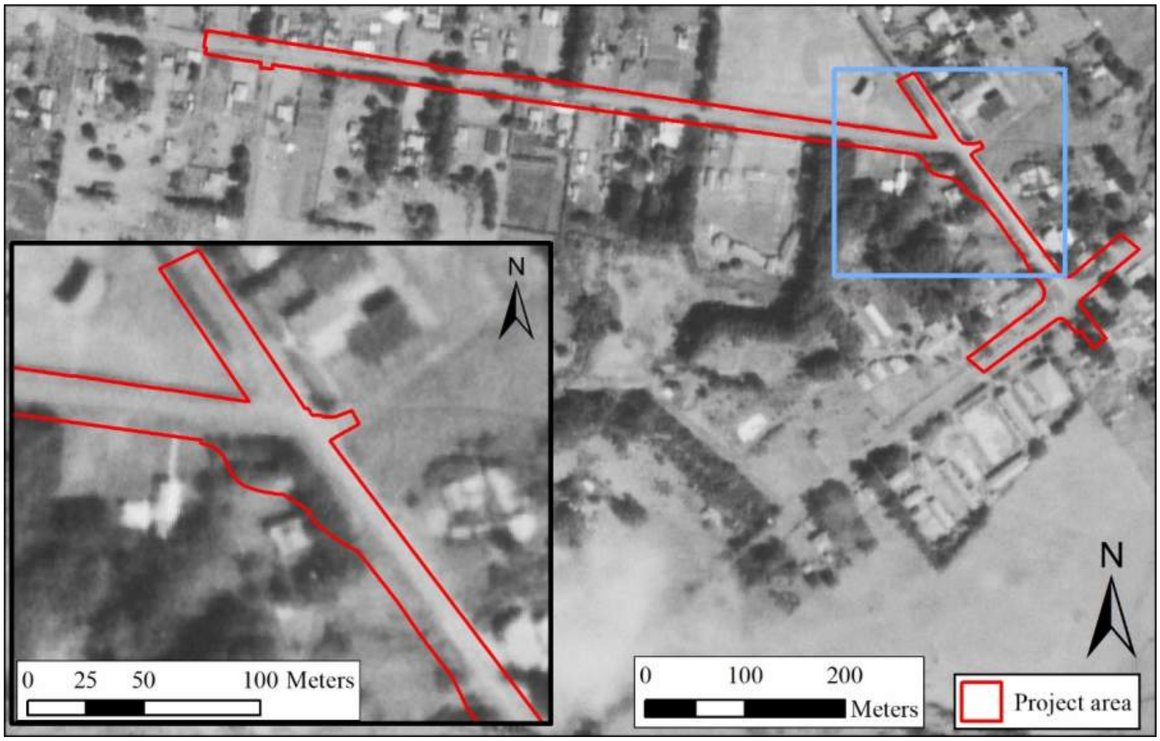


Figure 33. A 1954 aerial photograph (USGS 1954) showing the current project area (outlined in red).

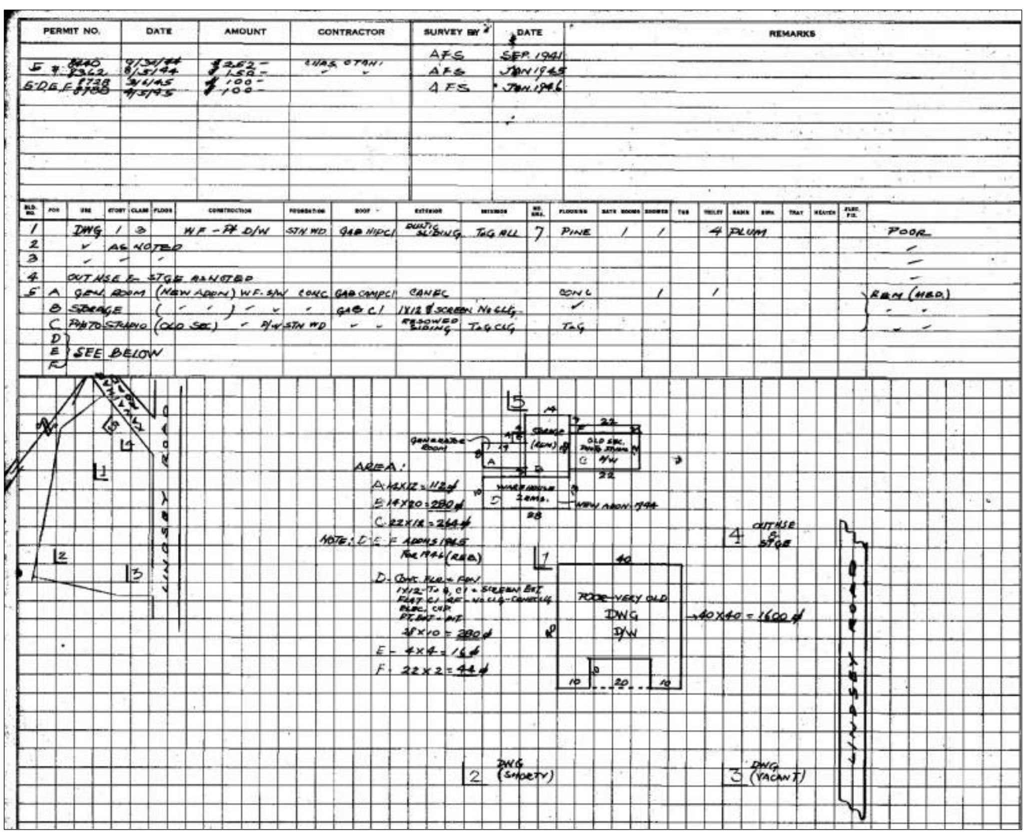
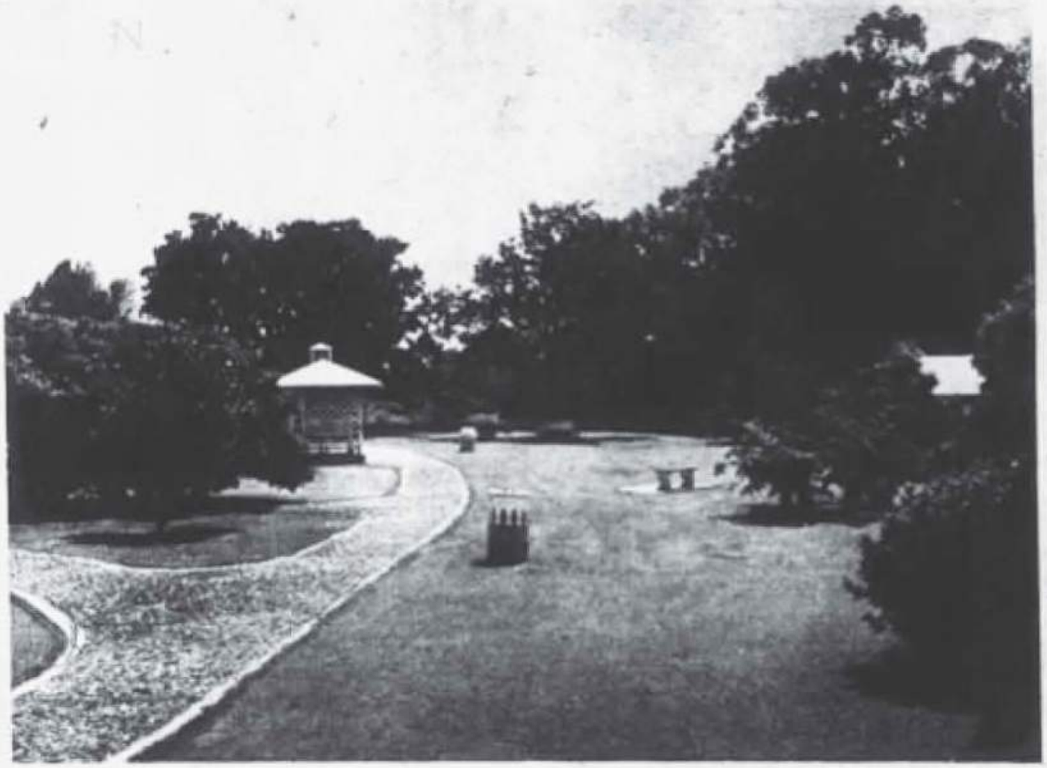


Figure 34. 1951 County of Hawaiʻi tax record depicting improvements on the former LCAw. 3785 parcel.

While Parker Ranch and the ranching lifestyle persisted as the social and economic center of Waimea, new community infrastructure, including parks, became a vital component of the town's development. Richard Smart, Parker Ranch's fifth-generation heir and now owner of the ranch and its vast landholdings, set aside a park in honor of his beloved maternal grandmother, Elizabeth Jane Lanakila Dowsett, known to Smart affectionately as "Auntie Tootsie" (Nakano 1992:42). It had been Dowsett, who, upon the death of her husband John Palmer Parker III, relinquished her 1/3 interest of Parker Ranch lands to their infant daughter and Smart's mother, Annie Thelma Kahilu'onāpua'api'ilani Parker (Bergin 2004). The location chosen for Lanakila Park, named for Richard Smart's grandmother, was the former LCAw. 3785 parcel situated directly west of the junction of Lindsey Road and Kawaihae Road. The buildings on the lot were demolished in 1959, and the park (Figures 35 and 36) was dedicated in 1962. To mark the occasion, the Hawaii Tribune-Herald (1962) reported:

> Future is Arriving At Kamuela – The open airiness of the western range remains about this still highest town in the 50th State. But the old "Cowtown" look is fast disappearing. One recently polished facet of Waimea village is its tiny but prim and precise Lanakila Park, just so named in honor of Parker Ranch Owner Richard Smart's grandmother. "Tootsie" Dowsett's Hawaiian name was Lanakila. In a program of conscious stewardship, the park with its well-planned plantings of evergreens and mixture of tropicals is shaping up along lines of Kamuela's monarchy theme. Just now in bloom, blue agapanthus harmonize with the background blue and white tool shed. A bandstand and small pavilion are included in future plans.

Figure 35. Lanakila Park ca. 1962, view to the northwest from Waikōloa Stream (Hilo Tribune-Herald 1962).



BEAUTIFUL LITTLE LANAKILA PARK—Lanakila Park in the center of Waimea was dedicated in 1962 by Richard Smart as a memorial to his late grandmother, Mrs. John Parker III, the former Elizabeth Lanakila Dowsett. A small bronze plaque in a lava rock column on the grounds bears the appropriate inscription. Reminiscent of the Victorian era, there is a small latticed pergola, picnic shelter, walkways, broad expanses of lawn, a profusion of trees, flowers and over all, a quiet serenity. For public use, the park is about three-quarters of an acre. A circular seat around a spreading tree, stone benches, and rubbish containers painted in scalloped designs are all in keeping with a restful atmosphere. In the early days, the area was a Volcano Stables station, and later several old houses stood there. —T-H photo by Hugh Clark.

Figure 36. Lanakila Park ca. 1968 view to the southwest from Kawaihae Road (Hawaii Tribune-Herald 1968).

Ten years later, State of Hawaiʻi tax records indicates that the park contained much of the same elements as are found today: a cemented cobblestone walkway (visible in Figures 35 and 36), the storage shed, a 20x8-foot rest area, an open concrete bench, an open octagon wooden bench around a tree, a plaque, a three-foot-tall stone wall along the road (visible in Figure 35), and a two-foot-tall stone wall around the park's other boundaries. Throughout the 1970s, development in Waimea began to increase and the town center expanded. By the 1970s, the Parker Ranch Center across the street from the current project area had been built (Figure 37), further illustrating the continuing urbanization and increasing community infrastructures such as cemeteries, parks, schools, and the expansion of first responder infrastructure such as a fire department.

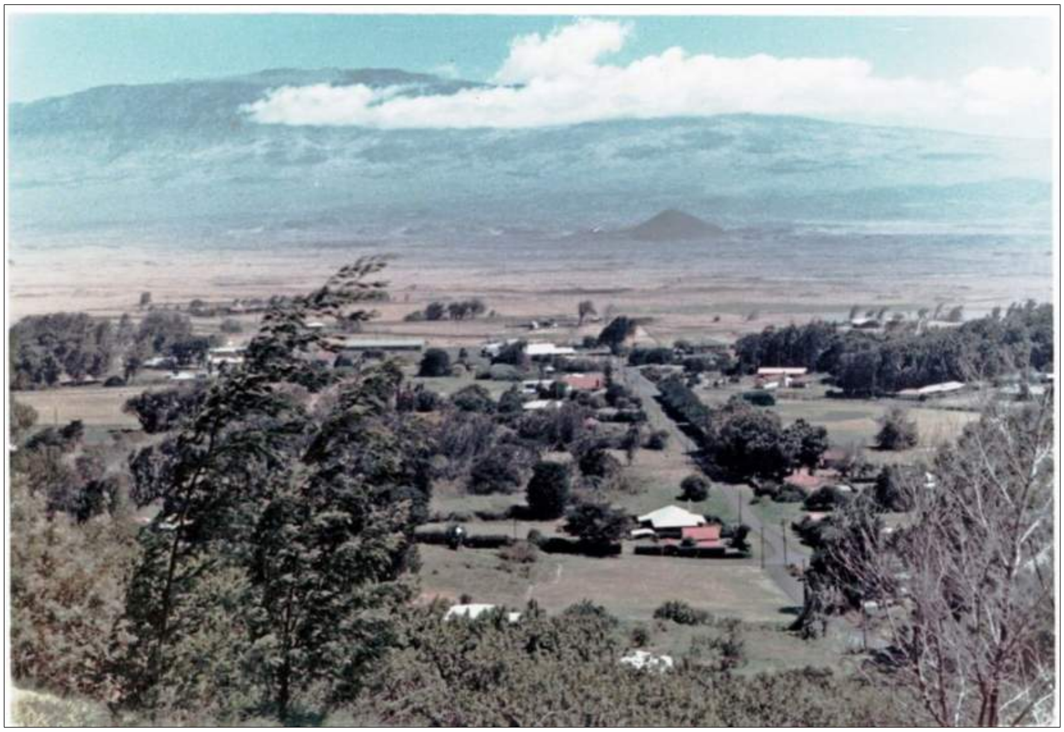


Figure 37. Waimea Town in ca. 1970 (photo courtesy of Kō Educational Center, Honokaʻa).

PREVIOUS ARCHAEOLOGICAL AND CULTURAL STUDIES

To understand the nature of the archaeological and valued cultural resources that have been previously identified in the project area vicinity, past archaeological and cultural studies have been reviewed and summarized below. Table 3 is a listing of all relevant studies and Figure 38 shows the location of each listed study. Although no previous archaeological investigations have been conducted within the confines of the current project area, there have been numerous studies conducted in the general vicinity and within the greater Waimea Region. Many of these studies have focused specifically on the Lālāmilo agricultural field system, a large complex of Precontact agricultural features and associated habitations that were used into Historic times (Barrera and Kelly 1974; Barrera 1993; Ching 1979; Clark 1981a; Clark 1987; Clark et al. 1990; Hammatt and Shideler 1989; Haun et al. 2003; Rechtman 2000). These studies were all conducted in the south and west of the current project area. Feature types identified within the Lālāmilo field system include terraces, mounds, enclosures, field boundaries (*kuaiwi*), irrigation ditches (*ʻauwai*), stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and various other miscellaneous types (Haun et al. 2003). Areas associated with the agricultural fields were later utilized for military training and cattle ranching, with sites and features relating to those repurposed functions being interspersed with the Precontact agricultural fields and habitations. Not pictured in Figure 38 is the project area for an archaeological inventory survey of a portion of Māmalahoa Highway (Site 30187) between Mud Lane and Mānā Road conducted by LaChance et al. (2017), who found no intact constructed elements of the original Māmalahoa Highway. Based on studies conducted elsewhere on the island, Site 30187 was determined eligible for listing in the National Register of Historic Places (State Historic Preservation Division Correspondence Log No. 2017.00231; 00232; 00233; 00234;00235, Doc. No. 1703JLP07). Contributing character-defining features of this historic property include the highway's linear route, bridges, culverts, drainage headwalls, and bounding rock walls.

Table 3. Select previous archaeological and cultural studies conducted in the general vicinity of the proposed project area.

Year	*Author(s)*	*Type of Study*
1992	Thompson and Rosendahl	Inventory Survey
1996	Erkelens	Reconnaissance Survey
1998	Erkelens	Survey and Testing
1999	Wolforth	Data Recovery
2000	Wolforth	Reconnaissance Survey
2001	Magnuson and Athens	Burial Testing and Monitoring
2002	Kikiloi et al.	Archaeological Assessment
2003	Souza et al.	Cultural Impact Assessment
2004	Clark and Rechtman	Inventory Survey
2005	Burtchard and Tomonari-Tuggle	Data Recovery
2006a	Clark and Rechtman	Inventory Survey
2006b	Clark and Rechtman	Archaeological Monitoring
2007	O‘Day and Rieth	Monitoring and Emergency Data Recovery
2009	Yucha et al.	Inventory Survey
2009	Wilkinson et al.	Archaeological Monitoring
2010	McIntosh et al.	Inventory Survey
2010	McGerty and Spear	Cultural Impact Assessment
2011	Haun and Henry	Inventory Survey and Testing
2012	Rechtman	Burial Site Component of a Preservation Plan
2012	Rieth and Filimoehala	Monitoring and Emergency Data Recovery
2013	Rechtman	Inventory Survey and Testing
2014	McElroy et al.	Cultural Impact Assessment
2015	McElroy and Duhaylonsod	Inventory Survey
2016	Tam Sing and Rechtman	Archaeological Monitoring
2016	Kepa‘a and Rechtman	Archaeological Assessment
2016	Tam Sing and Barna	Inventory Survey
2016	Barna et al.	Cultural Impact Assessment
2017	Tam Sing et al.	Archaeological Monitoring
2018	Tam Sing and Barna	Inventory Survey
2019	Barna	Field Inspection
2020	Barna	Field Inspection

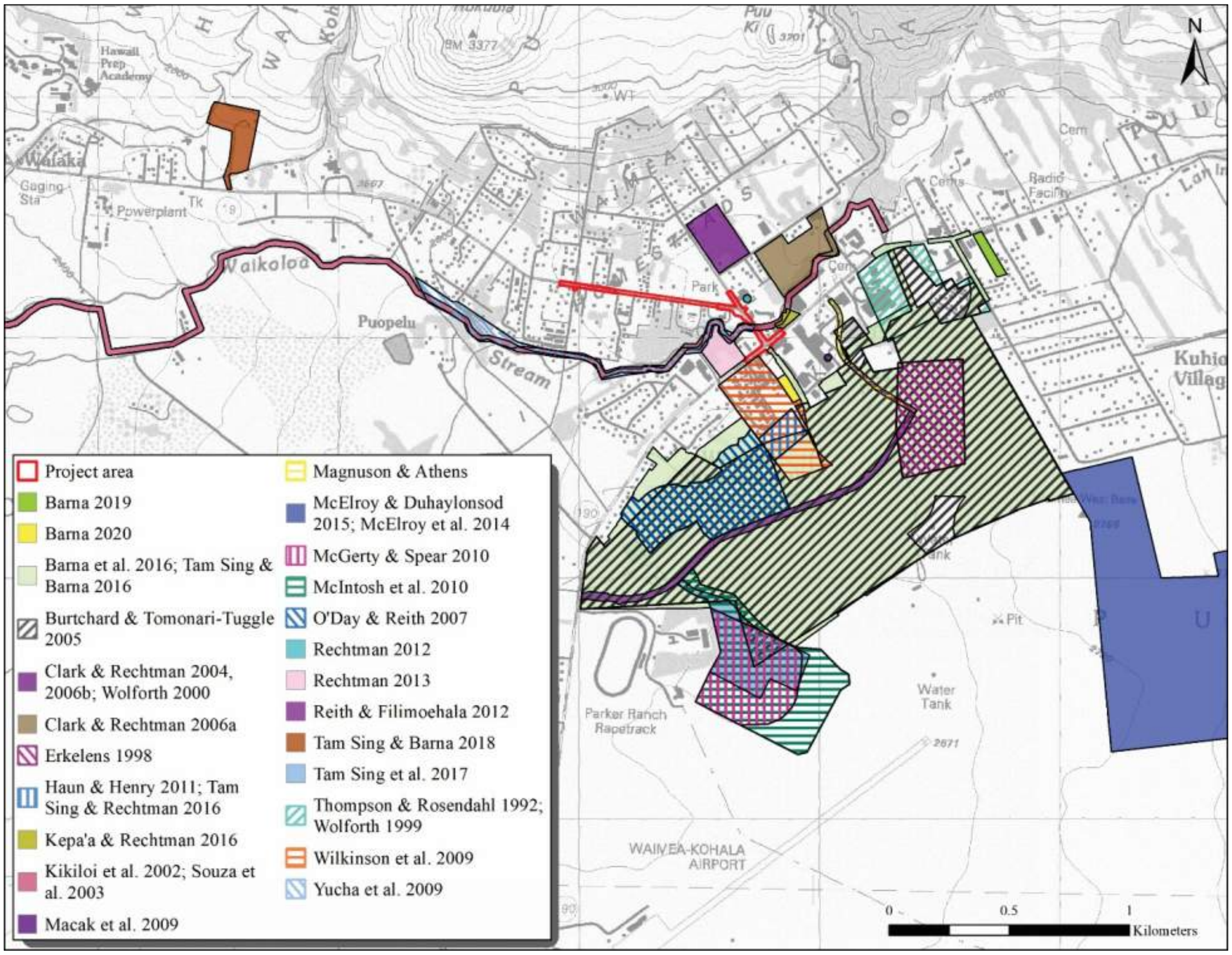


Figure 38. Previous archaeological studies in the vicinity of the current study area.

In 1992, Paul H. Rosendahl, Inc. (PHRI; Thompson and Rosendahl 1992) conducted an Archaeological Inventory Survey (AIS) of seven potential locations for the North Hawaiʻi Community Hospital. All of these parcels were located to the southeast of the current project area on TMKs: (3) 6-7-002:013 and 017, (3) 6-7-003:011, and (3) 6-8-001:001, and 002 (see Figure 38). Four of the parcels examined by Thompson and Rosendahl (1992) contained the remains of a Precontact *ʻauwai* system (Site 16095), and one of the parcels contained the remains of an agricultural complex (Site 18054). Several manually excavated units were dug, however, no significant cultural material was recovered. Three backhoe trenches were also excavated, one, in particular, was oriented specifically to bisect one of the ditches (Ditch D) identified during the fieldwork. One radiocarbon date obtained from charcoal in the base of the *ʻauwai*, which yielded a calibrated age range of A.D. 770 to 1020.

In 1996, Archaeological Research and Consulting Services, Inc. (ARCH; Erkelens 1996) conducted an archaeological reconnaissance survey of four known burial sites (the Bright Family burial site, the Duncan/Lanakila burial site, the Yutaka Pen burials, and the Puʻukapu Homesteads Lot burials) situated within the proposed Waimea Town Center project area and Puʻukapu Homesteads on TMKs: (3) 6-4-002:014 and 017 and (3) 6-4-001:042 located to the southeast of the current project area (see Figure 38). The purpose of the reconnaissance survey was to locate unmarked burials within the confines of each known burial area based on additional information supplied by lineal descendants. Erkelens (1996) did not identify any new burials associated with the known burial locations, however, he did note the location of two burial areas adjacent to the proposed Waimea Town Center project area, indicating that the burial area south of the North Hawaiʻi Community Hospital was associated with the Kaanaana family. Additionally, the Kaanaana family is associated with the Duncan/Lanakila burial site (Site 19416) which was consisted of 16 individual graves within two adjacent enclosures situated within Land Grant 5977 which was awarded to Ella Duncan in 1915.

In 1998, International Archaeological Research Institute, Inc. (IARII; Erkelens 1998) conducted an archaeological survey and subsurface testing of the proposed 385-acre Waimea Town Center property for Parker Ranch, located southeast of the current project area on TMK: (3) 6-7-002 (see Figure 38). They identified five sites including three 19th century house lots (including two LCAw. parcels and a Grant parcel) covering an area of 26.6 acres (Site 8812), a Historic cemetery (Site 19416), and four Historic structures grouped into three sites (Sites 19417, 19418, 19419). Twenty-four backhoe trenches were excavated at the five recorded sites. The skeletal remains of two individuals and a large number of Historic artifacts were discovered during the subsurface excavations. This led the researchers to suggest that there was the likelihood of encountering more unmarked burials within the study area during ground-disturbing activities and further monitoring and burial testing was recommend for the study area. The additional work did not result in any additional findings (Magnuson and Athens 2001).

During the mid-1990s, IARII also conducted data recovery investigations (Burtchard and Tomonari-Tuggle 2005) at several sites within the proposed Waimea Town Center development area located to the south of the current project area (see Figure 38). Their work was focused on gathering data on the development of the agricultural systems and associated habitations within their project area; more specifically, assessing the antiquity of irrigated fields on the Waimea Plains. Burtchard and Tomonari-Tuggle (2005) concluded that while traditional agriculture may date back to the A.D. 1400s in this area, it consisted of non-irrigated fields; and the formal irrigation systems that characterize the Waimea Agricultural System are a 19th-century development associated with commercial agriculture.

In 1999, PHRI (Wolforth 1999) conducted archaeological data recovery excavations at Site 16095 on TMK: (3) 6-7-002:013, one of the parcels investigated by Thompson and Rosendahl in 1992 east of the current project area (see Figure 38). The primary focus of the excavations was to establish a date of construction and use of the *‘auwai*. The system was also mapped in detail. Based on five radiocarbon dates, pollen and macrobotanical analysis, stratigraphic contexts, and historical documentary research, Wolforth (1999) concluded that the earliest use of the *‘auwai* was likely sometime after A.D. 1175, and that it continued to be used into the Historic Period.

An archaeological assessment was completed in 2002 by Cultural Surveys Hawai‘i (Kikiloi et al. 2002) for the proposed Waimea Trails and Greenway project corridor, which bordered Waikōloa Stream and extended from Chruch Row to the South Kohala View Estates (see Figure 38). As a result of the field inspection, Kikioi et al. (2002) reported a concentration of features most of which were associated with the Waimea-Lālāmilo agricultural system in the area *makai* of the County of Hawai‘i Transfer Refuse Station. The site types reported in this section included *‘auwai*, agricultural fields, both Pre-and Postcontact habitation sites, concrete fords, and Historic era ranching infrastructure. Several Historic era structures including a wall, a stream crossing, and the historic ‘Imi‘ola Church was reported in the area *mauka* of the Transfer Refuse Station, however, Kikiloi et al. (2002) added that this part of the trail corridor had been impacted by the development of Waimea town. Kikiloi et al. (2002) recommended that an inventory level survey be conducted, with emphasis on the area *makai* of the Transfer Refuse Station once the staked alignment of the trail is accurately identified.

The Waimea Trails and Greenway project corridor (see Figure 38) was also subject to a Cultural Impact Assessment (Souza et al. 2003). Culture historical background information was prepared, and interviews were conducted with four individuals, Melvin Hewett, Hisao Kimura, Alan Lindsey, and Lynn Taylor, with the first three being former Parker Ranch employees. Mr. Lindsey spoke about the prevalence of native plant species along Waikōloa Stream, some of which were gathered and used medicinally. Mr. Lindsey also spoke about gathering *‘ōpae* (shrimp) and other fish from the stream. Souza et al. (2003) also recorded the historic ‘Imi‘ole Church (Site 50-10-06-7151) and the nearby Spencer Family Cemetery. With regard to burials, Souza et al. (2003) noted that burials had been documented in the area *makai* of the County Refuse Transfer Station (Erkelens 1998; Haun et al. 2002). Several of the consulted parties spoke about spiritual customs and beliefs including the “calling tree” near Kohala Estates as well as the “Rain Rock” near the Anna Perry Fiske property. Additionally, the former Parker Ranch employees described the changing climate of Waimea, noting the presence of less rain and streamflow as a result of water diversions. Souza et al. (2003) concluded that their assessment did not identify any ongoing cultural practices and provided recommendations, which included a concentration of historic and culturally significant sites in the area *makai* of the Transfer Refuse Station and the creation of interpretive signs along the trail corridor.

In 2004, Rechtman Consulting, LLC conducted an AIS (Clark and Rechtman 2004) of three parcels within the Waimea Homesteads (TMKs: (3) 6-5-004:029, 030, 050), northeast of the current project area. The parcels were previously subject to a reconnaissance survey by Scientific Consultant Services, Inc. in 2000 (Wolforth 2000) (see Figure 38). As a result of the survey, a single archaeological site (Site 24168) was recorded. Site 24168 consisted of Parcel 030 (LCAw. 3674) in its entirety and included the remains of a Historic dwelling and several associated features, including a stone walkway, a concrete foundation of a small outbuilding, a stone and mortar construction that formerly anchored a post or pole, an outbuilding that possibly functioned as a bathhouse, a trash dump, and four scattered sections of an iron fence that once enclosed a Historic burial. The burial had been removed from the property and re-interred prior to the Clark and Rechtman (2004)) study. Site 24168 was awarded to Barenaba as LCAw. 3674, and likely saw nearly continuous use of the parcel from the pre-*Māhele* times until the early 1960s. The ground surface in the vicinity of the site was littered with Historic and Modern era remains.

Rechtman Consulting, LLC (Clark and Rechtman 2006b) conducted archaeological monitoring of their 2004 survey area for the proposed development of the Waimea Parkside Residential Subdivision located northeast of the current project area (see Figure 38). As a result of monitoring, a small stone concrete construction along the southern boundary of Parcel 030 that was previously concealed with soil was identified. This new feature, a koi pond, was subsequently designated as Feature H of Site 24168. Additionally, Clark and Rechtman (2006b) recovered two adze fragments from isolated locations in the development area.

In 2006, Rechtman Consulting, LLC (Clark and Rechtman 2006a) conducted an AIS of a roughly 13.6-acre property (TMK: (3) 6-5-004:025 and 026) located to the east of the current project area (see Figure 38). As a result of the survey, four archaeological sites were identified: Site 26680, two segments of a Historic wall; Site 26681, a Historic wall; Site 26682, an *ʻauwai*; and Site 26683, a Historic structure likely associated with the U.S. Military. In addition to a surface survey of the parcel, Clark and Rechtman (2006a) excavated five mechanical backhoe trenches (BT 1-4) within their study area. While BT 1-3 were devoid of cultural material and subsurface features, the excavation of BT-4 revealed fragments of a concrete flume consistent with the approximate location of the eastern end of Site 26682, which had been previously covered by bulldozer push.

In 2007, IARII (O'Day and Rieth 2007) conducted archaeological monitoring and emergency data recovery associated with the development of Lualaʻi Subdivision located to the southwest of the current project area (see Figure 38). They investigated Site 21873, the remains of a mid-19th century residence previously documented by Burtchard and Tomonari-Tuggle (2005). As a result of the emergency data recovery of Site 21873, O'Day and Rieth (2007) uncovered a historic cemetery as well as several subsurface charcoal deposits associated with an *imu* and a hearth which were submitted for radiocarbon dating. Radiocarbon dating results from the hearth ranged from the 14th to the 15th century, while results from the *imu* yielded dates ranging from the late 17th century to the early 20th century.

In 2009 Cultural Surveys Hawaiʻi, Inc. (CSH) conducted an AIS (Yucha et al. 2009) of portions of several parcels comprising almost 9 acres of the Waimea Trails and Greenway Project along the banks of Waikōloa Stream (TMKs: (3) 6-5-003:004 (por.), 005 (por.), 007 (por.), 044 (por.), (3) 6-6-003:006 (por.), and 013 (por.) located west of the current project area (Figure 38). As a result of the study, three sites were identified. Site 50-10-06-26871 was recorded as two remnant features (a paved roadway and a concrete stream crossing associated with WWII Camp Tarawa activities. Site 26872 was assigned to a water transport ditch known historically as the Akona ʻAuwai. Site 26873 is a relatively intact concrete stream ford and associated roadway. Sites 26871 and 26872 were determined significant under Criteria a and d, and Site 26873 was concluded to be significant under Criterion d. The concrete stream crossing of Site 26871 and Site 26872 was slated for preservation and no further work was recommended for the other features and sites. Within Lanakila Park, a stone terrace located along Waikōloa Stream was determined not to be a historic property.

In 2009, CSH monitored the placement of six large capacity septic tanks along with 47 meters of trenching on TMK: (3) 6-7-002:015 for Waimea Elementary and Middle School, located to the southwest of the current project area (see Figure 38). While they did recognize that Waimea Elementary School is on the Hawaiʻi Register of Historic Places (Site 7523), they reported that "no significant cultural materials [sic] and/or subsurface features were encountered during the monitoring work" (Wilkinson et al. 2009:ii). They further recommended that "although no cultural layers or materials were discovered during the DOE wastewater system improvements at Waimea Elementary and Middle School, in the future, if any subsurface activities are conducted on-site archaeological monitoring is recommended" (Wilkinson et al. 2009:39).

An AIS and Cultural Impact Assessment (CIA) was prepared in 2010 for the Waimea District/Regional Park located southwest of the current project area (TMK: (3) 6-7-001:025 por., (3) 6-7-002:017 por. and :063 por; see Figure 38). The AIS fieldwork conducted by Pacific Legacy (McIntosh et al. 2010) resulted in the identification of a previously identified but unrecorded site (Site 8804—a windbreaker shelter), a wall (Site 8809), and three previously unrecorded archaeological sites (Site 28140—an agricultural terrace; Site 28141—an enclosure; and Site 28142—a section of an *ʻauwai* with an adjoining terrace. Subsurface testing was also performed but failed to identify any subsurface cultural deposits. McIntosh et al. (2010) assessed each site as significant under criterion d and recommended preservation. McIntosh (2010:i) added that "if passive preservation is not feasible, further data recovery excavations are recommended for only one site" (Site 8804) and that "no further work is recommended for the remaining sites."

The CIA conducted by Scientific Consultant Services Inc. (McGerty and Spear 2010) for the Waimea District/Regional Park (TMK: (3) 6-7-001:025 por., (3) 6-7-002:017 por. and :063 por.; see Figure 38) included culture-historical background information and consultation with agencies and individuals who were believed to have knowledge of the project area. One interview was conducted with Mr. Barndi Beaudet of Parker Ranch who shared that the parcel had been used for pasture and had been partially excavated to control water flow. Mr. Beaudet was not aware of any cultural activities in the area that would be impacted by the park‘s construction. Based on the negative findings, McGerty and Spear (2010) concluded that the park’s construction would not adversely affect any traditional customary rights.

A 5.2-acre portion of the Waimea Elementary and Middle School campus was the subject of a subsequent AIS (Haun and Henry 2011) (see Figure 38). Historical records indicated that late nineteenth/early 20th-century land use in their project area consisted of activities relating to agriculture (sections of possible *‘auwai*) and commercial ranching, however, no Historic Period artifacts associated with the military were encountered during the survey. Rather, the fieldwork identified two discontinuous segments of a curvilinear depression (possible *‘auwai*) in the southern portion of the project area. Historical background research backhoe trenching indicated that portions of a small network of ditches (SIHP 50-10-06-30172) fed by larger Waikōloa-fed ditches (Lyons, Akona, and Lanakila) were present within the project area. The location of a “Branch of Lyons auwai” was tested, but no evidence of that ditch was observed. No buried cultural deposits or artifacts from the Precontact or Historic Periods were observed in any of the trenches.

In 2012, Rechtman Consulting, LLC prepared a burial site component of a preservation plan (Rechtman 2012) for Site 29368, the location of the inadvertently discovered skeletal remains of a single adolescent individual on TMK: (3) 6-5-004:027, located to the northwest of the current project area (see Figure 38). The remains were displaced during electrical trenching activities under a corner of Parker School’s Theater Building. The remains were recovered from the trench, and the in-situ portion of the skeleton was identified and documented. A decision was made in consultation with DLNR-SHPD and the Hawai‘i Island Burial Council (HIBC) to preserve the remains in place, and to install a preservation buffer around the site extending four feet beyond the location of the remains. A sign indicating the presence of culturally sensitive resources was also to be posted at the preservation area, and the burial site location was to be maintained by Parker School.

In 2012, International Archaeological Research Institute, Inc. (IARII; Rieth and Filimoehala 2012) completed archaeological monitoring and emergency data recovery associated with the construction of the Parker Ranch Connector Road and Pukalani Extension (TMK: (3) 6-7-002:070, :001 (por.), and :069 (por.); see Figure 38). They documented 126 archaeological features at sixteen sites, the bulk of which were Precontact hearths at temporary habitation sites associated with dryland agricultural activities. Some Historic material was encountered and believed to either be associated with 19th-century residences or U.S. Military Camp Tarawa. All sites were considered significant under Criteria d and e, and were mitigated through archaeological monitoring, mapping, and/or data recovery excavations. Site 8805, Camp Tarawa was also deemed significant under Criterion a for its association with World War II. Site 8808 and 9179 described as expansive Pre- and Postcontact agricultural sites were deemed significant under Criterion c.

The following year, Rechtman Consulting, LLC conducted an AIS (Rechtman 2013) of a roughly 5-acre property (TMK: (3) 6-5-003:002) for the proposed development of a commercial/retail center, located to the west of the current project area (see Figure 38). The inventory survey identified two previously documented Historic Period sites; Remnant features associated with U.S. Military Camp Tarawa (Site 26871), and remnants of the Akona *‘Auwai* and a side branching ditch (Site 26872) initially recorded during an inventory survey by CSH in 2009 (Yucha et al. 2009). Historical evidence suggests that the Akona Ditch was constructed in 1845 to bring water to the upstart sugarcane operation at Līhu‘e to the west of the current project area and that by the late 19th-century was the headwater for the large dendritic irrigation system that serviced the Lālāmilo fields. In addition to a surface survey of the parcel, Rechtman Consulting, LLC Rechtman (2013) also excavated three controlled test units (TT-1, TT-2, and TT-3) and five soil percolation test trenches (PTs). Two of the three controlled test units (TT-1 and TT-2) were excavated on top of the projected course of the main ditch, and TT-3 was excavated on top of the projected course of the side branch. In all three cases, a buried *‘auwai* feature was encountered.

A CIA was prepared in 2014 by Keala Pono Archaeological Consulting, LLC (McElroy et al. 2014) for the Waimea Nui Community Development Initiative located to the southeast of the current project area (TMK: (3) 6-4-038:011; see Figure 38). McElroy et al. (2014) compiled culture-historical background information and conducted interviews with four *kupuna* from Waimea, Mr. Sonny Keakealani, Allen “Uku: Lindsey, Mark Yamaguchi, and an unnamed female *kupuna.* In summarizing the findings from the interviews, McElroy et al (2014:49) reported that the area was formerly called Christmas Paddock and that no material remains of the paddock exist today. The interviewees also did not know of any archaeological resources within the area but noted that the place was utilized for gathering *koali* (morning glory). They also shared their thoughts on the changes to Waimea over time and made note of the changes in weather, flora, fauna, and lifestyle. They also provided the following concerns and recommendations: the need to construct another road into the area; concerns about cultural practices hindered by laws and regulations; concerns about further development, overpopulation, and the waste; concerns about water; recommendations to utilize the old place names; recommendation to hold a blessing before construction begins; recommendations to work with *kama'āina* and the general community in the planning process. McElroy et al (2014) also noted the presence of two surface archaeological features, which were identified during an AIS (McElroy and Duhaylonsod 2015) of the subject property and a modern *ahu* located outside of the project area along Hi'iaka Street, which was constructed by Hawaiian cultural practitioner, Keali'i Bertelmann. In light of their findings, McElroy et al. (2014) recommended that archaeological monitoring be performed during all ground-disturbing activities.

As previously noted, the Waimea Nui project area (TMK: (3) 6-4-038:011; see Figure 38) was also subject to an AIS (McElroy and Duhaylonsod 2015). The AIS included a pedestrian survey of the entire parcel as well as three subsurface test units and ten trenches. The survey resulted in the identification of a single site Site 30195, a surface alignment of cobbles. The site was determined to be significant under criterion d and no further work was the recommended treatment. McElroy and Duhaylonsod (2015) recommended archaeological monitoring only in the vicinity of Site 30195.

In 2015, ASM Affiliates conducted an Archaeological Assessment (AA) (Kepa'a and Rechtman 2015) of a roughly 0.677-acre property for the proposed expansion of the KTA Waimea grocery store parking lot located to the east of the current project area (see Figure 38). Fieldwork for the project included a systematic 100% pedestrian survey of the surface of the project area as well as subsurface testing (mechanical trenching) at five selected locations. As a result of the fieldwork, no surface or subsurface archaeological sites or features were identified within the project area.

In 2016, ASM Affiliates conducted archaeological monitoring (Tam Sing and Rechtman 2016) of 5.5-acres for the development of the Waimea Middle School Eight Classroom Building Project on TMK: (3) 6-7-002:015 located south of the current project area (see Figure 38). As a result of monitoring activities, nine isolated Historic Period artifacts (e.g. intact and fragmented glass bottles, metal chains, pickaxe head, and a panel from a seed trough) were recovered, however, no intact buried cultural deposits were identified.

Again in 2016, ASM Affiliates (Tam Sing and Barna 2016) completed an AIS for the roughly 385 acres associated with the Waimea Town Center (WTC) development located south of the current project area (TMKs: (3) 6-7-001:025, (3) 6-7-002; and (3) 6-7-003; see Figure 38). The purpose of their study was to bring the archaeological inventory of the WTC up to date by compiling the results of previous relevant reports and augmenting those prior studies with additional fieldwork to fill gaps in earlier inventory work. The WTC project area has been intensively studied by archaeologists since the late 1970s. Tam Sing and Barna 2016 recorded that fifty-one archaeological sites have been previously recorded within the WTC project area and nearly all of the sites were assessed as historically significant under one or more criteria. Data recovery or monitoring has occurred at most of these sites, and therefore most sites have approved historic preservation treatments of "no further work." Exceptions include sites containing burials and historic cemeteries (Sites 19416, 21850, 21852, 21873) that have been preserved, and sites located within established preservation areas such as the Bullock Pen preservation area (Sites 21869, 21870, and 21871), the Agricultural site preservation area (Sites 8808, and 21855), and Pukalani Stables preservation area (Sites 19417, 19418, and 19419). Due to the extent of previous archaeological studies in the WTC project area, only a few small areas had not yet been subject to an inventory-level survey. These "gap areas" included the Lindsey Road Extension adjacent to the Parker Ranch Center parking lot, a portion of Kamāmalu Street between Māmalahoa Highway and Waimea Elderly Housing, and a portion of Māmalahoa Highway adjacent to North Hawaii Community Hospital. These gaps in coverage contain disturbed roads and road shoulders that have been continually maintained. In addition to these gap areas, background research identified two previously unrecorded Historic buildings within the WTC project area. The fieldwork concentrated on recorded the two previously unrecorded Historic buildings (the Camp Tarawa-era slaughterhouse and the Breaking Pen coffee shack) and inspecting the "gap areas" described above. As a result of the fieldwork, only one newly-recorded site (Site 30623) and one newly-recorded feature of an existing site (19419) were identified. Site 30623 was assessed as significant under Criteria a, c, and d, and recommended for preservation (rehabilitation and adaptive reuse). Site 19419 was assessed as significant under Criteria a, b, c, and d, and also recommended for preservation.

The WTC project area (see Figure 38) was also subject to a CIA, which was completed by ASM Affiliates (Barna et al. 2016). Barna et al. (2016) compiled culture-historical background information and conducted interviews with twelve individuals, all of whom had genealogical ties to the Waimea area, ties to Parker Ranch, and or had knowledge of cultural practices and features associated with the WTC project area. In summarizing the findings and recommendations for the WTC development, Barna et al. (2016:48) concluded that:

> Another potential cultural impact relates to the protection of cultural beliefs and traditions that are important to the *paniolo* community. Many of the interviewees stated that in order to protect these cultural beliefs and traditions, it is vital not only to preserve historic properties associated with such beliefs and traditions, but also to promote the perpetuation of ranching and ranching-related activities in Waimea. Thus, any diminishment of the overall traditional landscape and character of the community (e.g., substantial residential and commercial development, the cessation of ranching-related activities) could be seen as a potential cultural impact. Specific historic properties mentioned as being integral to the *paniolo* character of the WTC area include the Pukalani Stables area (Sites 8812 19417, 19418, and 19419), the Bullock (Minuke ʻOle) Pen (Site 21871), and Puehale Pen (Site 8807). All of these places continue to communicate and inform the rich and storied history that is at the heart of the *paniolo* way of life.

Based on their findings, Barna et al. (2016) also recommended that a "heritage trail" be developed as a way to inform residents and visitors about the historically and culturally significant sites within the WTC project area, including the *paniolo* history as well as traditional *kuleana* lots and the agricultural features. It was also recommended that continued consultation with stakeholders in the Waimea community be continued as the WTC projects move forward. The interviewees also expressed concern for Waimea's ranching way of life—which connects them to the place and which they want to pass on to future generations—is quickly disappearing. While the interviewees generally understood the reasons for developing the WTC, they ask that future development should retain the overall feeling of historic Waimea and the visual effect of the Precontact and ranching landscape. Chief among their concerns was the maintenance of open space and adaptive reuse of historic buildings.

In 2017, ASM Affiliates conducted archaeological monitoring (Tam Sing et al. 2017) of construction activities on 50-acres of Parker Ranch land for the development of Phase I of the Waimea District/Regional Park, located southwest of the current project area (see Figure 38). As a result of the monitoring, 119 Historic and Precontact artifacts were identified and collected, all of which derived from isolated contexts or were associated with previously identified sites. Artifact locations were identified in the access road adjacent to Ala ʻŌhiʻa Road in two distinct concentrations: Concentration 1 and Concentration 2. Artifact types identified in Concentration 1 were determined to be directly associated with a previously identified stone wall (Site 21860) and primarily consisted of 19th-century ceramics and bottle glass and were interpreted to have been domestic refuse discarded by the former occupants of the site. Alternatively, Concentration 2 was deemed to be temporally and spatially associated with Site 8805 (Camp Tarawa) and contained artifacts dating to the A.D. 1940s. Additionally, four sets of human skeletal remains were inadvertently discovered during the course of monitoring, two of which were identified in a primary context and two which were concluded to have been secondarily deposited. Two sets of remains were preserved in place and two were relocated to a designated preservation area. Aside from the inadvertent burial discoveries, no new archaeological sites were encountered during monitoring activities.

In 2018, ASM Affiliates (Tam Sing and Barna 2018) conducted an AIS of TMK: (3) 6-5-006:005, a 9.363-acre parcel located northwest of the current project area (see Figure 38). As a result of the survey, two previously unrecorded archaeological sites were identified. The first of these, Site 30917, consisted of a remnant Historic boundary wall separating the subject parcel from four residential parcels located to the west. It consisted of two Historic (i.e., as originally constructed) segments and two modern (reconstructed in 1993) segments. The second site, Site 30918, consisted of a ditch remnant formerly utilized to water agricultural fields that were formerly located adjacent to the parcel. Tam Sing and Barna (2018) related that at least half of Site 30918's original length was removed during construction activities that occurred in 1993. Both sites were evaluated as significant under Criterion d, and it was concluded that the proposed subdivision of the subject parcel would result in "no historic properties affected."

A field inspection was completed by ASM Affiliates in 2019 (Barna 2019) for a rezoning application of a 2-acre parcel (TMK: (3) 6-4-006:022) located to the southeast of the project area see Figure 38). As a result of the field inspection, no archaeological resources were observed this Barna (2019) concluded that the proposed rezoning action would result in an effect determination of "no historic properties affected" (Barna:2019:9)

Most recently in 2020, ASM Affiliates conducted a field inspection (Barna 2020) of TMK: (3) 6-7-002:054, a 1.127-acre property located within the Waimea Town Center located just south of the current project area to facilitate the transfer of the parcel from Parker Ranch to the Department of Education (see Figure 38). As a result of the field inspection, a highly disturbed 5.8-meter-long by 0.9 to 1.2-meter-wide and 45 to 50 centimeters deep linear depression representing a segment of the previously identified Lyon's ʻAuwai (Site 9179) was observed along the western parcel boundary. Based upon the poor condition of the *'auwai* remnant, it was concluded that although it was previously determined to be significant under Criterion d for its information content, it suffered from a severe loss of integrity of multiple categories. Thus, it was concluded that the proposed land transfer would result in a determination of "no historic properties affected."

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts on resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the written historical record of a place. As stated in the OEQC (1997) *Guidelines for Assessing Cultural Impacts*, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

INTERVIEW METHODOLOGY

To identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current project area, a public notice was submitted to the Office of Hawaiian Affairs (OHA) for publication in their monthly newspaper, *Ka Wai Ola*. The public notice was submitted via email on March 25, 2020, and was subsequently published in the May edition of *Ka Wai Ola*. A copy of the public notice is included in Appendix A. Additionally, ASM staff utilized the list of suggested agencies in the *Guide to the Implementation and Practice of the Hawaii Environmental Policy Act* published by the (OEQC 2012) as well as the Native Hawaiian Organization List published by the Department of the Interior (Parker and King 1998).

Although no responses were received as a result of the *Ka Wai Ola* publication, requests for consultation letters were mailed to five Native Hawaiian Organizations/Institutions (NHO) servicing the Kohala District area, and one government agency (the Department of Hawaiian Homelands). Additionally, requests for consultation letters were emailed to three NHOs/Institutions, four community members, and one government agency (Office of Hawaiian Affairs). In total, ASM staff attempted to contact fourteen community members, NHOs, and government agencies. Of the fourteen community members, NHOs/Institutions, and government agencies contacted, four individuals responded to our request for interviews.

Per the OEQC (2012) *Guidelines for Assessing Cultural Impacts* – Section III regarding ethnographic and oral history interview procedures, it states the inclusion of "any constraints or limitations which might have affected the quality of the information as obtained" (OEQC 1997:3). In December 2019, the World Health Organization (WHO) detected an unknown pneumonia in China and later declared a Public Health Emergency of International Concern the following month. The newly discovered coronavirus was later called COVID-19, which eventually impacted the United States and Hawai'i. To limit the spread of COVID-19, on March 23, 2020, the State of Hawai'i issued a third supplementary proclamation mandating social distancing measures and stay-at-home orders throughout the state, which was effective until April 30, 2020. On April 25, 2020, the State of Hawai'i released its sixth proclamation extending the social distancing and stay-at-home orders until May 31, 2020. In lieu of in-person interviews due to the mandated orders and to keep our *kūpuna* and communities safe and healthy, ASM Affiliates opted to hold telephone and videoconferencing as alternative methods to the consultation process. It should be pointed out that some individuals and organizations prefer to meet in-person to share (but not limited to) personal photos, visit cultural sites, trails, gathering areas, etc., however, due to the government mandates to limit the spread of COVID-19, that was not possible. Although the quality of information exchanged during the consultation for this project has been useful in identifying potential cultural impacts; not being able to meet in-person, which is the preferred method of consultation for a CIA, may have (although not apparent) affected the quality of the information obtained.

As part of the interview process and with the consent of the interviewees, three of the interviews were audio-recorded for note-taking purposes only (audio files not available). Upon completion of the interview, the lead author Lokelani Brandt prepared an interview summary, which was emailed to the interviewees for review. The interviewees were provided with the opportunity to review and edit the summary. The goal of this review process is to ensure that the information presented in the summary accurately reflected the thoughts, knowledge, and concerns, of the interviewees. With the approval of the interviewees, the final versions of their summaries are presented below.

KAMUELA PLUNKETT

On April 26, 2020, Mr. Kamuela Plunkett was interviewed by ASM staff, Ms. Lokelani Brandt via Zoom. When asked if he could share a bit about his personal history and connection to Waimea, Mr. Plunkett related that he wasn't born in Waimea but his family moved there when he was 3 months old. He grew up in Kuhio Village, a Hawaiian Homestead community located to the east of the proposed project area; he attended Waimea Elementary School. He lived in Waimea full-time until he was 7 years old. He and his mother moved to the east side of the island after his Father died. While living on the east side of the island he and his mother would visit his sister 1 to 2 times a year in Waimea who retained the family house in Kuhio Village.

When asked about his earliest memories of Waimea, Mr. Plunkett recollected that the community was rural, the population was rather small, and that the presence of Parker Ranch was so much more visible. He recalled seeing the Parker Ranch trucks on the roads as well as the continuous movement of large trucks and trailers hauling cattle and other livestock. In recalling memories of his childhood, Mr. Plunkett shared that up until the 1980s, he remembered seeing people still riding horses in the neighborhood and even into town. He related that although it was not the primary mode of transportation, people still used horses to get around and that the hitching post at the bank was evidence of that (hitching post also mentioned in Paka Paniolo periodical). He believes that sometime in the 1980s a County ordinance was passed that prohibited the use of horses on the roadways. He shared that growing up in Waimea in the 1980s-90s, the town was small, people knew each other, and that they would go to town to shop for groceries at the Old Parker Ranch shopping center. He fondly recalled certain local eateries located in Waimea town which included Wild Horse Pizza located across the Police Station, and Kamuela Deli which today would have been somewhere across the street from McDonald's.

From 1999 to 2014 Mr. Plunkett lived full time on Oahu. Mr. Plunkett went back to school in 2010 and it was during this time that he began to study the Hawaiian cultural history of land-use, traditional food production systems and the *moku* (district and *ahupua'a*) system. He took an interest in learning about the ancient trail systems and began to study the function of the ancient *kalana* land division. Mr. Plunkett described that in Precontact times Waimea Kalana was comprised of multiple *'ili* and *ahupua'a* land divisions and all of the land units, whether small or large, contributed to its wealth and abundance. He added that during the Historic Period, particularly as a consequence of the *Māhele* of 1848, many of the ancient lands divisions were reclassified and that the transition to fee simple ownership impacted traditional land-use practices. He shared that research conducted by Holly McEldowney found that before ranching, Waimea was an *ulu lā'au* (forests) where agroforestry was practiced. Mr. Plunkett also shared insight into the Waimea Field System. He explained that this roughly 3,000-acre field system was both rain-fed and intermittently irrigated with freshwater diverted from nearby streams including Waikōloa Stream. He also named other nearby streams including Lanimaomao, (located east of the project area) and Keanu'i'omanō, a name which is associated with the coldness of the shark's skin (located west of the project area near Anna's Ranch). He spoke about how *'auwai* (irrigation ditches) were constructed to move water from the stream into the field system and related that some of these *'auwai*, including one named Akona's 'Auwai have been recorded on certain historical maps such as that one prepared by Wall in 1915 (see Figure 27). Mr. Plunkett reflected that while working as an Archaeological Monitor for a project at Waimea Elementary, construction activities had uncovered a portion of an *'auwai* that once fed into the field system. He lightheartedly shared that he could not believe that this *'auwai* was just a few feet underground in a field that he played on as a child. Mr. Plunkett opined that despite the transformation of Waimea Town, these ancient sites remain.

Concerning the ancient trail networks, Mr. Plunkett related that in Precontact times, Waimea served as an important crossroads for travelers moving between the *moku* of Kona, Kohala, and Hāmākua. He explained that the main roads leading into Waimea were originally part of the ancient trail systems that overtime evolved to support the changing modes of transportation. He reminisced that as a child Waimea only had two-lane roads and far fewer cars and people. He expressed that changes to Waimea Town appear to have happened rapidly while he was away for college noting that because he came home occasionally, change was noticeable. He shared that over time he saw old buildings torn down and replaced with new structures, roads widened, and traffic lights added. He reflected that today we are further away from Waimea as a traditional Hawaiian crossroads.

When asked if he thought the proposed project would result in a cultural impact, Mr. Plunkett stated that the proposed project will be both costly and will impact the culture of this community. He believes that the proposed project is a temporary fix and that the best solution would have been a by-pass around the town to the south. He related that past street widening efforts in Waimea Town have created more space for more vehicles resulting in traffic congestion and an increase in speeding. He shared how the South Kohala Community Development Plan (SKCDP) establishes the importance of preserving the small ranch and *paniolo* farm feel of Waimea. He worries the proposed project will continue to alter the charm and sense of place unique to Waimea. In reflecting on travel patterns, Mr. Plunkett opined that Waimea continues to serve as a crossroads for various districts, and expressed that much of the traffic today is created by comercial vehicles destined to and from Kawaihae harbor or the resort area of the South Kohala coastline for employees and tourist. “A by-pass could get all those vehicles to their destination faster while also preserving the towns rural character. Mr Plunkett believes its not equitable to sacrfice the unique rural character of Waimea for the convieniece of traffic not directly meant for Waimea. Mr. Plunkett shared that Waimea is unique because of its rich *paniolo* and Hawaiian history and its environmental setting. He metioned “its the combination of the mountains, hills, altitude, winds, mist, and forest, and the forest that once was”. He related that because of these elements Waimea will continue to attract more people. He believes a more long-term solution needs to be seriously explored and shared that a new bypass road should be strongly considered. He expressed how the idea of a bypass has been in the talks for many decades but the lack of political will and *pono* community collaboration has hindered its manifestation. In closing, he highlighted that Waimea is special because of the land, which is embued with *mana* (its collective elemental essence) and the culture that codeveloped over the generations; and he emphasized that this uniqueness needs to be preserved.

DR. WILLIAM “BILLY” BERGIN

A phone interview was conducted by ASM Staff, Ms. Lokelani Brandt on May 8, 2020, with Dr. William “Billy” Bergin. Born in Laupāhoehoe in 1940, his family moved to Pepeʻekeo then to Hilo. He shared how his dad was very fond of Kona and thus they spent a lot of time there. During his teen years, Dr. Bergin spent time working on different ranches on the island and during the summer of 1957, he lived in Kūhio Village with a *hānai* (adopted) uncle who worked for Parker Ranch. He reminisced how he and his uncle would ride their horses across the pasture from Kūhio Village to work and recalled Kūhio Village having only seven houses. He shared how most of the people in Waimea worked for Parker Ranch or were related to people who worked for the ranch. He stated that every Friday, ranch employees were given a five-pound packet of beef and a bag of *poi* and recalled traveling on horseback to the meat shop to pick up his beef and *poi* before returning home on horseback. Dr. Bergin eventually moved away for college and later returned to Kona in 1968 with his wife where he worked as a veterinarian. Around 1970, he took a position with Parker Ranch and served as the ranch’s veterinarian for over twenty-five years.

Dr. Bergin opined that one of the first major changes to occur in the project area vicinity happened when the bank was built at the intersection of Lindsey and Māmalahoa Highway near the former Parker Ranch headquarters. He explained that when the bank was built, it was the first effort to maintain and preserve the *paniolo*-colonial look and noted that the bank had installed hitching racks for horses. He shared that although you did not always see a horse tied to the hitch, it was intended to preserve the cowboy feel of the town. In detailing how the *paniolo*-colonial ranch feel has been maintained over the years, Dr. Bergin related that while working for Parker Ranch, Dr. Bergin worked under the management of Mr. Richard Smart. He spoke at length about Mr. Smart and described his efforts to preserve Parker Ranch as a single wholly intact ranch. During the 1970s, Dr. Bergin explained that Mr. Smart had spent enough time during his childhood to realize how quaint the ranch’s architecture was. Although simple, the architecture combined elements of plantation with floral enhancements. To preserve this charm, Mr. Smart worked with the County of Hawaiʻi during the 1970s and as a result, the County established a code that requires businesses to adhere to the *paniolo*-colonial architecture. He explained that Waimea has been able to preserve its feel and look because of the efforts of Mr. Smart. Despite the seasonal changes and sheer size of the ranch, Dr. Bergin related that Mr. Smart was cautious about not drawing too much attention to himself or the ranch. He related a story about Hōkūʻula (also known as “Buster Brown Hill”), which at one time was suffering from erosion. To minimize erosion, the ranch manager ordered pine trees to be planted in the shape of the letter “P” on the hill. Dr. Bergin related how the sight of this horrified Mr. Smart who then asked the manager to remove some of the trees to erase the sight of the “P.”

In discussing the proposed project, Dr. Bergin explained how he has participated in prior community meetings held by the planners (SSFM International) regarding the roadway improvements in Waimea. He shared, during the series of community meetings, there were discussions about the creation of a bypass road around Waimea Town. He added that while a bypass would be the absolute solution to ease traffic congestion, such an undertaking faces massive complications and costs that it could not be fully discussed or explored during the community meetings. He related that one of the most pressing issues with creating a bypass, which would have to traverse along the south side of Waimea Town, is the fact that it would directly impact and be particularly disruptive to the Department of Hawaiian Home Lands (DHHL) awardees. Dr. Bergin clarified that despite talks about a bypass, the planners have tried to focus on developing “smaller” projects that would ease traffic. He shared that as a result of the series of community meetings, the three proposed concepts were developed. Dr. Bergin stated that Ala ʻŌhiʻa Road—a connector road—has sort of served as a bypass as it diverts vehicular traffic around the south side of Waimea Town and onto Māmalahoa Highway.

In reflecting on the historic discussion of the bypass road, Dr. Bergin explained that roughly 25 years ago, the State of Hawai‘i had the opportunity to execute the bypass. He contended that 25 years ago, there were only about five DHHL awardees who were living on 300-acre ranches, however, since that time the DHHL has rightfully subdivided those lots into smaller 10-acre homesteads, thereby increasing the number of awardees. He explained that now, there are far more awardees and this number will continue to increase as more Native Hawaiians are awarded lands. Dr. Bergin believes this would make negotiations very challenging and costly.

Concerning the proposed improvements near the Opelo Road intersection, Dr. Bergin believes that in concept, it is a great plan, as it establishes one more lane which serves as turn-offs that will help to keep traffic flowing. He shared that while the details have yet to be worked out by the engineers, in concept it is an excellent plan.

Dr. Bergin spoke at length about the proposed roundabout. He shared that during the community meetings, many people reported on the long-standing historic issue about that intersection. He explained that the density of stakeholders (i.e. Parker School/Farmer’s Market, Paniolo Country Inn, Waimea County Lodge, Waimea Park, Catholic Church, and Lanakila Park) that rely on that intersection makes improving traffic and pedestrian safety exceptionally challenging and necessary. He noted that over the years, despite implementing many small changes to improve safety, it remains a problematic area. In conversations with County traffic safety officials and reflecting on past efforts, Dr. Bergin related that to seriously improve traffic and pedestrian safety at this intersection, there need to be serious improvements. He shared how the roundabout concept was discussed with the various stakeholders, many of whom expressed overwhelming support. He added, while there is support for a roundabout, several community members have expressed to him that it will take some time for people to learn how to use it. Dr. Bergin opined that there have been past efforts by Parker Ranch to sell Lanakila Park primarily because of the cost associated with upkeep and the fact that there is no legal vehicular entrance into the park. Because of these circumstances, he shared that few people use Lanakila Park and over the years, it has become a gathering place for homeless and other unwanted activities. He believes that whether the park is used by the adjacent Catholic Church or by the state for a roadway, “it serves a much greater purpose than leaving it as an invite to homelessness and carousing.” In examining the plan for a roundabout, Dr. Bergin noted that a portion of Lanakila Park will have to be acquired to meet the engineering specs of a roundabout.

When asked about the project’s potential to impact valued cultural resources and practices, Dr. Bergin shared that in every community that he has lived in regardless of landscape, there are always cultural findings. He explained that the people who would know about that are the *kupuna* and perhaps their children who are the recipients of that information. He explained that while working at Parker Ranch, he had the opportunity to work alongside some of these *kupuna* who would point out certain features of the land and burials. He added that if the *kupuna* did not point it out, these features could be easily overlooked or mistaken for something else. He shared that while working with the County on the Community Development Plan, he had been asked to comment on historic structures in Waimea. In light of this request, he recommended twelve historically significant and visually accessible structures all of which are still standing and actively used (none of which are within the proposed project area).

With respect to water resources, Dr. Bergin shared that there are three streams in Waimea, one of which, Lanimaomao, passes through Kūhio Village and Waikōloa Stream and cuts through the proposed project area. In relating information about Lanimaomao, Dr. Bergin explained that during big rains, the water would meander through this stream bed and emptied into a *pohā* (a hole created as a result of a volcanic explosion) dubbed “Wiliwiliwai” by the cowboys. He shared that the location of this *pohā* was pointed out to him by some of the older cowboys and recalled marveling at how much water would disappear into the *pohā*. While he was not sure of where the water went once in the *pōhā*, he noted that it was a sight to see. He shared that water no longer runs through Waimea like it used to, however, something like this *pohā* is not only an important cultural feature, it is also vital for flood control.

PATRICIA “PAT” COCKETT BERGIN

On May 8, 2020, Mrs. Patricia “Pat” Cockett Bergin was interviewed by ASM staff, Ms. Lokelani Brandt via phone. Mrs. Bergin was born on O‘ahu and spent part of her childhood in Lahaina where her mother worked as a nurse. Around the first grade, her mother relocated the family to Keaukaha in Hilo where they lived with her aunt. Educated in Hilo public schools, Mrs. Bergin attended UH Hilo then completed her college education on the mainland when she married her husband, Dr. William “Billy” Bergin, who was born and raised on the Big Island. After college, she and her husband moved to Kona until her husband eventually took a position at Parker Ranch when they relocated the family to Waimea around 1972. She has worked in education for much of her life that began with a teaching career in Kansas while her husband completed veterinary school then later teaching in Kona and Waimea. She has served in administrative positions at Kohala High School, Hookena Elementary School and Waimea Elementary and Intermediate School. She was Hawaii District Superintendent for Hawaii Island and more recently served a term on the Hawaii State Board of Education. Upon retirement from the DOE she was employed by Kanu o ka ʻĀina Learning ʻOhana (KALO), a non-profit organization which serves as a support organization of Kanu o ka ʻĀina New Century Public Charter School (KANU) and other Hawaiian focused charter schools throughout the state where she is currently employed. She was on loan to KANU, located in Waimea, serving as co-director for three years before returning to KALO. She has lived in Waimea for close to five decades and through her work at KALO, has helped to advance the Hawaiian culture-based education curriculum at KANU. She explained that the educational curriculum at KANU is designed in a way to best serve Hawaiian children, which includes project-based learning, developing observation skills, outdoor excursions to help foster a relationship with nature, and perpetuating Hawaiian cultural practices and ways of doing things. She added that KALO runs a preschool program on the KANU campus which sets both the educational and cultural foundation for the children. Mrs. Bergin emphasized that the school also utilizes intergenerational learning whenever possible bringing in *kupuna* to share their stories and knowledge with the children, who are taught to respect their *kupuna*.

When asked about her knowledge of traditional cultural places, resources, and practices near the project area, Mrs. Bergin commented that students at KANU visit Manaua, a culturally significant stone located near the Anna Perry Fiske property (Anna Ranch Heritage Center), located west of the project area. Mrs. Bergin spoke briefly about the Waimea Field System and noted that she was not sure if the students visit the area since the terrain there is unforgiving. She added that the students from KANU also spend time volunteering at Puʻukoholā Heiau in Kawaihae. Students participate in *Makahiki* games competition annually, first at school-wide competition on campus then later at community-wide Moku o Keawe *Makahiki* competitions for those placing first and second in school competitions held at Waimea Park. Of this group, middle and high school students maintaining a minimum GPA of 2.6 travel to Molokaʻi to compete.

Concerning the annual *Makahiki* games at Waimea Park, she added that the games are held toward the close of the traditional *Makahiki* season. When asked about the history of this cultural event, Mrs. Bergin shared that originally, this event was hosted by KANU where students would compete against each other and later with other area school students. She explained that while KANU students still participate in *Makahiki* the school no longer hosts the event and that the event is now hosted by Moku o Keawe Makahiki organization led by Keʻala Kahuanui (a former teacher at KANU). Mrs. Bergin shared that Keʻala Kahuanui and Mr. Nalei Kahakalau were the founders who revitalized the *Makahiki* rituals, ceremonies, and games for the school. She clarified that Mr. Kahakalauʻs wife, Kū Kahakalau was the founder and the first director of KANU.

When asked about her thoughts on the proposed project, Mrs. Bergin hopes the proposed plans will help to alleviate traffic. After discussing the details of the proposed plans, she explained that based on the conceptual plans, it is difficult to foretell how successful the project will be in alleviating traffic. She worries that although the roundabout will help to keep traffic moving, the stoplight at the Māmalahoa Highway intersection may impede traffic which may lead to traffic congestion near the proposed roundabout. These are details that will likely be addressed by project engineers. In looking at the conceptual plans for the proposed roundabout, she expressed concern over the four proposed crosswalks at each of the roundabout entry points and could foresee that feature halting traffic. She relayed that large trucks and cars traveling along Kawaihae Road often move swiftly through that intersection. For these reasons, she worries about how the inclusion of the crosswalks will affect pedestrian safety unless strategically placed within the conceptual plan with these safety issues in mind.

KUʻULEI KEAKEALANI

A phone interview was conducted by ASM staff, Lokelani Brandt on May 13, 2020, with Ms. Kuʻulei Keakealani. She descends from a long-line of *paniolo* who for many generations worked the lands from South Kohala to North Kona. She is a mother, wife, cultural practitioner, educator and currently works with the non-profit organization, Hui Aloha Kīholo. Ms. Keakealani currently lives on Hōkūʻula Road with her *ʻohana*.

When asked about the presence of significant cultural resources, sites, and or places within the project area vicinity, Ms. Keakealani related that she was aware of the old hitching post that used to be located by the Bank of Hawaiʻi building. She explained that the hitching posts were removed some year ago and the area concreted over. She also shared that Kihoi family home used to be located at the Hawaiʻi Belt Road-Lindsey Road intersection near the old Parker Ranch headquarters. She described how the home was removed from its original location and trucked to a lot on Church Row near the Kamuela Hongwanji Mission where it remains today. She also discussed the presence of a historic dry-stacked stone wall that separates the Lanakila Park property from the Annunciation Catholic Church property. In looking at the conceptual plan, Ms. Keakealani was unsure if the proposed roundabout would have a direct impact on the wall, however, she expressed that if a portion of the wall has to be removed that the stones be appropriately repurposed/reused and kept on the property. She also noted the presence of the cobble paved walkway in Lanakila Park and was not sure the stones from that path could be reused given they are laid into the concrete. She opined that what can be saved and repurposed should be preserved. She also spoke about known *iwi kupuna* that were discovered in the residential community off Lindsey Road. She spoke about the discovery of those *iwi kupuna* and explained that the *iwi* had been reinterred. She also expressed some concern for the potential alteration of Waikōloa Stream, but in looking at the proposed conceptual plans, she did not feel that the natural topography of the stream would be adversely impacted.

As a resident living on Hōkūʻula, Ms. Keakealani spoke at length about the need for improvements at the Lindsey Road-Kawaihae Road intersection. She discussed how the morning traffic poses major safety concerns and related that many businesses and Parker School rely on this intersection which creates a lot of morning congestion. She described how some small measures have been implemented over the years at this intersection to improve safety, however, none have had any true positive impacts. She also shared her concerns over the possibility of traffic backing up into the roundabout given that vehicles heading into town would have to stop at the traffic light. She hopes that measures (i.e. adjusting the timing of traffic lights) will be implemented to prevent this from happening which would effectively halt traffic in the proposed roundabout. Ms. Keakealani explained that although there are a few roundabouts on the islands, it would be a brand-new concept in Waimea. Because of people's unfamiliarity with properly using a roundabout, she cautioned that people will have to learn how to safely use it.

4. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC (1997) *Guidelines for Assessing Cultural Impacts* identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. A working definition of traditional cultural property is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 (Parker and King 1998) published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC (1997) guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study adopts the state criteria for evaluating the significance of historic properties contained in the Hawaiʻi Administrative Rules 13§13-284-6, of which traditional cultural properties are a subset. To be considered significant, the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa'akai O Ka 'Āina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

In addition to considering impacts to customary and traditional practices specific to any particular ethnic community, the current study also addresses potential impacts to customs and traditions of the *paniolo* subculture that gives Waimea its distinct character. Hawai'i's *paniolo* subculture has developed as a result of the long-term cultural intermingling of Native Hawaiians heritage and Mexican vaquero heritage since the 1830s in the context of Hawai'i's livestock ranches (Barna 2013; Bergin 2004; Loomis 2006). Although not an "ethnic group" as implied by the wording of Act 50 and Chapter 343 HRS, this community possesses subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs that have evolved in the course of its members' shared history. As the quintessential ranch town of Hawai'i Island, the sense of place in Waimea is intrinsically bound with its *paniolo* heritage.

SUMMARY OF CULTURE-HISTORICAL BACKGROUND RESEARCH

Mo'olelo and other traditional accounts generally describe the plains, the *pu'u,* the rains, the winds, and other culturally significant aspects of the Waimea area. Although these are natural phenomena of this region, the *mo'olelo* and early historic accounts show an intimate connection between these features and the staunch, agriculturally industrious native people who called Waimea home. Both historic and modern-day descriptions identify Waimea (Kamuela) as a city, however, traditionally Waimea was a *kalana*, a unique land division comprised of multiple traditional land units including *ahupua'a* and *'ili 'āina*. Collectively, these lands units would have contributed to the overall abundance and productivity of the Waimea area. It is abundantly clear from the archaeological and historical records that the project area was used during Precontact and Early Historic times for a variety of traditional Hawaiian cultural activities and practices including travel, residential, and subsistence production and procurement. While some of these practices, although different from the Precontact and early Historic era persist, use of the project area for travel has been ongoing since at least—and most likely well before—the early historic period. Early Historic descriptions note travel from the coastal area of Kawaihae to Waimea via foot trails and by the 1830's—coinciding with the rise of ranching in this region—foot trails were converted to roads.

By the late 1840s and early 1850s, the shift from the traditional land management system to private, fee-simple ownership had set the foundation for the expansion of Hawai'i ranching history, most notably the growth of Parker Ranch. Some 140 claims for Land Commission Awards (LCAw; *kuleana* lots) were made by native tenants in the Waimea area. One award and likely another which the project area encroaches upon were claimed and awarded; LCAw. 3785, a house lot awarded to Olepau situated within Lanakila Park and LCAw. 3915 another house lot located to the east of Lindsey Road. From the maps and historical documents generated as part of the land claims process, it is clear that the house lots were enclosed with either stone walls and wood fencing, and that the native tenants cultivated crops on lots located elsewhere in Waimea.

Throughout the remainder of the 19th century, Parker Ranch continued to expand its operations thereby further solidifying the *paniolo*-ranching lifestyle unique to Waimea. By the turn of the 20th century and after the overthrow of the Hawaiian monarchy, the Territory of Hawaiʻi established the Waimea Homestead in the areas north and southwest of the current project area. Kawaihae Road was realigned and incorporated into the homestead lots and Opelo Road was laid out. Lindsey Road was named in honor of the prolific Lindsey family who had long-standing ties to Waimea and Parker Ranch's beginnings. By March of 1919, a government-owned lot sandwiched between LCAw. 3785 parcel and Lindsey Road was sold as Land Grant 7224 to Mrs. Minnie Lonohiwa. With the onset of WWII, the population in Waimea grew to accommodate the influx of U.S. marines stationed at Camp Tarawa. Pipelines to provide water to the camp were installed along all three roads in the project area as shown. Several U.S. Army installations were located immediately adjacent to the project area, including a recreation field at the current location of Waimea Park, a main hospital in the converted Waimea Ranch Hotel building, and a hospital school at the junction of Lindsay Road and Māmalahoa Highway. Within a year of the Japanese surrender, the U.S. Military had all but left the town, and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry.

While Parker Ranch and the *paniolo*-ranching lifestyle persisted as the social and economic center of Waimea, new community infrastructure, including parks, became a vital component of the town's development. Richard Smart, Parker Ranch's sixth-generation heir set aside a parcel on the southwest corner of Lindsey Road and Kawaihae Road for the creation of Lanakila Park, named in honor of his maternal grandmother, Elizabeth Jane Lanakila Dowsett. The buildings occupying the lot were demolished in 1959 and the park was formally dedicated in 1962. During the latter half of the 21st century, development in Waimea town increased which further illustrates the continued urbanization and population growth.

IDENTIFICATION OF VALUED CULTURAL RESOURCES AND ONGOING TRADITIONAL CULTURAL PRACTICES AND MITIGATIVE MEASURES

Archaeological and cultural studies conducted in Waimea Town are numerous with most studies concentrated south of the current project area. Many of these studies have focused on documenting elements of the expansive Lālāmilo-Waimea agricultural system as well as Historic era ranching and military occupation. Although no prior archaeological or cultural studies have been conducted within the confines of the current project area, studies conducted in the nearby vicinity (northeast of the project area) have documented the remains of Historic dwellings, a trash dump, as well as Historic burials. The culture-historical background did identify the presence of two *kuleana* house lot parcels; LCAw. 3785, a house lot awarded to Olepau situated within Lanakila Park and LCAw. 3915 another house lot located to the east of Lindsey Road as well as Land Grant 7224 awarded to Mrs. Minnie Lonohiwa also within Lanakila Park. While a field inspection of the project area conducted by ASM Affiliates (Kepaʻa and Barna 2020 in prep) on March 6, 2020, did not document any above-ground historic properties, encountering subsurface features, which would at a minimum be considered significant under Criterion d, within Lanakila Park, and along Lindsey Road is possible. In light of these findings and to mitigate the potential cultural impacts, it is recommended that an Archaeological Inventory Survey (AIS), which should include subsurface testing in Lanakila Park be conducted before any ground disturbance. Additionally, archaeological monitoring should be conducted during construction activities. If *iwi kupuna* are discovered during construction, all work shall be halted and treatment of the site shall be conducted in accordance with Hawaiʻi Administrative Rules §13-300.

As a result of the consultation process, several culturally significant sites were identified including Manaua Rock (located west well beyond the project area boundaries), the *pōhā* of Wiliwiliwai (located southeast well beyond the project area boundaries), the Lālāmilo-Waimea agricultural field system (which encompassed the project area and nearby vicinity), and a Historic dry-stacked stone wall located on the boundary between Lanakila Park and the Annunciation Catholic Church property. Of the identified culturally significant sites, the latter two, which would at a minimum be considered significant under Criterion d, have the potential of being impacted by the proposed road improvements. With regard to the Lālāmilo-Waimea agricultural field system, subsurface testing conducted as part of an AIS could help with identifying and mitigating any subsurface archaeological features. With respect to the dry-stacked Historic wall, Ms. Kuʻulei Keakealani expressed that if a portion of the wall has to be removed to accommodate the roundabout that the stones be appropriately repurposed/reused and kept on the property.

The consultation process also identified ongoing cultural practices that take place within Waimea Park, specifically the annual Moku O Keawe *Makahiki* competitions and associated ceremonies. While this cultural event is a more recent development, the practices and rituals of observing *Makahiki* is a long-standing traditional Hawaiian cultural practice. While it is not anticipated that the proposed road improvements would directly impede upon or adversely impact the Moku O Keawe *Makahiki* at Waimea Park, planners must be made aware of this cultural event and take the necessary measures to mitigate any potential impacts by maintaining communication with event coordinators, Ke‘ala Kahuanui of the non-profit Pūko‘a Kani ‘Āina.

While all of the consulted parties saw the need for road improvements and generally supported the proposed project, many also spoke about the importance of creating another alternative route that would help alleviate traffic in Waimea Town. As expressed by Mr. Plunkett, Waimea is the crossroads for three major districts and as development continues to expand in the peripheries of Waimea, the effects of this growth will be felt in Waimea, particularly in the form of traffic. While most of the consulted parties saw the needs for a new bypass road, they also related some of the challenges that would arise if such a project is undertaken; challenges that would pose a significant impact to the Department of Hawaiian Home Land beneficiaries. While population and economic growth in Waimea are projected to increase, long-term planning for improving infrastructure is a necessary component for sustainable growth. The consulted parties also shared their concerns regarding the need for public education about the proper and effective use of the proposed roundabout. One of the underlying themes that emerged as a result of the consultation process was the importance of maintaining the *paniolo*-colonial look and feel of Waimea Town. In light of these concerns, and to limit visual impacts to a perceived “*paniolo* culture,” it is recommended that planners attempt to incorporate *paniolo*-colonial architectural elements into the overall project design.

CONCLUSION

In conclusion, the recommendations provided above are intended to ensure that HDOT considers the findings from the culture-historical background research as well as the concerns and thoughts shared by the consulted parties. While none of the consulted parties explicitly opposed the proposed project, the findings and community concerns offered above are intended to support HDOT in being mindful of the cultural, social, and environmental uniqueness of Waimea. Conducting background research, consulting with community members, and taking steps towards mitigating any potential cultural impacts is done so in the spirit and practice of *Aloha ‘Āina*, a contemporary movement founded on traditional practices and beliefs that emphasize the intimate relationship that exists between Native Hawaiians and the *‘āina* (land). The phrase *Aloha ‘Āina* was also utilized by Parker Ranch heir, Mr. Richard Smart, who valued and sought to preserve Waimea’s *paniolo* heritage. While growth and change is an inevitable part of life, wholehearted efforts must be made by planners to understand the cultural context of a project and implement measures to ensure that any proposed project does not encourage change that would drastically alter the look and feel of a place. After all it is precisely this unique *paniolo* heritage and the landscape and cultures from which it evolved that attracts people to Waimea. Therefore, attention to, and implementation of the above describes issues and measures relative to identified cultural resources and ongoing cultural practices will help to ensure that no such resources, practices, or beliefs will be adversely affected by the proposed Waimea Roadway Improvements project.

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APPENDIX A.
KA WAI OLA PUBLIC NOTICE

CULTURAL IMPACT ASSESSMENT - KAWAIHAE AND LINDSEY ROAD

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) for a proposed roundabout at the intersection of Kawaihae Road and Lindsey Road, multimodal improvements along Kawaihae Road and Opelo Road, and intersection improvements at Māmalahoa/Lindsey Roads, Waimea, South Kohala, Hawai'i. The CIA reports will serve as a companion document to the environmental documentation being prepared in compliance with Hawai'i Revised Statutes Chapter 343 Environmental Review process. We are seeking consultation with community members that might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the subject property, that may be impacted by the proposed project. If you have and can share any such information please contact Lokelani Brandt (lbrandt@asmaffiliates.com); phone (808) 969-6066, mailing address ASM Affiliates 507-A E. Lanikaula Street, Hilo, HI 96720.

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APPENDIX F

Archaeological Literature Review and Field Investigation Report and Archaeological Inventory Survey Report

An Archaeological Literature Review and Field Inspection for the Waimea Roadway Improvements Project

TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.)

Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

DRAFT VERSION

Prepared for:

SSFM International
99 Aupuni Street
Hilo, HI 96720

April 2020

ASM affiliates
Archaeology • History • Anthropology • Architectural History

Hilo Office: (808) 969-6066 Fax: (808) 443-0065
507-A E. Lanikaula Street, Hilo, HI 96720

Honolulu Office: (808) 439-8089 Fax: (808) 439-8087
820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 34580.00

An Archaeological Literature Review and Field Inspection for the Waimea Roadway Improvements Project

TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.)

Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

Prepared by:
Lauren Kepaʻa and Benjamin Barna, Ph.D.

ASM affiliates

EXECUTIVE SUMMARY

At the request of SSFM International, Inc., on behalf of the State of Hawai‘i Department of Transportation (HDOT), ASM Affiliates (ASM) conducted an archaeological literature review and field inspection of a roughly 4.0-acre project area associated with the Waimea Roadway Improvements Project. HDOT proposes to make multimodal safety and operations improvements to existing roadways using state and local financial resources. The proposed project includes improvements to existing State-owned roadways (Lindsey Road, Kawaihae Road, and Māmalahoa Highway) in Waimea and on portions of Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, and 6-5-004:027.

The results of the literature search indicate that although the current project area was not included in the Waimea Field System field complexes defined by Clark (1983), other archaeological studies in Waimea have identified surface and subsurface archaeological sites and features associated with Hawaiian occupation of the Waimea Plain dating from the 1400s through the twentieth century, along with deposits left by ranching activity and World War II-era military activities at Camp Tarawa. Subsurface historic properties have also been identified in the vicinity of the current project area, and have included habitation sites and both Precontact and Historic period burials with little or no surface indications. The alignment of the Māmalahoa Highway (SIHP 50-10-06-30187) is included in the project area. Most of the current project area, however, consists of existing paved roads and previously disturbed portions of the right-of-way. The proposed roundabout would extend into Lanakila Park and cause ground disturbance within the boundaries of a former *kuleana* parcel (LCAw. 3479 to Olepau). The *kuleana* parcel is known to have been a *pāhale* or house lot occupied at least as early as the mid-nineteenth century, and almost certainly earlier than that. During the twentieth century this parcel was developed, gradually acquiring five buildings used for lodging and a variety of commercial activities. Two of these buildings appear to have been at least partially located within the current project area. In 1959, the buildings were demolished for the creation of Lanakila Park.

On March 6, 2020, an archaeological field inspection was conducted of the approximately 4.0-acre project area by Benjamin Barna, Ph.D. The fieldwork consisted of a visual inspection of 100% of the ground surface of the project area as estimated from the most recent project description and conceptual drawings provided by SSFM, plus a 10-foot buffer beyond the estimated boundaries. The estimated project was uploaded to a handheld tablet computer running ESRI’s Collector application connected to an EOS Arrow 100 GNSS receiver with sub-meter accuracy set to the NAD 83 Zone 5N datum. The locations of any potential historic properties were noted, and photographs were taken of the potential historic properties as well as the estimated project area.

No above-ground historic properties of any kind were observed within the project area within the existing rights-of-way for Lindsey Road, Kawaihae Road, Opelo Road, or Māmalahoa Highway, nor were any identified on TMKs: 6-5-004:027, 6-5-005:021 and 025, or 6-5-007:001. No Historic features of the Māmalahoa Highway (Site 30187) are present within the current project area. One historic property was identified within the current project area on TMK: (3) 6-5-003:005. Lanakila Park, which occupies this TMK parcel, was originally constructed in 1962, and thus the age of the park qualifies it as a historic property as defined by HRS Chapter 6E-2. Only one of what would likely be considered the park’s character-defining elements is located within the current project. This is the cobble-paved walkway, which was constructed shortly after the park’s dedication. Lanakila Park has not been fully documented or evaluated for historical significance under HRS Chapter 6E. Because it is part of the built environment, 6E-8 review of project effects to Lanakila Park would likely be conducted by SHPD’s architecture branch.

It is anticipated that impacts to the historic character of the park would be limited to the demolition of a portion of the original cobble-paved walkway and a reduction in the size of the park. With respect to the historic character of the park as whole, these impacts would be considered to be minimal, and if necessary could be mitigated by reconstructing the walkway in a similar style.

With respect to the potential for subsurface archaeological historic properties, prior archaeological studies in the Waimea area have demonstrated that the ability to predict the locations of buried archaeological sites lacking surface features is limited. Archaeological monitoring is recommended as an identification measure within the project area, and especially on TMK: (3) 6-5-003:006 where LCAw. 3479 was located.

The current study was conducted in support of environmental documentation being prepared to comply with Hawai‘i Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division’s (DLNR-SHPD) HRS Chapter 6E review of the proposed project.

CHAPTERS

FIGURES

FIGURES

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1. INTRODUCTION

At the request of SSFM International, Inc., on behalf of the State of Hawaiʻi Department of Transportation (HDOT), ASM Affiliates (ASM) conducted an archaeological literature review and field inspection of a roughly 4.0-acre project area associated with the Waimea Roadway Improvements Project. HDOT proposes to make multimodal safety and operations improvements to existing roadways using state and local financial resources. The proposed project includes improvements to existing State-owned roadways in Waimea and on portions of Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, and 6-5-004:027 as shown in Figures 1, 2, and 3. The current study was conducted in support of environmental documentation being prepared to comply with Hawaiʻi Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division's (DLNR-SHPD) HRS Chapter 6E review of the proposed project.

HDOT Highways Division plans to implement safety and operations improvements along existing State-owned roadways in Waimea. Improvements would include installation of a roundabout at the intersection of Kawaihae Road and Lindsey Road and multimodal treatments to Kawaihae Road between Lindsey Road and Opelo Road, and also to the Māmalahoa Highway and Lindsey Road intersection. The roundabout (Figure 4) would be a 125-foot inscribed circle and would include sidewalks, bikeways, and crosswalks. The sidewalk and bikeway would be combined into a single raised sidewalk. The north leg of Lindsey Road would handle the transition into the existing travelway with Parker School's drop-off lane. Improvements to Kawaihae Road between Lindsey Road and Opelo Road (Figure 5) would include installation of a center turn lane, sidewalks and bikeways on both sides of the road, marked crosswalks with a rectangular rapid flash beacon at Opelo Road, and a gateway feature west of Opelo Road. Recommended improvements to the Māmalahoa Highway and Lindsey Road intersection (Figure 6) include installation of raised pedestrian islands with bollards, reconfigured lanes, and bicycle facilities, as well as optimizing signal timing. The project is currently in the design phase, and the extent and depth of ground disturbance is not yet determined. Ground disturbance, however, is not expected to exceed previous ground disturbance within the State-owned right of way or within portions of adjacent parcels that will be acquired for the project.

This report contains background information describing the proposed project, the location and environment of the project area, a culture-historical context for the project area, a summary of the previous archaeological work conducted in the vicinity of the project area, an explanation of the survey methods used during the field inspection, findings from the field inspection, and recommendations for completing the HRS Chapter 6E review process based on our results.

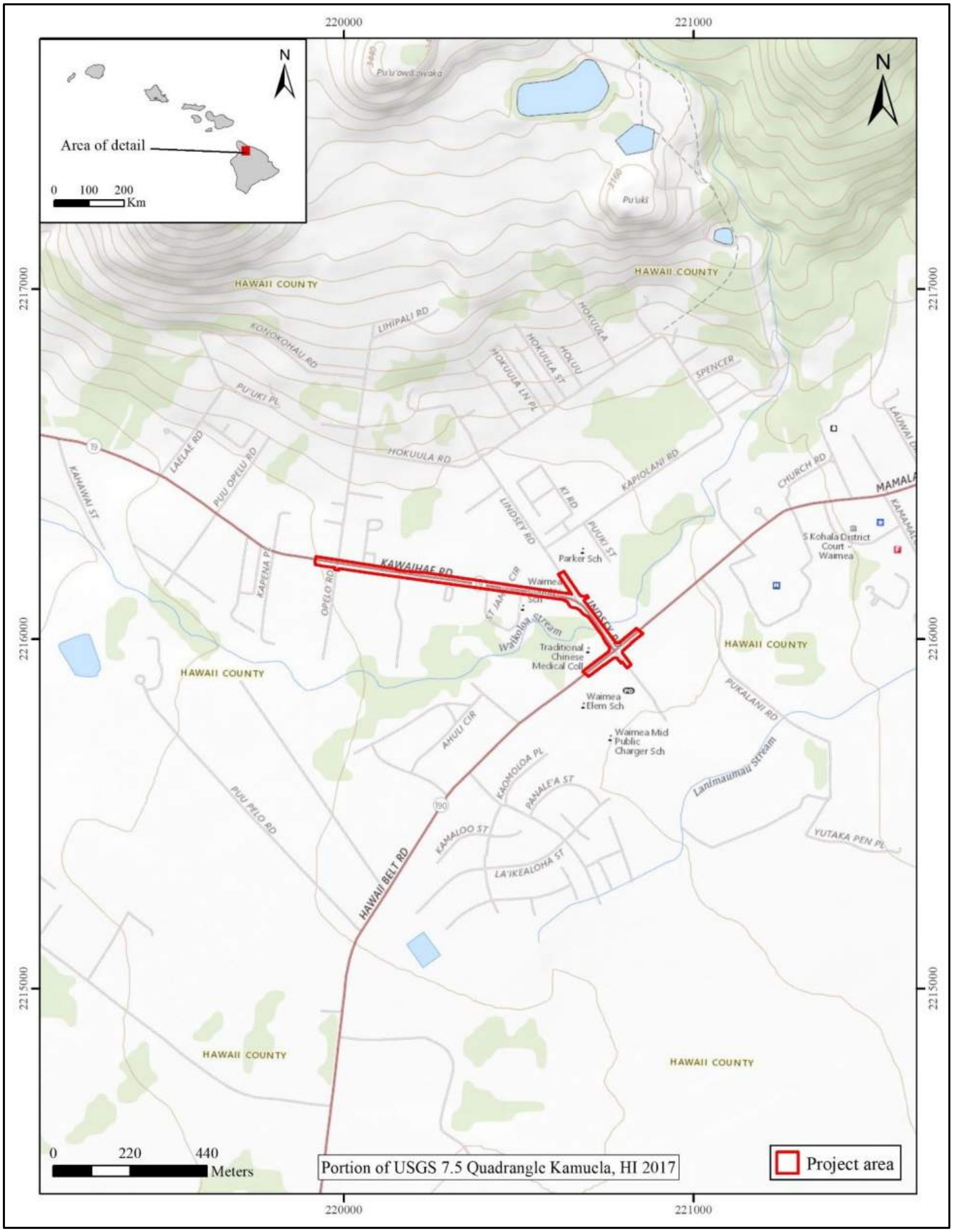


Figure 1. Project area location.

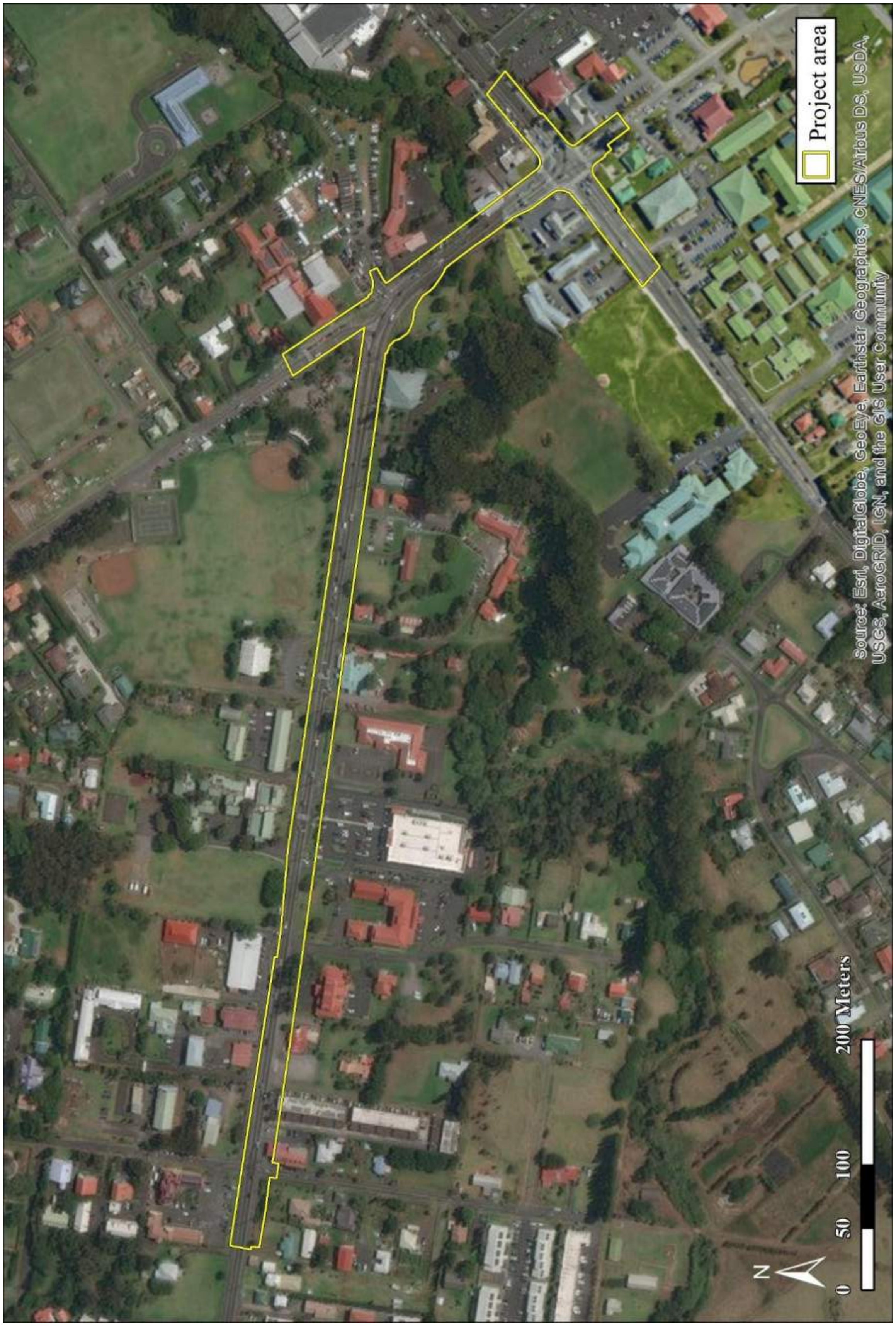


Figure 2. Recent satellite imagery of the project area and vicinity.

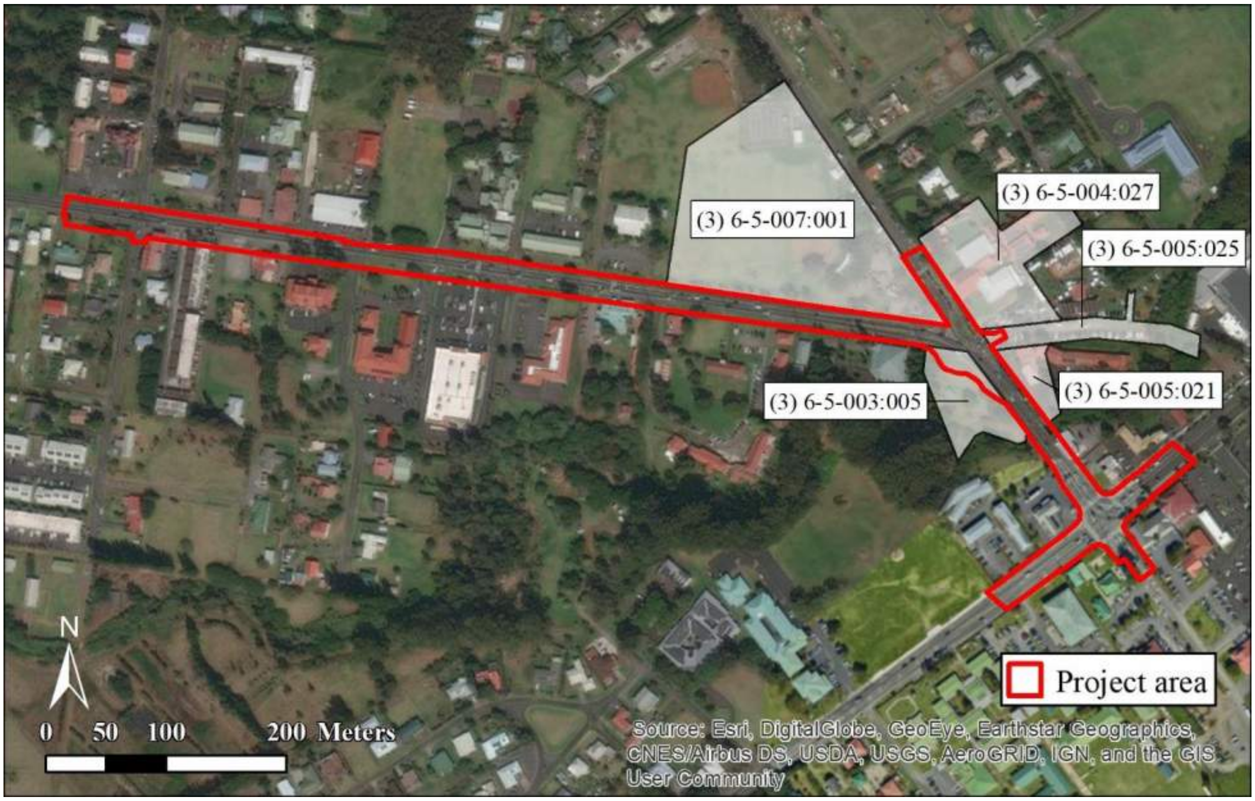


Figure 3. Tax Map Key parcels included in the current project area.

Figure 4. Kawaihae Road and Lindsey Road roundabout conceptual plan.

Figure 5. Kawaihae Road at Opelo Road conceptual plan.

Figure 6. Māmalahoa Highway and Lindsey Road conceptual plan.

PROJECT AREA DESCRIPTION

The current project area consists of approximately 4.0 acres comprising portions of the State-owned right of way for Lindsey Road, Kawaihae Road, and Māmalahoa Highway, along with portions of five TMK parcels (Table 1, see Figure 3) adjacent to the current right of way that will be acquired for the project. The project area is located at elevations ranging from 2,635 to 2,675 feet above sea level on the Waimea Plain, approximately 15.9 kilometers (9.8 miles) from the coast at Kawaihae (to the west) and 13.7 kilometers (8.6 miles) from the coast at Waipiʻo (to the northeast). Surface geology in the current project area is mapped as Hāmākua lava flows of alkali and transitional basalt (symbol Qhm in Figure 7) dating to between 64,000 and 300,000 years ago. Soils in the current project area (Figure 8) are primarily derived from a parent material of volcanic tephra formerly referred to as “Pahala Ash” (Sato et al. 1973:100). In the current USGS soil survey (Soil Survey Staff 2020), the Phase 1 portion and most of the Phase 2 portion of the project area are mapped as Waimea medial very fine sandy loam, 0 to 6 percent slopes (symbol 383 in Figure 8). The far eastern side of the Phase 2 portion of the project area are mapped as Kikoni medial silt loam, 0 to 3 percent slopes (symbol 493 in Figure 8). These soils are highly erodible, susceptible to high seepage loss, and have unstable slopes (Sato et al. 1973), which Burtchard and Tomonari-Tuggle (2005:7) note are “hardly the kind of soils that should be associated with extensive and long-term irrigation.” The climate on the Waimea Plain is generally cool and moist year-round. Mean annual temperatures range between 60 and 70 degrees Fahrenheit, with low temperatures in the winter months reaching the freezing point (Giambelluca et al. 2014). The mean annual rainfall is 833.9 millimeters (32.83 inches), with heavier rain the winter. Waikoloa stream is the prominent hydrological feature near the current project area.

The entire project area has been previously developed. The majority of it contains sixty-foot wide asphaltic concrete (AC) paved roads. Outside of the paved travel lanes on Lindsey Road (Figures 9 through 14) and Māmalahoa Highway (Figures 15 through 19), there are concrete sidewalks for most of the project area’s length. Along Kawaihae Road (Figures 20, 21, and 22), sidewalks are not present. Instead, the road shoulder consists of asphalt or grass, depending on the adjacent parcel. A portion of the project area on Lindsey Road crosses Waikoloa Stream over Waikoloa Bridge (Figure 23), which was widened to its current configuration in the 1970s.

A portion of the project area that could contain the roundabout at the intersection of Lindsey Road and Kawaihae Road extends into Lanakila Park (Figure 24), located on TMK: (3) 6-5-003:005. Within the park, the terrain is flat, apparently graded during the landscaping. Ground cover consists of a manicured grass lawn, with native and introduced ornamental trees planted throughout the park. A concrete and rock wall surrounds the park. There is a cobble-paved walkway that crosses the park, connecting a wooden rest area and concrete benches to park entrances on Lindsey Road and Kawaihae Road.

Table 1. Tax Map Key parcels included in the project area.

TMK	***Owner(s)***	***Notes***
(3) 6-5-003:005	Parker Land Trust	Lanakila Park
(3) 6-5-007:001	State of Hawaiʻi	Waimea Park
(3) 6-5-005:021	Kanilehua Traders LLC, Owyhee Trading Company	
(3) 6-5-005:025	Parker School	
(3) 6-5-004:027	Parker School	

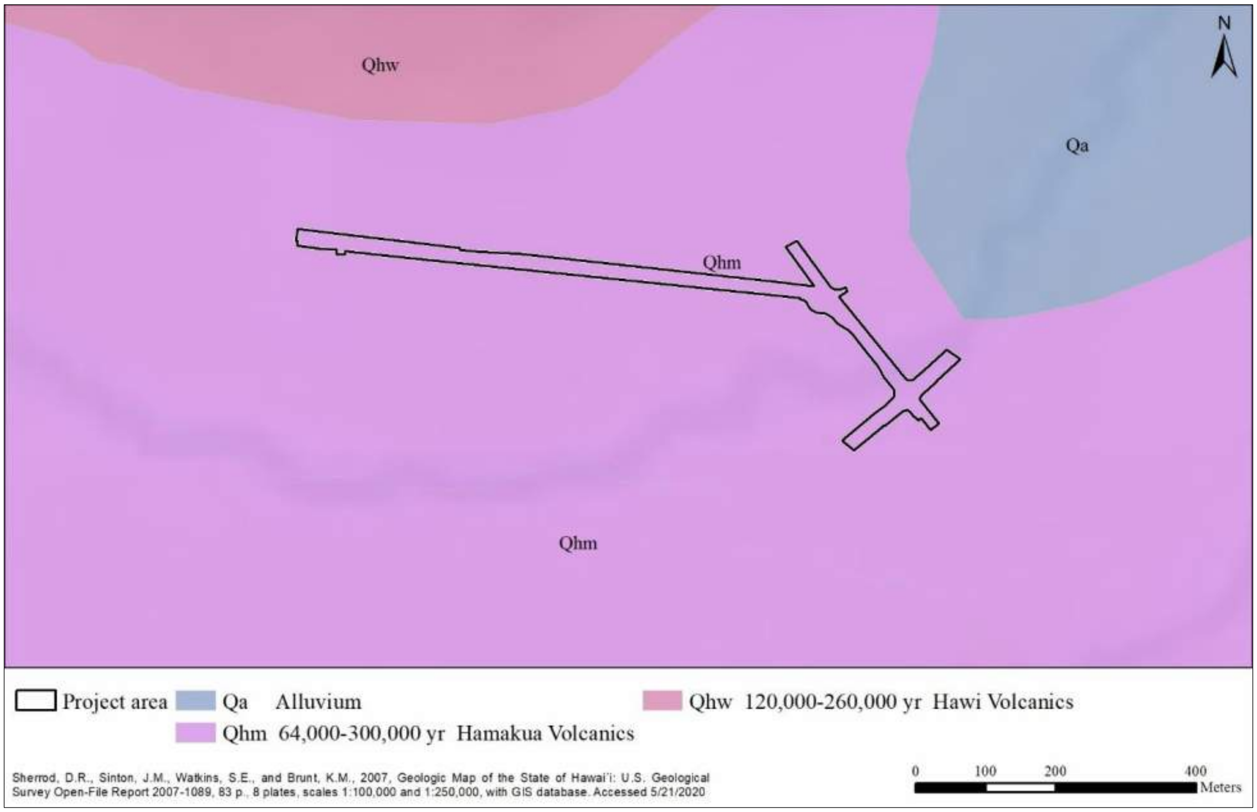


Figure 7. Geology in the current project area.

Figure 8. Soils in the current project area.

Figure 9. Lindsey Road, view to southwest adjacent to Waimea Park.

Figure 10. Kawaihae Road-Lindsey Road intersection, view to southwest adjacent to Parker School.

Figure 11. Intersection of Kawaihae Road and Lindsey Road, view to north from Lanakila Park.

Figure 12. Intersection of Kawaihae Road and Lindsey Road, view to north from Parker School.

Figure 13. Lindsey Road, view northeast toward Parker School.

Figure 14. Lindsey Road, view to southwest from Lanakila Park.

Figure 15. West-bound side of Māmalahoa Highway, view to southwest.

Figure 16. Lindsey Road at Māmalahoa Highway, view to the northwest.

Figure 17. Westbound side of Māmalahoa Highway, view to the northeast.

Figure 18. Eastbound side of Māmalahoa Highway, view to the northeast.

Figure 19. Eastbound side of Māmalahoa Highway, view to the southwest.

Figure 20. Kawaihae Road-Opelo Road intersection, view to the north.

Figure 21. Kawaihae Road-Opelo Road portion of the project area, view to west.

Figure 22. Kawaihae Road-Opelo Road portion of the project area, view to east.

Figure 23. Waikoloa Bridge, view to the south.

Figure 24. Lanakila Park adjacent to the Kawaihae Road-Lindsey Road portion of the project area, view to southwest.

2. LITERATURE REVIEW

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the South Kohala region that includes specific information regarding the known history of Lālāmilo Ahupuaʻa and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the project area.

CULTURE-HISTORICAL CONTEXT

The project area is located on the Island of Hawaiʻi within the District of South Kohala in the *ahupuaʻa* of Lālāmilo. Lālāmilo (Lit., "milo tree branch"; Pukui et al. 1974:128) was described by Handy et al. (1991:528):

> The district of Kohala is the northernmost land area of the island of Hawaii. ʻUpolu Point, the northwesterly projection, fronts boldly out into the Alanuihaha [sic] Channel towards the southeastern coast of Maui, and is the nearest point of communication between the two islands. To the south, along Hawaii's western coast, lies Kona; to the east the rough coast of Hamakua District unprotected from the northerly winds and sea. Kohala was the chiefdom of Kamehameha the Great, and from this feudal seat he gradually extended his power to embrace the whole of the island, eventually gaining suzerainty of all the Hawaiian Islands.

Handy et al. (1991:528) further describe Kohala, and more specifically, Waimea:

> The rugged central area of the district is formed by the mountainous remains (elevation 5,505 feet) of the Kohala dome, the oldest of the island's volcanoes, now long regarded as extinct. The high table land between Mt. Kohala and the vast northern slopes of Mauna Kea, known as Waimea, has one of the finest and most salubrious mountain climates in the Hawaiian Islands, and also offers excellent grazing for cattle. In post-European times it became the seat of the Parker Ranch, one of the largest ranches in the world.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model and amended to include recent revisions offered by Kirch (2011). Re-evaluation and syntheses of genealogical, oral historical, mythological, and radiometric data by Kirch (2011) and others (Athens et al. 2014; Duarte 2012; Wilmshurst et al. 2011) have convincingly argued that Polynesians may not have arrived in the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the previously- accepted chronology alters the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, the Expansion Period to A.D. 1350 to 1650, and the Proto-Historic Period to A.D.1650-1795. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian Kahiki—were the Marquesas and Society Islands (Emory in Tatar 1982:16-18).

The Settlement Period was a time of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984, 2010). According to Fornander (1969), Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, Kanaloa, and Lono; the *kapu* system of law and order; cities of refuge; the *ʻʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Conventional wisdom suggests that the first inhabitants of Hawaiʻi Island focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Kirch 1985).

As time passed a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of the Development Period of the Hawaiian prehistory reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are ʻ*ulu maika* stones and *lei niho palaoa*. The later were status items worn by individuals of high rank, which indicates recognition of status differentiation (Kirch 1985). As population expanded in the Hawaiian Islands so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Once most of the ecologically favorable zones of the windward and coastal regions of the major islands were settled, the more marginal leeward areas were developed. Migrations to Hawai‘i from the Marquesas and Society Islands may have continued throughout the early Settlement and Development Periods (Kirch 1985, 2012).

In the District of Kohala, the long ridge of the Kohala Mountains extends perpendicular to the predominant northeasterly trade winds, creating an orographic rainfall pattern that separates the district into two distinct environmental zones; a wetter windward zone on the eastern (Hāmākua) side, and a drier leeward zone on the western (Kona) side. The first settlers of this district likely established a few small communities near sheltered bays with access to fresh water primarily in the windward valleys and gulches. The communities would have shared extended familial relations and had an occupational focus on the collection of marine resources. Evidence for early occupation of leeward Kohala was speculated for Kapa‘anui, where Dunn and Rosendahl (1989) reported radiocarbon dates as early as A.D. 461, and from ‘Anaeho‘omalu where Barrera (1971) reported A.D. 900 as the initial date for settlement; however, these early dates should be viewed with suspicion (c.f. Kirch 2011). Other early dates from windward Kohala were reported by Cordy (2000); these sites are believed to have been utilized in the early thirteenth century. Data recovered from Māhukona, along the leeward coast of North Kohala, suggest initial occupation taking place there by about A.D. 1280 (Burgett and Rosendahl 1993:36). Permanent settlement in Kohala has been reported as early as A.D. 1300 at Koai‘e, a coastal settlement, where subsistence primarily derived from marine resources, but was probably supplemented by small-scale agriculture as well (Tomonari-Tuggle 1988).

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period, and it was during this time that a second major migration settled in Hawai‘i, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pā‘ao settled in the islands during the 13th century. Pā‘ao was the keeper of the god Kū‘kā‘ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pā‘ao was expelled from his homeland in Tahiti by Lonopele. He prepared for a long voyage and set out across the ocean in search of a new land. On board Pā‘ao’s canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ‘ā‘īpu‘upu‘u*), the chief Pilika‘aiea (Pili) and his wife Hina‘aukekele, Nāmau‘u o Malaia, the sister of Pā‘ao, and the prophet Makuaka‘ūmana. Lonopele did not let Pā‘ao leave peacefully, but instead called on the cold north winds to sink his canoes; one of the winds was named “Waikōloa” (Kamakau 1991:5). There are several versions of this story that are discussed by Beckwith (1976), including the version where Mo‘okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pā‘ao are said to be deposited in a burial cave in Kohala in Pu‘uwepa [possibly Pu‘uepa?] (Kamakau 1964:41). The Pili line’s initial ruling center was likely in Kohala too, but Cartwright (1933) suggests that Pili later resided in and ruled from Waipi‘o Valley in the Hāmākua District. Ethnohistorical traditions (Fornander 1969) indicate that Waipi‘o Valley was associated with at least nine successive Pili line rulers of Hawai‘i Island, from Kaha‘imoele‘a to ‘Umi (from roughly A.D. 1460 to 1620).

Heiau construction flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, “played a key role as visual markers of chiefly dominance” (Kirch 1990:206). This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and evidence suggests that substantial changes were made to the political system as well. Within Kohala, for example, the Great Wall complex at Koai‘e is organized with certain platforms in the complex physically separated from contemporaneous features. Griffin et al. (1971) interpret these separate spaces as symbolizing class stratification.

The period from A.D. 1300–1500 was characterized by population growth as well as expanded efforts to intensify upland agriculture. Rosendahl (1972) has proposed that settlement in leeward Kohala at this time was related to seasonal, recurrent occupation, and that coastal sites were occupied in the summer to exploit marine resources, while upland sites were being occupied during the winter months with a primary focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976:118). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua*‘*a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

According to Kirch’s (1985) model, the concept of the *ahupua‘a* was established sometime during the A.D. 1400s, adding another component to an already well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua‘a* were ruled by *ali‘i ‘ai ahupua‘a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua‘a* generally speaking, are wedge-shaped subdivisions of land that radiate out from the center of the island, typically extending from the mountain into the sea. Their boundaries are often defined by the topography of the land and its geological features. In these land units the native tenants tended fields and cultivated crops necessary to sustain their families, and the chiefly communities with which they were associated. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people (*maka‘āinana*), who lived in a given *ahupua‘a* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment, and supplying the needs of the *ali‘i* (see Kamakau 1992; Malo 1951).

Entire *ahupua‘a*, or smaller portions of the land called *‘ili* were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali‘i-‘ai-ahupua‘a* (chief who controlled the *ahupua‘a* resources). The *ali‘i-‘ai-ahupua‘a* in turn answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* and *‘ohana* who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). The *ahupua‘a* were further divided into smaller sections such as the *‘ili ‘āina, mo‘o ‘āina, paukū ‘āina, kīhāpai, kō‘ele, hakuone*, and *kuakua* (Hommon 1986; Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mō‘ī* (king).

In ancient times, Lālāmilo was an *‘ili* of the *kalana* (or *‘okana*) of Waimea. A *kalana* was treated as a sub-district: smaller than a district (*moku o loko*), but composed of several other land divisions, such as *ahupua‘a* and the more independent *‘ili kūpono*, all of which contributed to its wealth (Maly and Maly 2002). The lands subject to the *kalana* of Waimea were those that form the southern limits of the present-day South Kohala District including ‘Ōuli, Wai‘aka, Lālāmilo, Puakō, Kalāhuipua‘a, ‘Anaeho‘omalu, Kanakanaka, Ala‘ōhi‘a, Paulama, Pu‘ukalani (Pukalani), Pu‘ukapu, and Waikōloa (Figure). In ancient times, Lālāmilo was referred to as Waikōloa Iki, and the neighboring area of Waikōloa was referred to as Waikōloa Nui (Maly 1999). Bernice Judd, a former librarian at the Hawaiian Mission Children’s society, explains that:

> In the early days Waimea meant all the plateau between the Kohala Mountains and Mauna Kea, inland from Kawaihae. This area is from eight to ten miles long and from three to five miles wide. There was no running water on Mauna Kea, so the inhabitants lived at the base of the Kohala Mountains, where three streams touched the plain on their way towards the sea… (Judd 1932:14)

With respect to the Precontact use of the general project area within the various land divisions of Waimea, Clark (1987) offered a regional settlement pattern model that includes four elevationally delimited environmental zones. The Coastal Zone extends up to about 150 feet elevation, and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops and was a locus for the collection of wild floral and faunal resources. The current project area, situated at elevations ranging from 2,635 to 2,675 feet, is perhaps at the interface of Clark’s (1987) Kula and Wilderness Zones.

Ultimately the increased upland population resulted in the creation of the Waimea Field System at elevations ranging from roughly 2,460 to 2,950 feet (750 and 900 meters) above sea level. At these elevations, located in Clark’s (1987) Kula Zone, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Clark (1983) identified four field complexes (Figure 23) in the Waimea area, each containing an extensive network of fields fed by a system of irrigation ditches that drew water from the Waikoloa and Kahakohau Streams. Kirch (1985:231) surmises that the fields were perhaps intermittently irrigated with “simple furrows” that were used to “direct water across the sloping field surfaces.” Recent modelling of water flow in a portion of Field Complex 3 (located west of the current project area) by McIvor and Ladefoged (2018) suggests that intermittent irrigation there may have been used to grow a variety of crops. In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, bananas, sugarcane, coconuts, and *hala* (Haun et al. 2003). According to Barrère (1983:27), “the cultivating places at Waimea were first expanded to supply the chiefs’ needs while sojourned there and at Kawaihae”. The closest documented portion of the Waimea Field System to the current project area is Field Complex 4, which extends south of Māmalahoa Highway between the Parker Ranch racetrack and the Pu‘ukapu Homesteads. This complex contains spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along Waikōloa Stream at the eastern margins of the system (Burtchard and Tomonari-Tuggle 2005).

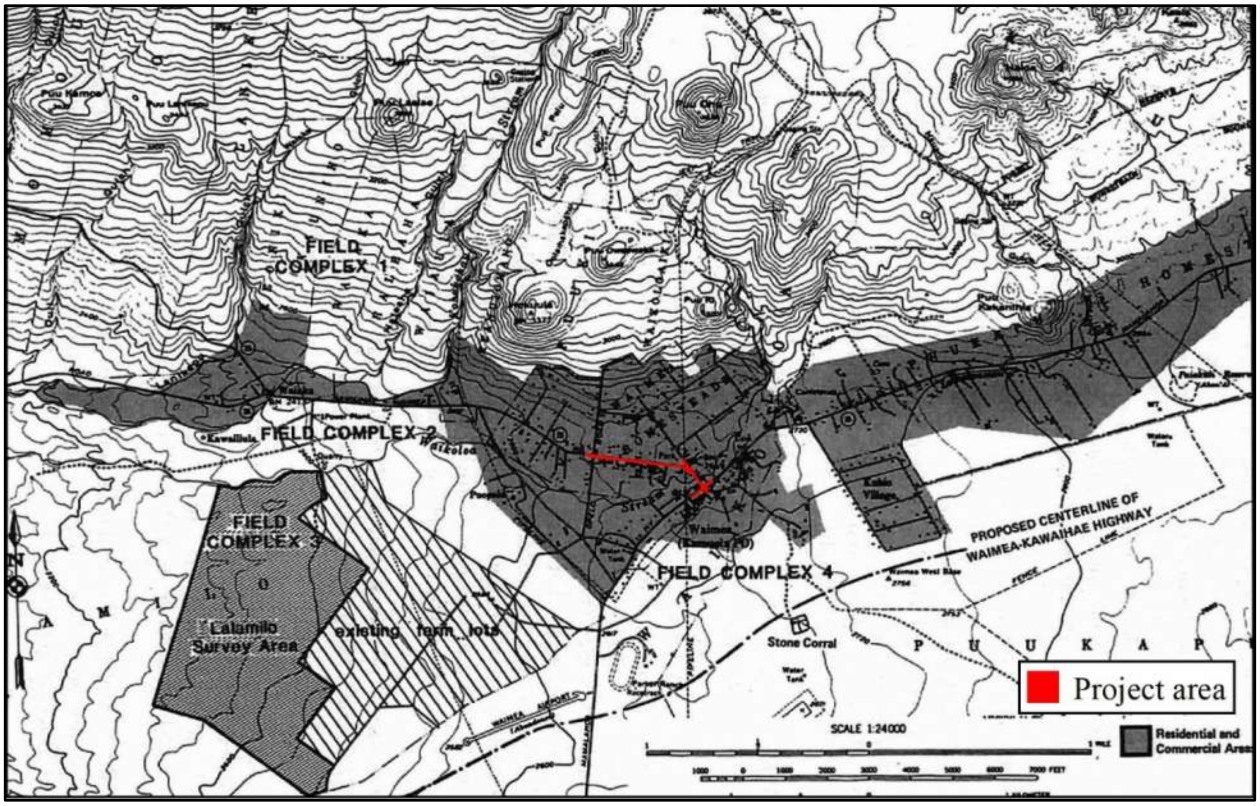


Figure 25. Waimea Field System complexes identified by Clark and Kirch (1983).

By the seventeenth century, large areas of Hawai‘i Island (*moku āina* – districts) were controlled by a few powerful *ali‘i ‘ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ‘Umi a Līloa, a renowned *ali‘i* of the Pili line who ruled from Waipi‘o Valley, is often credited with uniting the island of Hawai‘i under one rule (Cordy 1994). According to Kamakau (1992) ‘Umi was a skilled fisherman, and fishing for *aku*, his favorite fish, often brought him to the beaches of South Kohala from Kalāhuipua‘a to Makaula, where he also fished for *‘ahi* and *kala* with many other famed fishermen and all the chiefs of the kingdom. ‘Umi’s reign lasted until around A.D. 1620, and was followed by the rule of his son, Keawenui a ‘Umi, and then his grandson, Lonoikamakahiki.

During the time of Lonoikamakahiki’s rule, several battles were fought in the general vicinity of the project area. One such battle took place between the army of Lonoikamakahiki and that of his older brother, Kanaloakua‘ana, who rebelled against him. According to Fornander (1880:120–121), Lonoikamakahiki clashed with his brother’s forces at ‘Anaeho‘omalu and then pursued them northward to Kaunaoa between Puakō and Kawaihae, where they fought again. Kanaloakua‘ana then fled inland but was met again by Lonoikamakahiki’s army at Nakikiainihau, Pu‘u Pā (on the Waimea Plain southwest of the current project area), and at Pu‘ukoholā, each time suffering defeat but managing to retreat. Lonikamakahiki’s army continued to chase the rebel forces, forcing three more skirmishes before finally conquering and slaying their last remnant at Pololū.

Fornander (1916–1917) also records a series of attacks against Lonoikamakahiki by Kamalālāwalu, the *ali‘i nui* of Maui. These battles began along the South Kohala coastline, but culminated in a massive fight on the Waimea Plain. Kamalālāwalu and his army, upon the advice of two advisors named Kauhipaewa and Kihapaewa, proceeded to Hōkū‘ula in Waimea, just north of the current project area. Kamalālāwalu anticipated an easy victory thanks to the intelligence provided by hist two advisors, but unbeknownst to him, Kauhipaewa and Kihapaewa were actually Lonoikamakahiki’s allies who had infiltrated the Maui chief’s camp and gained his trust. Upon awakening the next morning, Kamalālāwalu was stunned to discover that the black lava near the coast had turned red with warriors from all of Hawai‘i Island, who marched through the night and “covered the whole of the grassy plain of Waimea like locusts” (Kamakau 1961:58). As Fornander (1916-1917:229) recounts,

> that night and including the following morning the Kona men arrived and were assigned to occupy a position from Puupa to Haleapala. The Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia [Puukakanihia], while those of Kohala guarded from Momoualoa to Waihaka."

Seeing that he was surrounded and outnumbered, Kamalālāwalu met with Lonoikamakahiki to avoid the coming battle, but Lonoikamakahiki, enraged at the manner in which his ally Kanaloakuaʻana had been slain earlier in the invasion, denied him. Kamalālāwalu general Makakuikalani positioned his men and was met by Lono's warrior, Puapuakea at Waikakanilua and Puʻuʻoaʻoaka:

> The battle of Puoaoaka [Puʻuoaoaka] was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger for the slinging of stones that would fall like raindrops from the sky. The stones would fall about with a force like lightening, breaking the bones into pieces and causing sudden death as if by bullets.
>
> Maui almost won in the first battle because of Hawaii's lack of a strong champion. Maka-ku-i-ka-lani [representing Maui] was first on the field and defied any man on Hawaii to match strength with him. Maka-ku-i-ka-lani tore Hawaii's champion apart. When Puapua-kea arrived later by way of Mauna Kea, those of Hawaii rejoiced at having their champion. Maka-ku-i-ka-lani and Puapua-kea matched their strength in club fighting on the battle site before the two sides plunged into the fight. (Kamakau 1961:58-59)

Puapuakea was the eventual victor of this fight, and once Maui's champion had been killed,

> the two sides began to fight. Short and long spears were flung, and death took its toll on both sides. The Maui men who were used to slinging shiny, water-worn stones grabbed up the stones of Puʻoaʻoaka [sic]. A cloud of dust rose to the sky and twisted about like smoke, but the lava rocks were light, and few of the Hawaii men were killed by them. This was one of the things that helped to destroy the warriors of Kama-lala-walu: They went away out on the plain where the strong fighters were unable to find water. (Kamakau 1961:59-60)

The warriors of Maui were put to flight, retreating to the coast, where Kamalālāwalu and nearly all of the invaders, with the exception of his son Kauhiakama, were executed (Kamakau 1961:60).

During the eighteenth century, Waimea became the home of Alapaʻinui, the son of a former Kona war chief, who eventually reigned over the entire island (Kamakau 1961). Alapaʻinui invaded Hawaiʻi Island from Maui, where he had been living since the death of his father. His first victories were against the chiefs of Kona and Kohala, and from there he later gained control of the Hilo and Kaʻū Districts. After gaining control of the Island, Alapaʻinui is said to have lived in Waimea for a time:

> Alapaʻi dwelt in Hilo for a year and then went to live in Waipiʻo. Shortly after, he and the chiefs moved to Waimea and others went by canoe to Kawaihae. From Waimea, he went to Lanimaomao, where he fell ill. (Kamakau 1961:77)

At Lanimaomao, Alapaʻinui appointed his son Keaweʻōpala to be ruler over the islands. Many of the chiefs who had been deprived of their lands by Alapaʻinui battled against Keaweʻōpala (Kamakau 1961). It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupuaʻa* of Kokoiki, near the Moʻokini Heiau (Kamakau 1961). There is some controversy about the year of his birth. Kamakau (1961:67-68) places it on a stormy night in the month of Ikuwa of 1736, but based on several lines of evidence, Makemson (1936) places it during Makaliʻi in 1758. Kalaniʻōpuʻu, one of the hereditary heirs to the land of Hawaiʻi, defeated Keaweʻōpala in South Kona and became the ruler of Hawaiʻi Island. Kalaniʻōpuʻu's reign was marked by near-constant warfare as he invaded Maui and defended himself from rebellions by Maui and Hawaiʻi *aliʻi* (Kamakau 1961). In A.D. 1775 Kalaniʻōpuʻu and his forces from Hāna, Maui, raided and destroyed the neighboring district of Kaupō, and then launched several more raids on Molokaʻi, Lānaʻi, Kahoʻolawe, and parts of West Maui. It was at the battle of Kalaeokaʻilio that Kamehameha, a favorite of Kalaniʻōpuʻu, was first recognized as a great warrior and given the name of Paiʻea (hard-shelled crab) by the Maui chiefs and warriors. During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi. Kalaniʻōpuʻu was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

The Arrival of Captain Cook and the Reign of Kamehameha I

The arrival of foreigners in the Hawaiian Islands marked the beginning of drastic changes in Hawai‘i's culture and economy. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas due to war and disease, yet increase in others, with relatively little change in material culture. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with foreign ships. There was a continued trend toward craft and status specialization, intensification of agriculture, *ali‘i* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered O‘ahu, Maui and Moloka‘i, in 1795, Hawai‘i saw the beginnings of a market system economy (Kent 1983).

Captain James Cook and his crew on board the ships the H.M.S. Resolution and Discovery first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalani‘ōpu‘u, who was still at war with Kahekili, visited Cook on board the Resolution off the East coast of Maui. Kamehameha observed this meeting but chose not to participate (Jarves 1847). The expedition did not explore inland to Waimea, but while sailing up the Kohala coast, Lt. King recorded his observations of that part of the countryside:

> Koaara [Kohala] extends from the Westernmost point to the Northern extremity of the island; the whole coast between them forming an extensive bay, called Toe-yah-yah [Kawaihae], which is bounded to the North by two very conspicuous hills. Toward the bottom of this bay there is foul, coraly ground, extending upward of a mile from the shore, without which the soundings are regular, with good anchorage, in twenty fathoms. The country, as far as the eye could reach, seemed fruitful and well inhabited, the soil being in appearance of the same kind with the district of Kaoo [Ka‘ū]; but no fresh water is to be got here. (King 1784:106)

After the death of Captain Cook at Kealakekua and the departure of *H.M.S. Resolution* and *Discovery*, Kalani‘ōpu‘u moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1961). While he was living in Kona, famine struck the district. Kalani‘ōpu‘u ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. While in Kohala, Kalani‘ōpu‘u proclaimed that his son Kiwala‘ō would be his successor, and he gave the guardianship of the war god Kūka‘ilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kiwala‘ō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moa‘ula was erected in Waipi‘o at this time (ca. A.D. 1781), and after its dedication Kalani‘ōpu‘u set out for Hilo to quell a rebellion by a Puna chief named ‘Īmakakolo‘a.

In 1790, John Young and Isaac Davis, sailors on board the ships *Eleanora* and *Fair American*, which were trading in Hawaiian waters, were detained by Kamehameha I and made his advisors. The story of their detention begins when the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui] as retribution for the theft of a skiff and the murder of one of the sailors. The *Eleanora* then sailed to Hawai‘i Island, where John Young went ashore and was detained by Kamehameha's warriors. The other vessel, the *Fair American,* was captured off the Kona coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1961). Kamehameha, with the aid of Young and Davis and their knowledge of the newly acquired foreign arms, then succeeded in conquering all the island kingdoms except Kaua‘i by 1796. It wasn't until 1810, when Kaumuali‘i of Kaua‘i gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically, initially through deforestation from the collection of sandalwood and then by the introduction of cattle to these lands (Rechtman and Prasad 2006). In 1792, Captain George Vancouver, who had sailed with Cook during his 1778-1779 voyages, arrived at Kealakekua Bay with a small fleet of British ships, where he met with Kamehameha. Vancouver stayed only a few days on this first visit, but returned again in 1793 and 1794 to take on supplies. Vancouver introduced cattle to the Island of Hawai‘i at Kealakekua during these latter two visits, giving them as gifts to Kamehameha I, who immediately made the cattle *kapu*, thus preventing them from being killed (Kamakau 1961; Vancouver 1984). Some of the offspring of these animals escaped the initial attempts to contain them (Barrère 1983; Bowser 1880; Henke 1929) and spread throughout Kohala, Kona, and the saddle region. In agricultural areas, they wrought havoc on crops and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes.

Hawai‘i's culture and economy continued to change drastically during Kamehameha's rule as capitalism and industry established a firm foothold in the Islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810.

Kamehameha, who resided on the Island of O‘ahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food and fish (Kamakau 1961). This new burden added to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau Kamakau (1961:204) indicates that, “this rush of labor to the mountains brought about a scarcity of cultivated food … The people were forced to eat herbs and tree ferns, thus the famine [was] called Hilaulele, Haha-pilau, Laulele, Pualele, ‘Ama‘u, or Hapu‘u, from the wild plants resorted to.” Once Kamehameha realized that his people were suffering, he “declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land” (Kamakau 1961:202). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua-Kona, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but also continued to enforce the rigid *kapu* system.

When Kamehameha I died on May 8, 1819, however, the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha’s death, a period of *‘ai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered (Kamakau 1961). Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu, and rather than re-establish the *kapu*,

> Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief’s tabu and the freeing of the eating tabu. The *kahu* said to the chief, “Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!” and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali‘i consented to the free eating and it was accepted on Kauai (Kamakau 1961:225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstituted the eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kūkā‘ilimoku, was dismayed by his cousin’s (Liholiho) actions and revolted against him, but was defeated.

With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai‘i to Kaua‘i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. By December of 1819, Kamehameha II had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *‘aumakua* worship, to continue (Kamakau 1961; Oliver 1961). With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawai‘i. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali‘i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopted their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the demands of the *ali‘i* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali‘i* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai‘i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, the missionary William Ellis described Waimea as a fertile, well-watered land “capable of sustaining many thousands of inhabitants” (Ellis 1831:399). The population was concentrated in three villages, Keaalii, Waikoloa, and Puʻukapu, each located where major streams reached the plain (Figure 26). Ellis notes that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. In the time since Kamehameha I’s death, the harvesting of sandalwood had once again been forced upon the *makaʻāinana*. During his travels along the coast of Kohala, Ellis noted that most of the villages were empty as the men of the region had been ordered to the mountains by the King to collect sandalwood. He wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young… Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 1831:396–397)

Taro was one of the foods that the Waimea lands were known for. Dry taro was planted along the lower slopes of the Kohala Mountains on the Waimea side, and on the plains south and west of the town (Handy et al. 1991:532). On his second visit to Waimea town, William Ellis (1831:354) made the following observation:

> The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants. About noon they [Messrs. Bishop and Goodrich] reached the valley of Waimea, lying at the foot of Mouna-Kea [sic], on the north-west side. Here a number of villages appeared on each side of the path, surrounded with plantations, in which plantains, sugar-cane, and taro were seen growing unusually large.

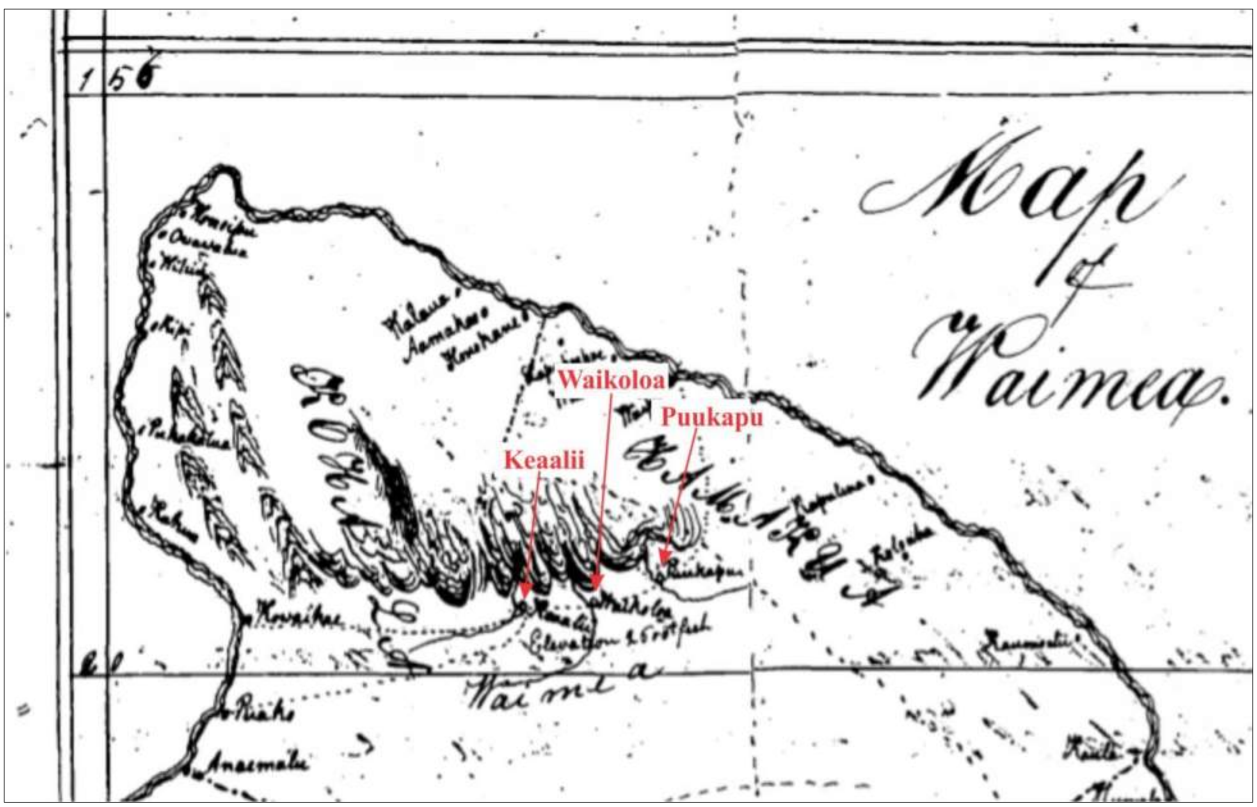


Figure 26. Portion of a Map of Waimea ca. 1830 (after Andrews et al. 1830).

The Early Development of Cattle Ranching in Waimea

Ellis (1831:402) describes a journey by one of his travelling companions to Mauna Kea, and the early use of the herds of cattle that were by that time roaming the mountain side:

> Although there are immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the native vessels. But this is attended with great labour and expense. They first carry all the salt to the mountains. When they have killed the animals, the flesh is cut off their bones, salted immediately, and afterwards put into small barrels, which are brought on men's shoulders ten to fifteen miles to the sea-shore.

In 1822 John P. Parker, originally of Newton, Massachusetts, was one of the early foreigners granted permission to hunt bullock for the crown (Brennan 1974). The wild cattle were often captured in bullock pits seven to eight feet long by four feet deep that were covered over with sticks and a thin layer of dirt; they were also hunted with guns, and in later years, after the arrival of *vaqueros* from Central and South America, lassoed from horses (Frost and Frost 1977; Wilkes 1845). By about 1830 Parker, would go on to found Parker Ranch, which would eventually grow to become the largest cattle ranch on the island (Henke 1929). In that same year, the appointed governor of Hawai‘i Island, Kuakini, moved to the town of Waimea (Figure 27) to oversee and improve on the government cattle industry. He ordered the construction of corrals and had a twelve mile stretch of trail between Waimea and Kawaihae widened (Escott 2008). The 1835 missionary census lists 6,175 people living in Kohala and another 1,396 people, including 500 men, 510 women, and 386 children, living in Waimea (Schmitt 1977). Despite the eventual prominence of ranching in Waimea, at the time Lorenzo (Lyons 1837:1) reported that “The beef establishment has lost some of its charms; & the attention of the people is more directed to the cultivation of the soil - a great portion of Waimea is being surrounded by a stone wall – to form an extensive garden from which all graminivorous animals are to be excluded & which is to be cultivated by the people for their own benefit as well as that of the chiefs.” Foreigners appear to have been somewhat transient during this period, as Lyons (1841:13–14) notes:

> There was a time when the foreign population numbered about 70 - & their children 30. But the number has considerably diminished & it is always fluctuating - sometimes more & sometimes less. They belong to 6 or 7 different nations & are variously employed – beefcatchers - sugar manufacturers - shoemakers, merchants - tanners - lawyers - blacksmiths - -combmakers - masons - doctors - saddlers - farmers & what not.

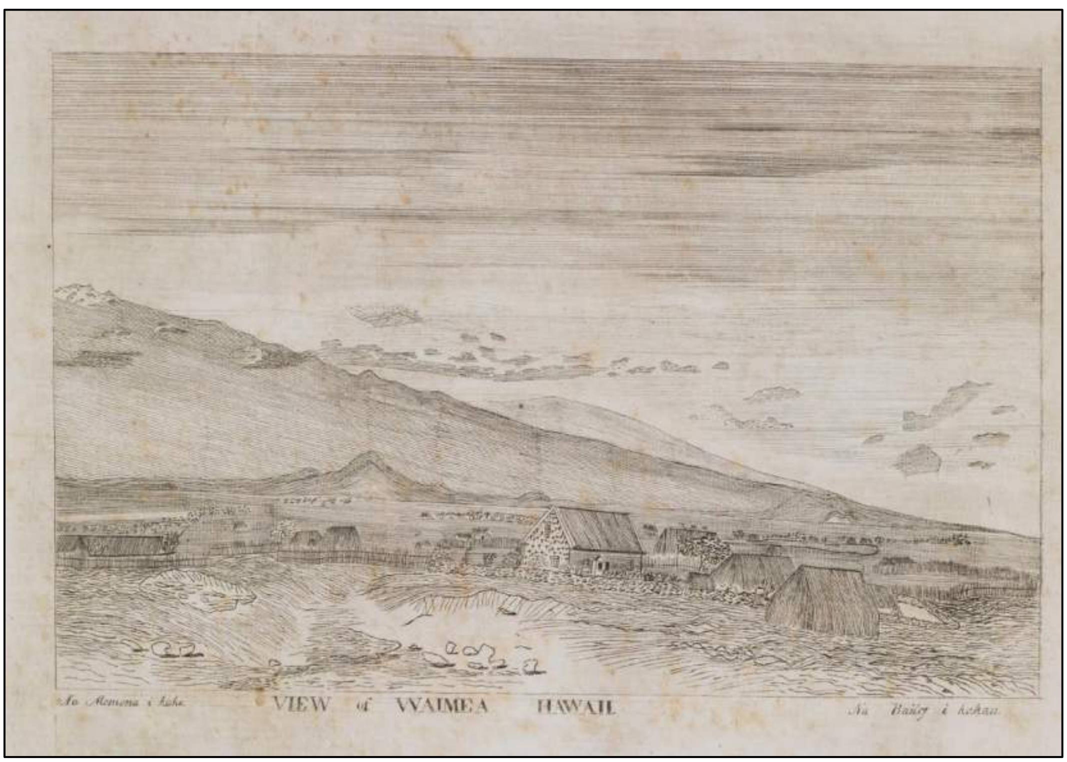


Figure 27. “View of Waimea Hawaii” circa 1840 (Hawai‘i Mission Houses Museum).

By 1840, bullock hunting had drastically reduced the population of wild cattle on Hawai‘i Island, so much so that a five year *kapu* was placed on hunting them solely for their hides and tallow (Bergin 2004). This led to further efforts to tame, brand, fence, and herd privately owned cattle (Wilkes 1845). For a while, agricultural products from Waimea replenished the cargo ships at Kawaihae Harbor, and in the late 1840s many of the potatoes grown in the Waimea area were shipped to California to help feed the gold rush (Haun et al. 2003), but the decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, ultimately led to a period of economic hardship and population decline in the Waimea area (Escott 2008).

At about this time, a Honolulu merchant named William French constructed his residence, currently known as the historic Spencer House, at Pu‘uloa to the northeast of the Lindsey Road-Māmalahoa Highway portion of the current project area. French operated a store in Kawaihae and another, a “thatched hut” at Pu‘uloa where he “employed a saddle-maker and operated a tannery” under the management of Parker, who “kept busy supervising this operation and collecting beef tallow, and leather to supply the needs of French’s growing business” (Wellmon 1973:50). Despite a lack of money in Waimea at the time, store did well for both French and Parker, as Wellmon (1973:50-51)

> There was no surplus of currency in Waimea at this time, and most of the business at the Puuloa store consisted of bartering for goods and services. Long-term credit and buying on time was the rule rather than the exception in these transactions. . . French supplied Parker with different goods in exchange for his services and produce. Parker used these goods himself or exchanged them with those who worked for French and those who paid the store in money or goods.

Francis Allyn Olmsted (1841:230), an American author, journeyed to Waimea in 1840 and described French’s storefront and the colorful *vaqueros* and bullock hunters who frequented the store:

> About eight o’clock, we came up with a collection of thatched houses, towards the principal of one which we directed our steps, which was a store belonging to Mr. French of Honolulu. Here a novel scene presented itself to us. In front of the door, a bright fire was blazing in a cavity in the earthern floor, displaying in strong light the dark features of the natives congregated around it in their grotesque attitudes. Immediately back of these, a group of fine looking men, in a peculiar costume, were leaning against the counter of the store. Some of them were Spaniards from California, and they were all attired in the poncho, an oblong blanket of various brilliant colors, having a hole in the middle through which the head is thrust. The pantaloons are open from the knee downwards on the outside seam. A pair of boots armed with prodigiously long spurs completed their costume. They were bullock hunters, employed in capturing the wild bullocks that roam the mountains, and had just returned from an expedition of eight or ten days, in which they had been very successful.

Travel in and out of Waimea during this period was accomplished by one of four main roads (Figure 28), which connected the town to Kohala, Kawaihae, Hāmākua, and Parker’s residence at Mānā. As the decade wore on, however, the population of Kohala began a rapid decline, and settlement patterns changed significantly. Leeward inhabitants relocated to the wetter windward slopes of North Kohala and the Waimea plain, abandoning their agriculturally marginal areas in favor of wetter sugarcane lands more productive farmland. According to (Tomonari-Tuggle 1988:author-year), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. (Tomonari-Tuggle 1988:33) clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali‘i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment.

These population shifts were accompanied by an overall decline in the number of people living in Kohala. Contemporary observers and modern scholars (see Burtchard and Tomonari-Tuggle 2005) offer several explanations, including the decline of the whaling industry, a *kapu* on killing wild cattle (Wilkes 1845), dissatisfaction with William Beckley’s appointment as *konohiki* (Doyle 1953), and disease (HSA 1848), and epidemics that raged through the islands in 1848 and 1849. The population reduction in Waimea as documented by missionaries was tremendous, as the Rev. Lorenzo Lyons expressed, “if the decrease of local people continues the same, how many years before they are all dead, without any left?” (Schmitt 1973:29). Similarly, an 1848 description of the Waimea population cited by McEldowney (1983:432) laments that “it can scarcely be said that there is any native population at all.”

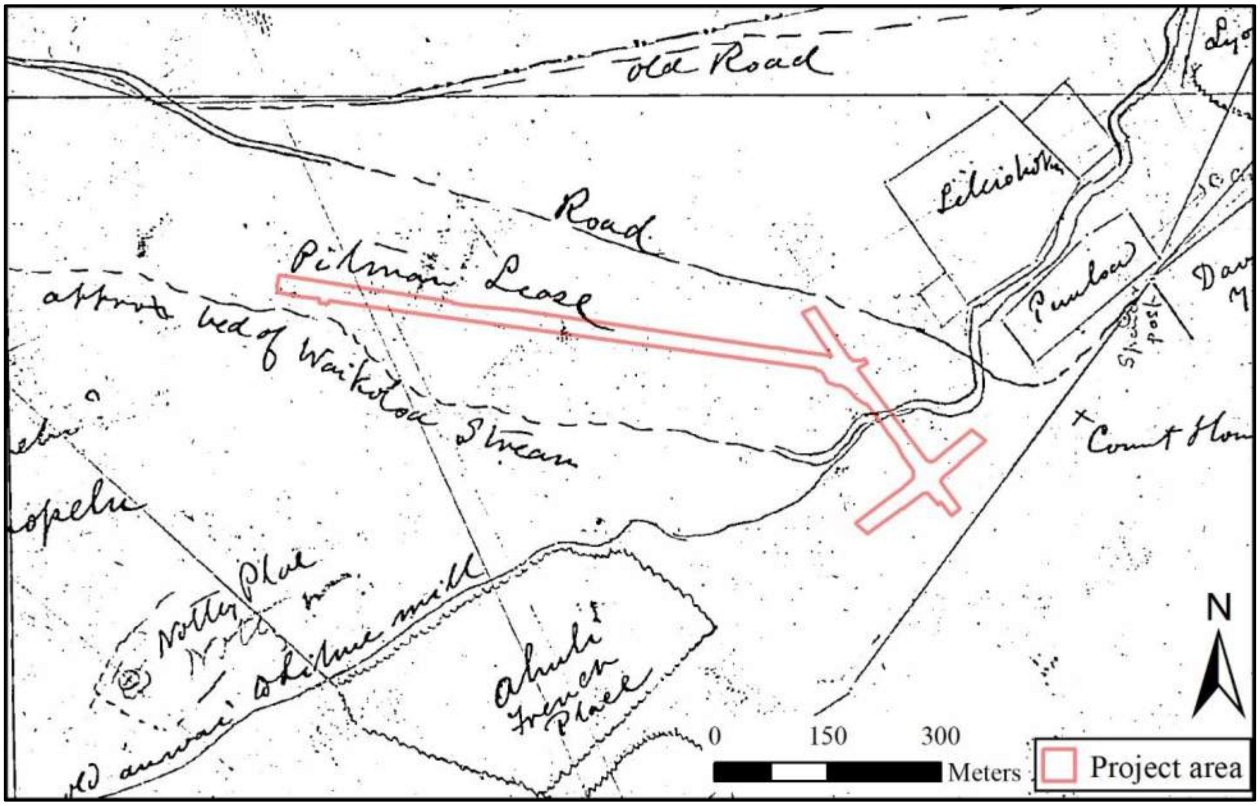


Figure 28. Detail of Registered Map 673 Part 1 showing roads exiting Waimea ca. 1887 –note “approximate” location of Waikoloa Stream (Wall and Lyons 1887).

The Legacy of the *Māhele ʻĀina* of 1848

In 1848, the Hawaiian system of land tenure was radically altered by the *Māhele ʻĀina*. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. As a result of the *Māhele*, all land in the Kingdom of Hawaiʻi came to be placed in one of three categories: (a) Crown Lands (for the occupant of the throne); (b) Government Lands; and (c) *Konohiki* Lands (Chinen 1958:vii; 1961:13). All lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission. Laws in the period of the *Māhele* record that ownership rights to all lands in the kingdom were “subject to the rights of the native tenants;” those individuals who lived on the land and worked it for their subsistence and the welfare of the chiefs. During the *Māhele* Kamehameha III retained Waimea as personal property (Crown Lands), and as a result, the detailed information about previous land use and cultural history that can be found in documents created during the *Māhele* is limited for much of Waimea.

The disposition and distribution of *Konohiki* Lands in and around Waimea Town, however, was a complicated issue and a matter of much testimony and debate among Commissioners, *kamaʻāina* informants, and land petitioners. To further complicate the issue, some of the land units within the *kalana* of Waimea were considered *ahupuaʻa* and others *ʻili kūpono.* As a result of the *Māhele* testimony and the Boundary Commission Testimony, many smaller *ahupuaʻa* names were dropped and the relatively independent *ʻili kūpono* were given *ahupuaʻa* status, and except for a portion of the Waikōloa *ahupuaʻa* (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. Almost all of the smaller *ʻili ʻāina* located on the southern slope of Kohala Mountain became Government Land, with two exceptions. The lands of Waiaka 1 and 2, located west of Waiauia, were retained by M. Kamaikui (LCAw. 8516-B:1) and G. Lahilahi (LCAw. 8520-B:2), respectively. Two *ʻili* given to Lunalilo (Pauahi and Lanikepu) were relinquished to the Government, and the rest, including Waiauia and the neighboring lands of Haleaha and Puʻu Ki, and the large *ahupuaʻa* of Lālāmilo, in which the current project area is located, also became government land. Which of the *aliʻi* relinquished these lands were not recorded in the Māhele Book (Soehren 2005).

To preserve the rights of tenants on the land, a program was set up through which they could apply for title to the land where they lived and worked. These awards are referred to as *kuleana,* using the Hawaiian term to describe the relationship of rights and responsibilities held among tenant, *konohiki*, and the land. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two year term, and the deadline was extended several times, not for new claims, but for the Land Commission to finish its work (Maly 2002) the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenant's rights to the land and its resources, and also the process by which they could apply for, and be granted fee-simple interest in their *kuleana*. The volumes of native registry and testimony collected for the *kuleana* claims provide a snap-shot of life in Hawaiʻi during the middle part of the nineteenth century. Information recorded in the these volumes contains the names of smaller land divisions (*ʻili*, *moʻo*, etc.) within the *ahupuaʻa*, ties individual claimants and their families to specific locations within those land divisions, provides background information about when and from whom, the claimants received their lands, and gives accounts of the land use at that time.

Over 140 claims for *kuleana* were made by native tenants within the Waimea area. Nearly all of these claims were for house lots or cultivated sections (Haun et al. 2003). Seventeen *kuleana* were claimed within Lālāmilo (Haun et al. 2003). Four located at the coast (listed as within Puakō) were not were awarded, but thirteen in the uplands were. The current project area includes one of these *kuleana* parcels, and likely encroaches on another (Figure 23). LCAw. 3785 as awarded to Olepau on February 11, 1851. The award consisted of a 0.42-acre house lot located at what is now the intersection of Lindsey Road and Kawaihae Road, within Lanakila Park. Olepau's *pāhale* contained two houses. William Beckley, the *konohiki* of Waimea, provided testimony on September 16, 1848. in support of Olepau's claim:

> Hoohikiia o W. Bakle Aolelo maila. Ua ike no au aia i ka ili aina i Kanakanaka, he Pahale, ua paa i ka pa, elua hale maloko, owau wale no na palena a puni, nou aku no kona, ua lohe au he mahikahiki 1848 noi mai oia ieiu, ae aku ou au nona ia wahi, me kuʻu keakea ole aku. (Native Testimony Volume 4:40)

Translated into English, the testimony reads:

> W. Bakle [William Beckley] sworn and stated. I have seen in the ili land at Kanakanaka a house-lot which has been enclosed, with two houses in it. The surrounding boundaries are mine only and his [Olepau] interest is from me. I had heard that was an old land belonging to him and when he had asked me in 1848, I consented to let him have that place without any objections.

Land Commission Award 3915 is located adjacent to the east side of Lindsey Road, north of Waikoloa Stream (see Figure 23). This parcel was awarded to Nahoena in 1877, and consisted of a house lot encompassing 6 5/100 acres. According to Native Testimony (Volume 4:9), the awarded parcel was one of three *ʻapana* claimed.

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite this stated goal, the program provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands, and during the middle to late 1800s Western businessmen established a number of diverse industries on these newly available lands. Letters written at the time of the *Māhele* indicate that by 1848 George Davis Hūʻeu had already established a cattle corral, a goat corral, and house lots on lands adjacent to his roughly 95,000-acre Waikōloa award (Maly and Maly 2002). By 1848, John Palmer Parker, founder of the Parker Ranch, had received two acres of land at Mānā where he built a family house and the first ranch buildings (Bergin 2004). In 1850 he purchased 640 acres surrounding the Mānā lands, and in 1851 he purchased another 1,000 acres. The next year, Kamehameha III granted Parker a lease on the lands of Waikōloa (presumably Lālāmilo and neighboring lands to the north and east), some of which would eventually be deeded to the ranch by outright purchase. By the middle of the decade, Parker had turned most of the day to day operations of Parker Ranch over to his son, John Palmer Parker II. When John Palmer Parker, died on August 20, 1868, the ranch controlled about 47,000 acres of land in the region (Bergin 2004). These lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr.

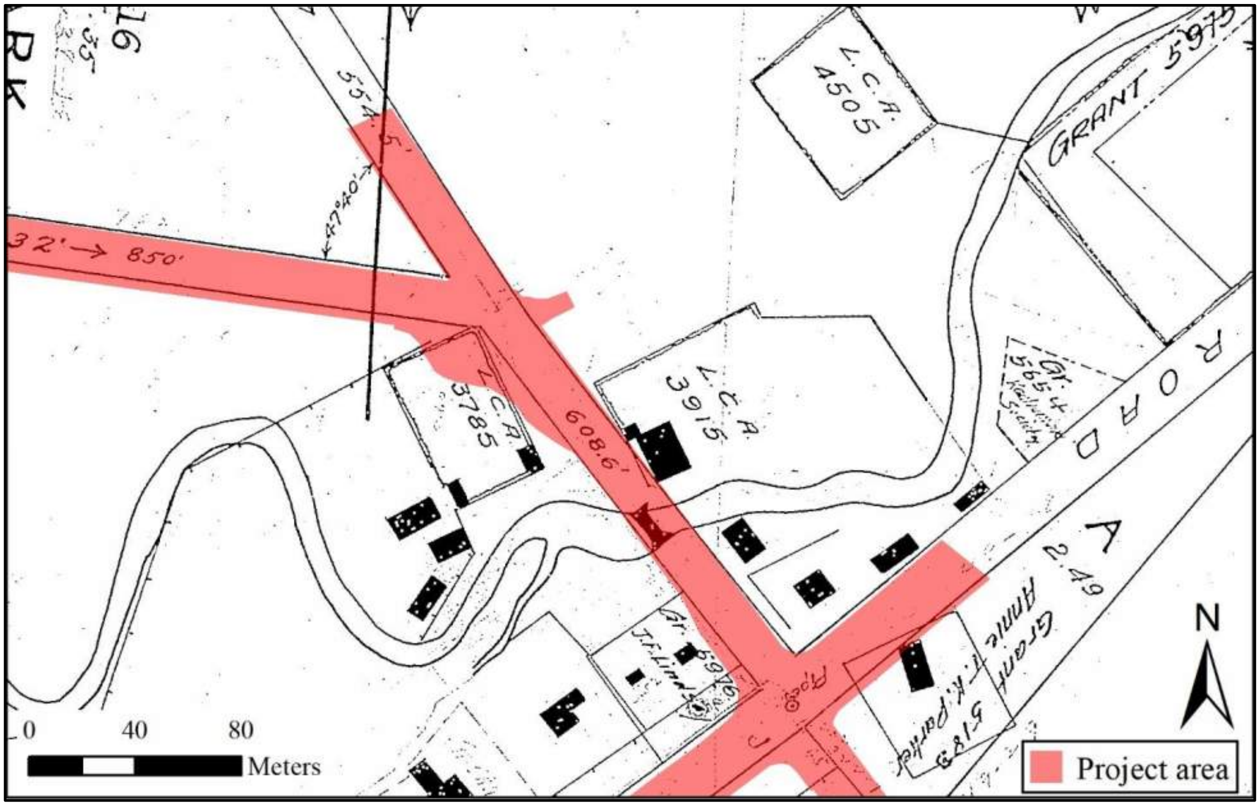


Figure 29. Portion of Registered Map 2470 with LCAw. parcels indicated near the current project area (Rowell and Taylor 1908).

The decades following the *Māhele* of 1848 were characterized by a growing detraction from traditional subsistence activities as the population along the Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up by the burgeoning ranching industry. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements or into dispersed upland habitations where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect their homes and gardens from cattle and other free-ranging animals, but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. The economy also transitioned, becoming cash based and taxes were collected. Foreigners controlled much of the land and most of the businesses, and the native population was largely dependent on these foreigners for food and money (Haun et al. 2003). The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region (McEldowney 1983). Parker Ranch continued to expand their operations in the Waimea area throughout the 1870s and 80s, eventually acquiring the lease to roughly 95,000 acres of Waikōloa that had formerly belonged to the Waimea Agricultural and Grazing Company. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship new managers were brought in to oversee the day to day operations at the ranch.

By the early 1900s, the Parker Ranch headquarters were located near what is now the corner of Lindsey Road and Māmalahoa Highway, in the same building as the old store, post office, and restaurant (Maly and Maly 2005). At this time, Parker Ranch was under the direction of Alfred W. Carter, who had been chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. By this time Parker Ranch was operating on several large leased parcels, but the fee simple holdings amounted to only 34,000 acres (Bergin 2004). Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. In 1903, with only a short period left on its lease, Carter acquired nine-tenths interest in the Waikōloa lands from Ms. Lucy Peabody for $112,000, securing important grazing lands for the ranch (ibid.). Soon thereafter, Carter purchased the adjacent lands of ʻŌuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines *makai* of Waimea Town. He also acquired the Puʻuloa Sheep and Stock Company, encompassing over 3,700 acres and including the Keʻāmuku Sheep station in Waikōloa, which he converted to cattle ranching over the next decade. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humuʻula, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

The Waimea Homesteads

Commercial agriculture was enabled by land tenure changes that were implemented after the overthrow of the Monarchy in 1893. Article 95 of the Republic's constitution expropriated the Crown lands from the deposed Queen, and the 1895 Land Act reclassified Crown lands and Government lands into a single category of "Public Lands." This act repealed much of the previous land-related laws, and made some Public Lands available to citizens of the Republic through homestead leases, right of purchase leases, and cash freehold agreements. Between the overthrow and Annexation, 46,594 acres of former Crown Lands were sold by the government (Van Dyke 2008).

In 1908, the Waimea Homesteads (to the north and east of the current project area) were created by the Territory of Hawaiʻi and sold as grants for house lots (Figure 30). Kawaihae Road was straightened and incorporated into the homestead lots, and Opelo Road was laid out about 600 meters southwest of Lindsey Road. Blocks 4, 5, and 6 of the homesteads are located adjacent to the Kawaihae Road-Opelo Road portion of the current project area. At the time that these lots were created, two houses were present on the LCAw. 3785 parcel, one in the southeast corner and one in the southwest corner, outside the current project area (see Figure 30). I

Not long after in 1914, Alfred W. Carter, on behalf of Parker Ranch, filed a petition against the Territory of Hawaiʻi and sixty-two other individuals over the appurtenant water rights to Waikōloa Stream for the purposes of irrigation (Haun et al. 2003). Carter, in an effort to protect the ranch's water-rights, claimed that the Territory had wrongly diverted waters from the stream in 1905 when they dammed it and ran pipes to Waimea Village, lessening the flow of water to the Parker Ranch lands in Waikōloa, Lālāmilo, and ʻŌuli. While the courts ruled that the Territory of Hawaiʻi was the legal owner of the waters of the stream, they also decided that the residents of the *ahupuaʻa* had the right to use such water for domestic purposes. These purposes included watering livestock and irrigation gardens. Testimony in this case was extensive and indicated that from time immemorial Waikōloa Stream had been tapped by a number of ditches or *ʻauwai*, and that the inhabitants of the area relied heavily on the water from Waikōloa Stream for the continued traditional existence. The stream's significant role in the traditional lifestyle of Waimea natives is evident in the *Māhele* records with the prevalence of house lots and houses in the areas surrounding Waikōloa Stream and in the vicinity of the current project area.

The firsthand accounts provided in the testimonies of the residents of the lands describe the Waikōloa Stream *ʻauwai* system and turn of the century agricultural practices in the Waikōloa-Lālāmilo area (Haun et al. 2003). All surplus of the stream waters beyond that needed for domestic use was granted to Carter and the Parker Ranch as landowners. A map of Waimea prepared in 1914 and 1915 (Hawaiʻi Registered Map No. 2576) illustrates the *ʻauwai* network in the greater Waikōloa, Lālāmilo and Puʻukapu areas (Figure 31). While Registered Map No. 2576 shows that these ditches are located south of the current project area, it also includes the names of individuals who purchased Waimea Homestead lots in the vicinity of Opelo Road, many of whom were members of the Lindsey family. In addition to the sale of the Waimea Homestead lots on the western side of the project area, a small government-owned lot sandwiched between the LCAw. 3785 parcel and Lindsey Road (Figure 32) was sold as Land Grant 7224 to Mrs. Minnie Lonohiwa on March 26, 1919 for $66.50 (Rivenburgh 1917).

With the Parker Ranch water rights understood, Carter began improving the ranch's range management practices by adding fence lines for controlled grazing and an improved water distribution system (Bergin 2004). Weed control measures, including the mechanical clearing of pasture and the planting of new grasses for better forage, were also implemented. Throughout the first quarter of the twentieth century, Waimea town remained fairly small, as depicted on an aerial photograph taken in 1925 (Figure 33). By 1932 and 1946, when Carter finalized the acquisition of Kohala Ranch Co. in North Kohala, Parker Ranch had grown to include roughly 327,000 acres of fee lands (Bergin 2004).

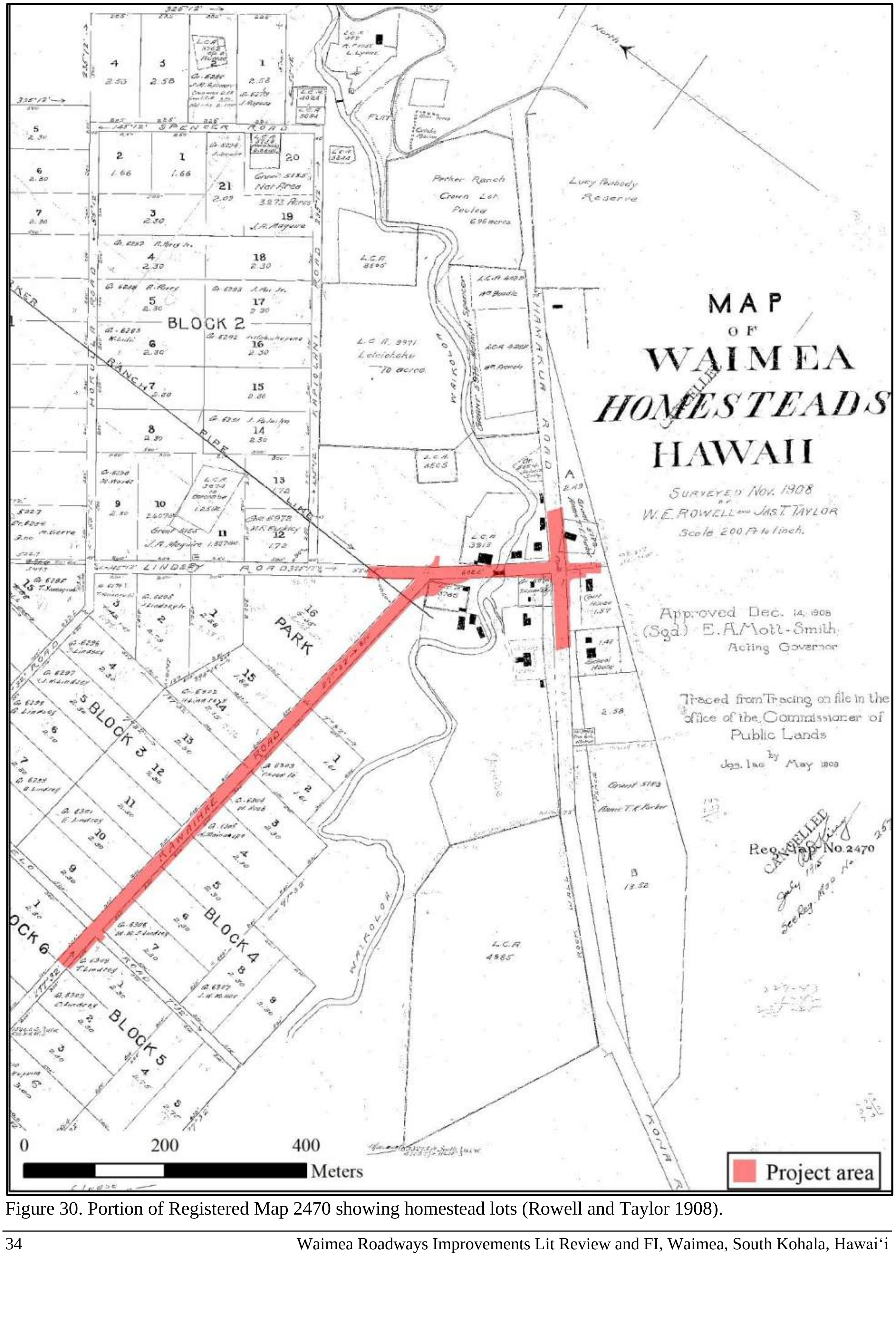


Figure 30. Portion of Registered Map 2470 showing homestead lots (Rowell and Taylor 1908).

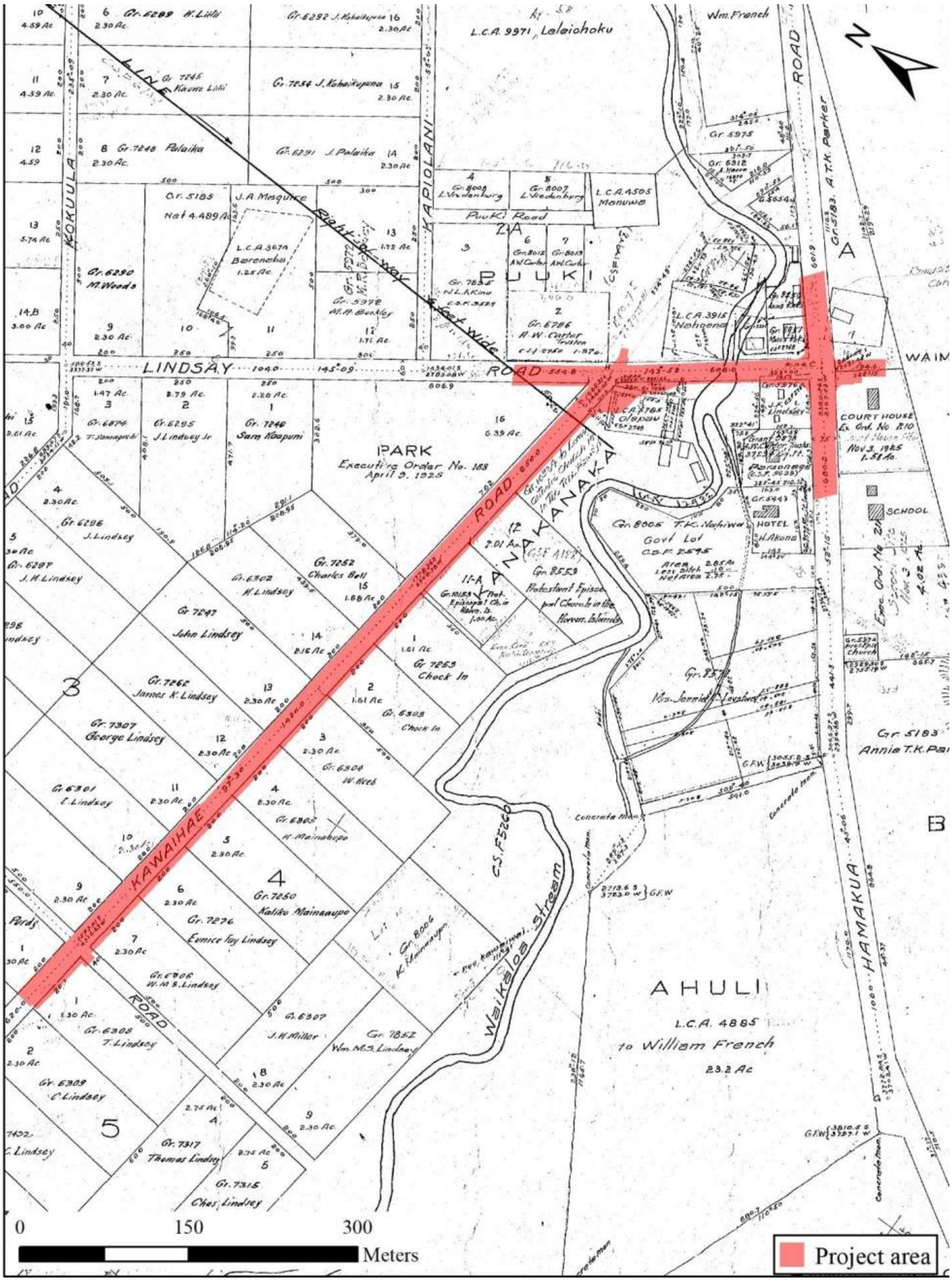


Figure 31. Portion of Hawai‘i Registered Map 2575 (after O'Neal 1915).

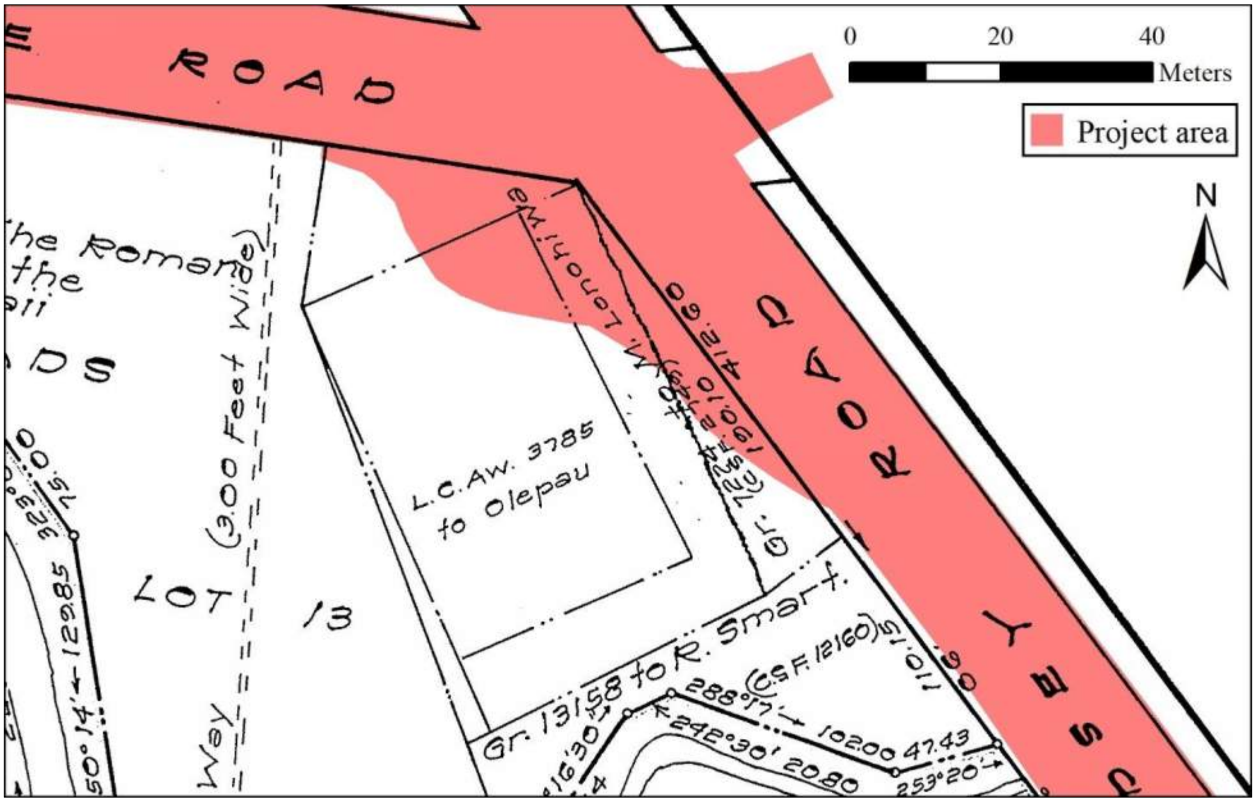


Figure 32. Portion of a map accompanying C.S.F. 12932 showing the approximate extent of the current project area within Grant 7224 and LCAw. 3785 (Hashimoto 1959).

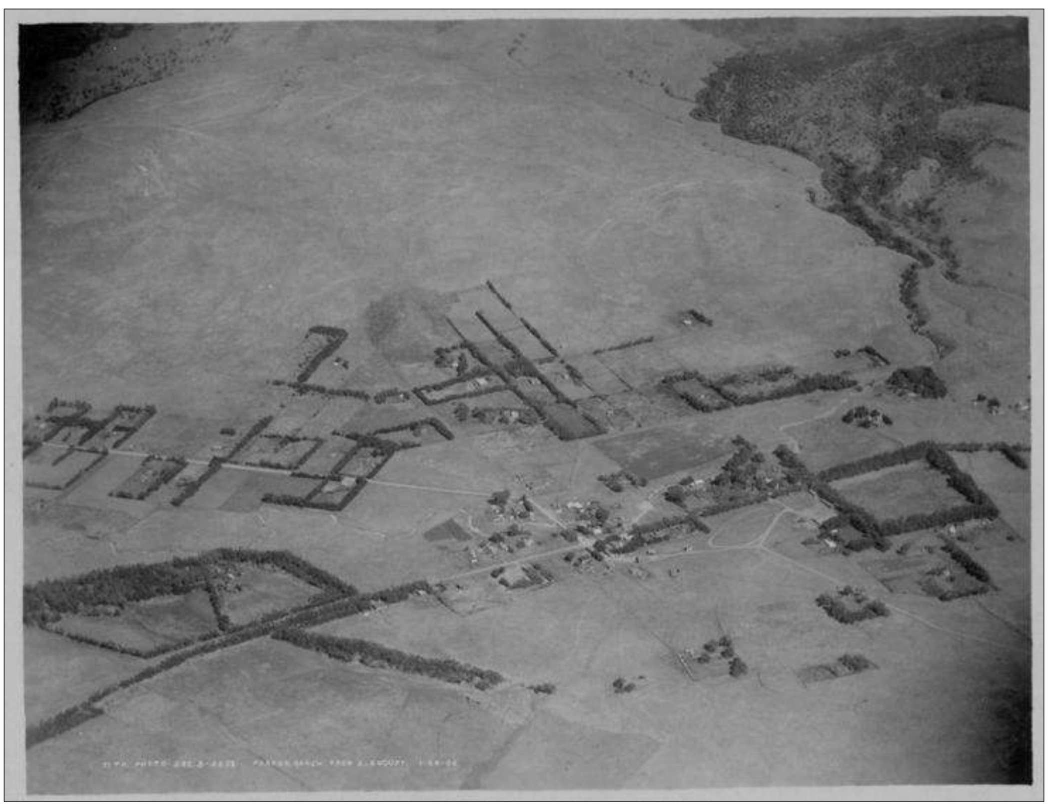


Figure 33. January 28, 1925 aerial photograph of Waimea Town (USAAF 1925).

In 1933, the Hawai‘i Belt Road, or Māmalahoa Highway (SIHP 50-10-47-30187) was completed, linking together a single highway around the island (Duensing 2015). The opening of the new highway was quite an occasion, attended by the governor in Kailua. Asa Thurston, waxed poetic in about the opening of the new highway:

> In a literal sense, what has just been completed in North Kona was to make straight in that desert land, through lava flows and over rough places, a highway for all people who wish to make the journey around the Island of Hawaii or who desire to travel from Waimea to this fair land of Kona. Across that desert-land many travelers have made their weary way, first on horses or in wagons from the more settled portions of North Kona, across the lava flow of 1801 and beyond Puuanahulu to the pastures near Waimea, and then in later years have journeyed in automobiles, an experience hard on the nerves of the driver and always hard on the tires of the car, making the trip an unwelcome one. (*The Friend* Vol. CIII, No.7, July 1933:147)

In Waimea, the new highway formally connected the Waimea-Hāmākua Road with the Waimea-Kona Belt Road. The Waimea-Kona Belt Road (SIHP 50-10-20-20855) was twentieth-century modification of ancient *Alaloa*, or foot trail, named Kealaku‘i connecting Waimea with Pu‘uanahulu to the south (Maly and Maly 2006). While this trail was known and used in Precontact and early Historic times, nineteenth century sources (e.g., see Figure 28) suggest much of the traffic between Kona and Kohala passed on the coastal road (Maly and Maly 2006), which was accessed from Waimea via Kawaihae. By the turn of the twentieth century, the route to Kona through Pu‘uanahulu had become more widely used, leading to the construction of the Waimea-Kona Belt Road (Site 20855) between 1916 and 1922 using prison labor under the direction of Eben Low. As the main throroughfare through town (see Figure 33). Māmalahoa Highway used this same alignment.. Parker Ranch’s main store and restaurant were located near the corner of Lindsey Road and the new Māmalahoa Highway (Figure 34).

Figure 34. Entrance to the former Parker Ranch store and restaurant ca. 1930s (photo courtesy of the Kō Education Center, Honoka‘a).

World War II and Post-War Changes

With onset of World War II, the population of Waimea would drastically expand. Beginning in 1941, months before the bombing of Pearl Harbor, the U.S. Army established an infantry headquarters in the Pu‘ukapu area of Waimea (Bergin 2006) located to the northeast of the current project area. After the United States formally entered WWII, the earlier Army presence in Waimea expanded into one of the largest multi-force (adding the Navy and Marines) U.S. military camps (Camp Tarawa) and training bases in the Pacific. Large areas of the town and the surrounding pastures were turned over to the U.S. Government for campsites (Figure 35) that housed approximately 20,000 soldiers and as firing ranges for training U.S. Marines (Brundage 1971). Maps and photos of Camp Tarawa the extent of the camp (Figures 36 and 37). Pipelines to provide water to the camp were installed along all three roads in the project area as shown in Figure 37. Several U.S. Army installations were located immediately adjacent to the project area, including a recreation field at the current location of Waimea Park, a main hospital in the converted Waimea Ranch Hotel building, and a hospital school at the junction of Lindsay Road and Māmalahoa Highway (see Figure 37). Within a year of the Japanese surrender, the U.S. Military had all but left the town and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry. However, the small town grew throughout the rest of the twentieth century. Figure 38 captures some of the grown that had occurred by 1954. Near Opelo Road, almost all of the homestead lots appear to have been built on by that time. The former LCAw. 3479 parcel (by then consolidated with the Grant 7224 parcel and an adjacent parcel owned by Parker Ranch) contains a large main building that housed the Magnolia Inn, a hamburger stand and restaurant begun during World War II by Hayashi family(Melrose 1997). Trees obscure four other buildings. The northernmost outbuildings, an outhouse and storage and a photography studio, (Figure 39), appear to have been inside the current project area, but the others do not.

Figure 35. Camp Tarawa training camp in Waimea—Opelo Road extends toward the upper left from the tent camp (http://www.pacificworlds.com).

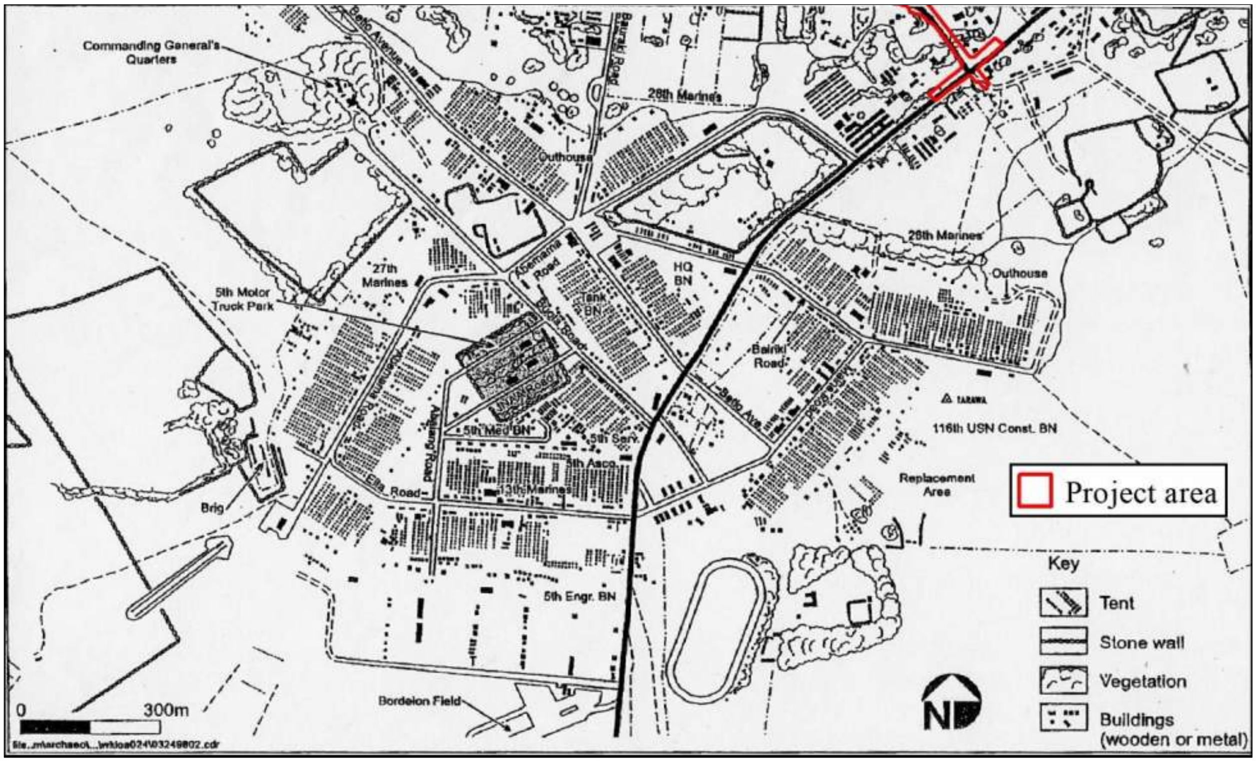


Figure 36. Map of Camp Tarawa ca. 1944 with the current project area indicated (after Nees and Williams 1998:17).

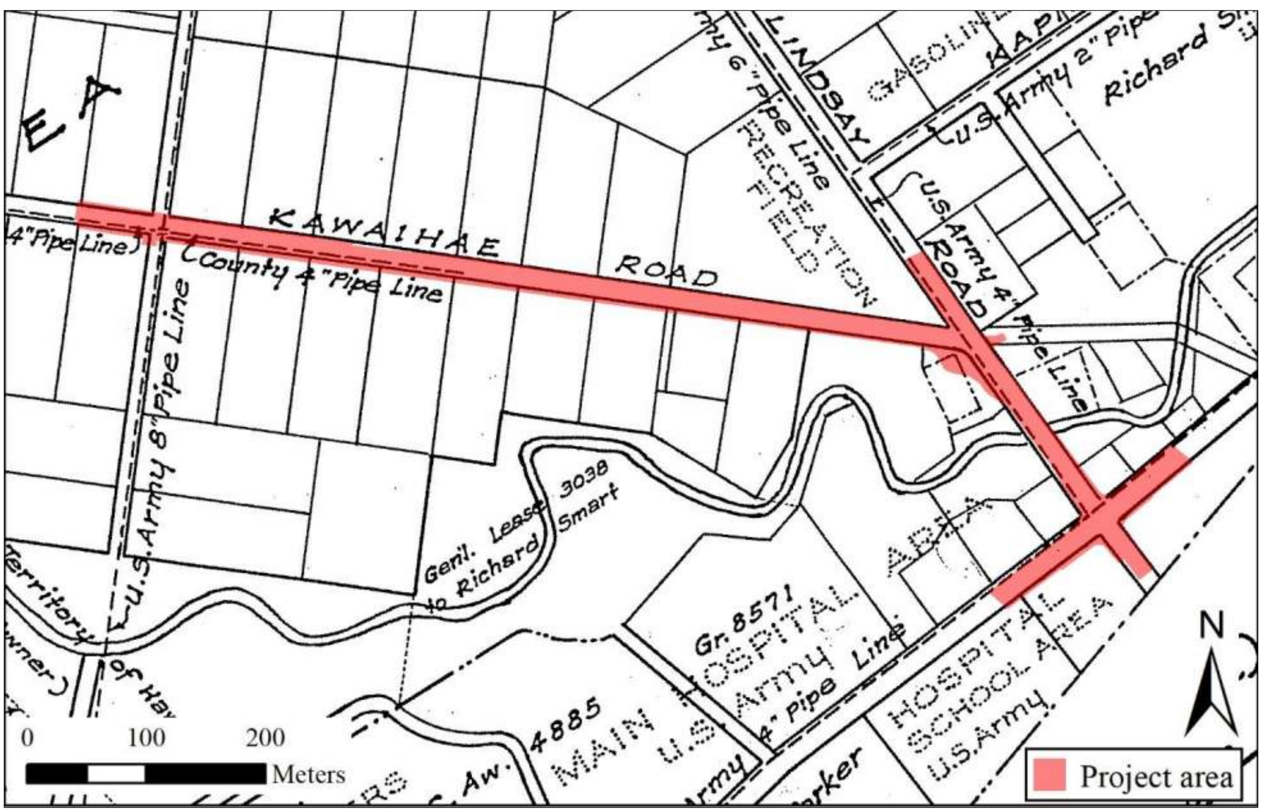


Figure 37. Detail of HTS Plat 411 showing Camp Tarawa infrastructure (after Lane 1945).

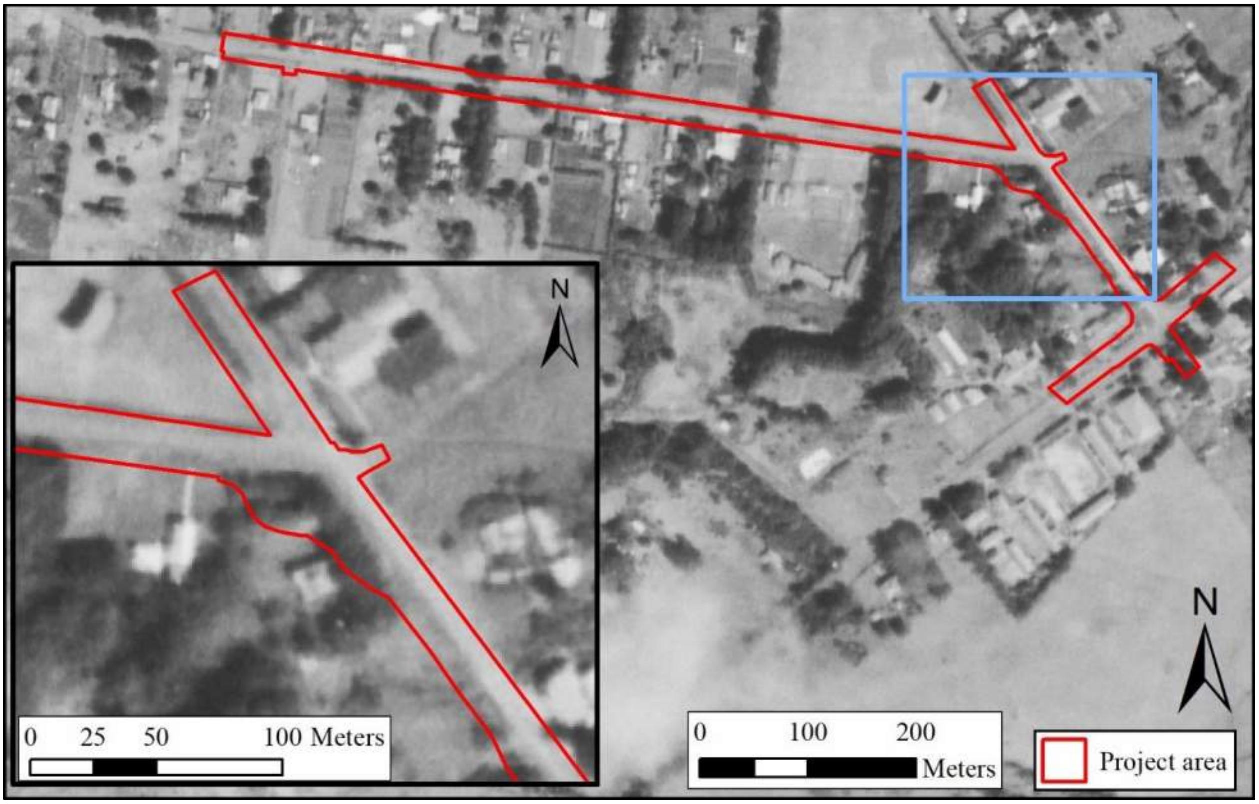


Figure 38. 1954 aerial photograph (USGS 1954) showing the current project area (outlined in red).

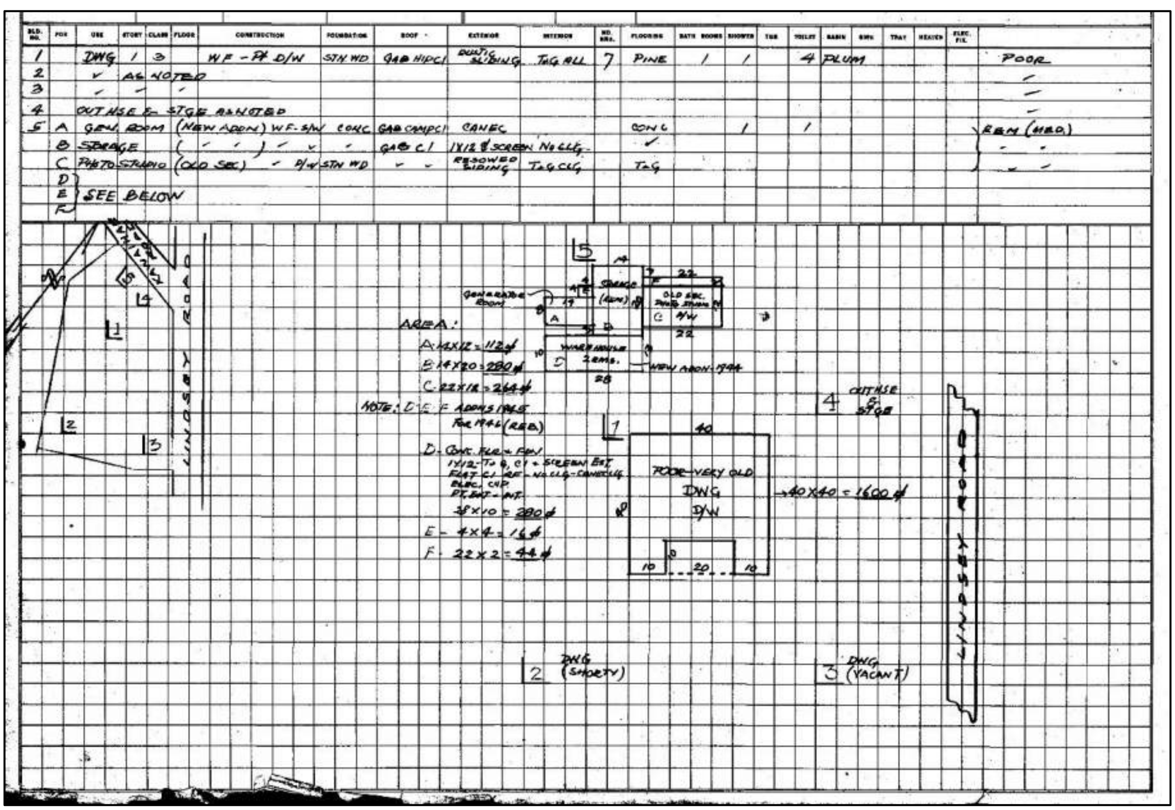


Figure 39. 1951 County of Hawai‘i tax record depicting improvements on the former LCAw. 3479 parcel.

While Parker Ranch and the ranching lifestyle persisted as the social and economic center of Waimea, new community infrastructure, including parks, became a vital component of the town's development. Richard Smart, Parker Ranch's sixth-generation heir and now owner of the ranch and its vast land holdings, set aside a park in honor of his beloved maternal grandmother, Elizabeth Jane Lanakila Dowsett (Figure 40), known to Smart affectionately as "Auntie Tootsie" (Nakano 1992:42). It had been Dowsett, who, upon the death of her husband John Palmer Parker III, relinquished her 1/3 interest of Parker Ranch lands to their infant daughter and Smart's mother, Annie Thelma Kahiluʻonāpuaʻapiʻilani Parker (Bergin 2004).

Figure 40. Richard Smart and his aunt Tootsie Lanakila Dowsett https://kamuela.com/we-are-one/).

The location chosen for Lanakila Park, named for Richard Smart's grandmother, was the former LCAw. 3479 parcel situated directly west of the junction of Lindsey Road and Kawaihae Road. The buildings on the lot were demolished in 1959, and the park (Figures 41 and 42) was dedicated in 1962. To mark the occasion, the Hawaii Tribune-Herald (1962) reported:

> Future is Arriving At Kamuela – The open airiness of the western range remains about this still highest town in the 50th State. But the old "Cowtown" look is fast disappearing. One recently polished facet of Waimea village is its tiny but prim and precise Lanakila Park, just so named in honor of Parker Ranch Owner Richard Smart's grandmother. "Tootsie" Dowsett's Hawaiian name was Lanakila. In a program of conscious stewardship, the park with its well-planned plantings of evergreens and mixture of tropicals is shaping up along lines of Kamuela's monarchy theme. Just now in bloom, blue agapanthus harmonize with the background blue and white tool shed. A bandstand and small pavilion are included in future plans.

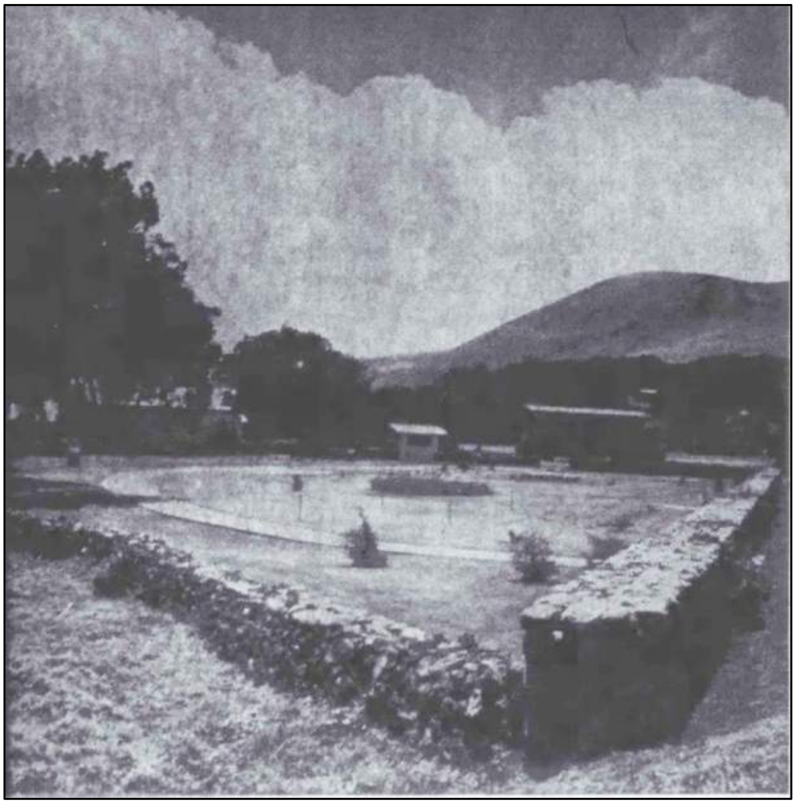
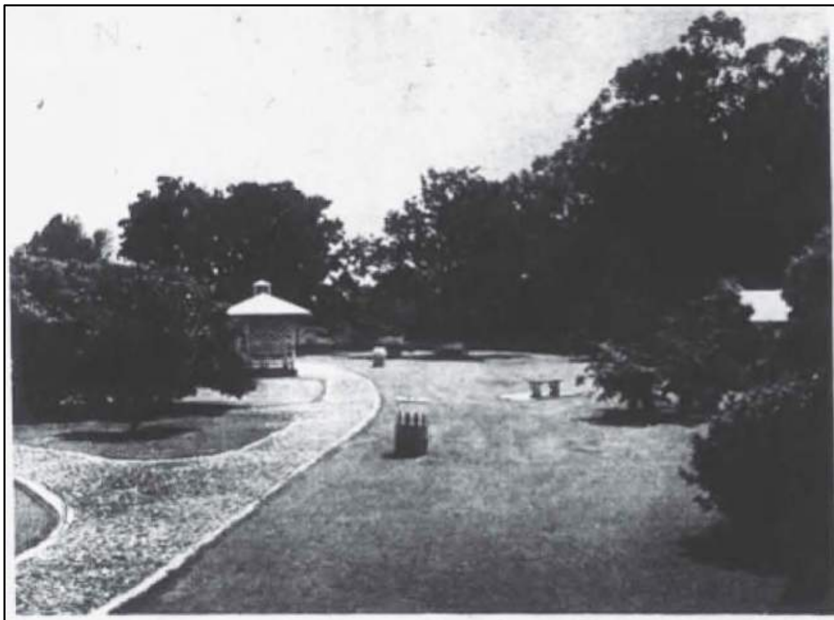


Figure 41. Lanakila Park ca. 1962, view to the northwest from Waikōloa Stream (Tribune-Herald 1962).



BEAUTIFUL LITTLE LANAKILA PARK—Lanakila Park in the center of Waimea was dedicated in 1962 by Richard Smart as a memorial to his late grandmother, Mrs. John Parker III, the former Elizabeth Lanakila Dowsett. A small bronze plaque in a lava rock column on the grounds bears the appropriate inscription. Reminiscent of the Victorian era, there is a small latticed pergola, picnic shelter, walkways, broad expanses of lawn, a profusion of trees, flowers and over all, a quiet serenity. For public use, the park is about three-quarters of an acre. A circular seat around a spreading tree, stone benches, and rubbish containers painted in scalloped designs are all in keeping with a restful atmosphere. In the early days, the area was a Volcano Stables station, and later several old houses stood there.
—T-H photo by Hugh Clark.

Figure 42. Lanakila Park ca. 1968 view to the southwest from Kawaihae Road (Tribune-Herald 1968).

Ten years later, State of Hawaiʻi tax records indicate that the park contained much of the same elements as are found today: a cemented cobble stone walkway (visible in Figure 42), the storage shed, a 20x8 foot rest area, an open concrete bench, an open octagon wooden bench around a tree, a plaque, a three-foot tall stone wall along the road (visible in Figure 41), and a two foot tall stone wall around the park's other boundaries. Throughout the 1970s, development in Waimea began to increase and the town center expanded. By the 1970s, the Parker Ranch Center across the street from the current project area had been built (Figure 43), further illustrates the continuing urbanization and increasing community infrastructure such as cemeteries, parks, schools, and the expansion of critical infrastructure such as a fire department.

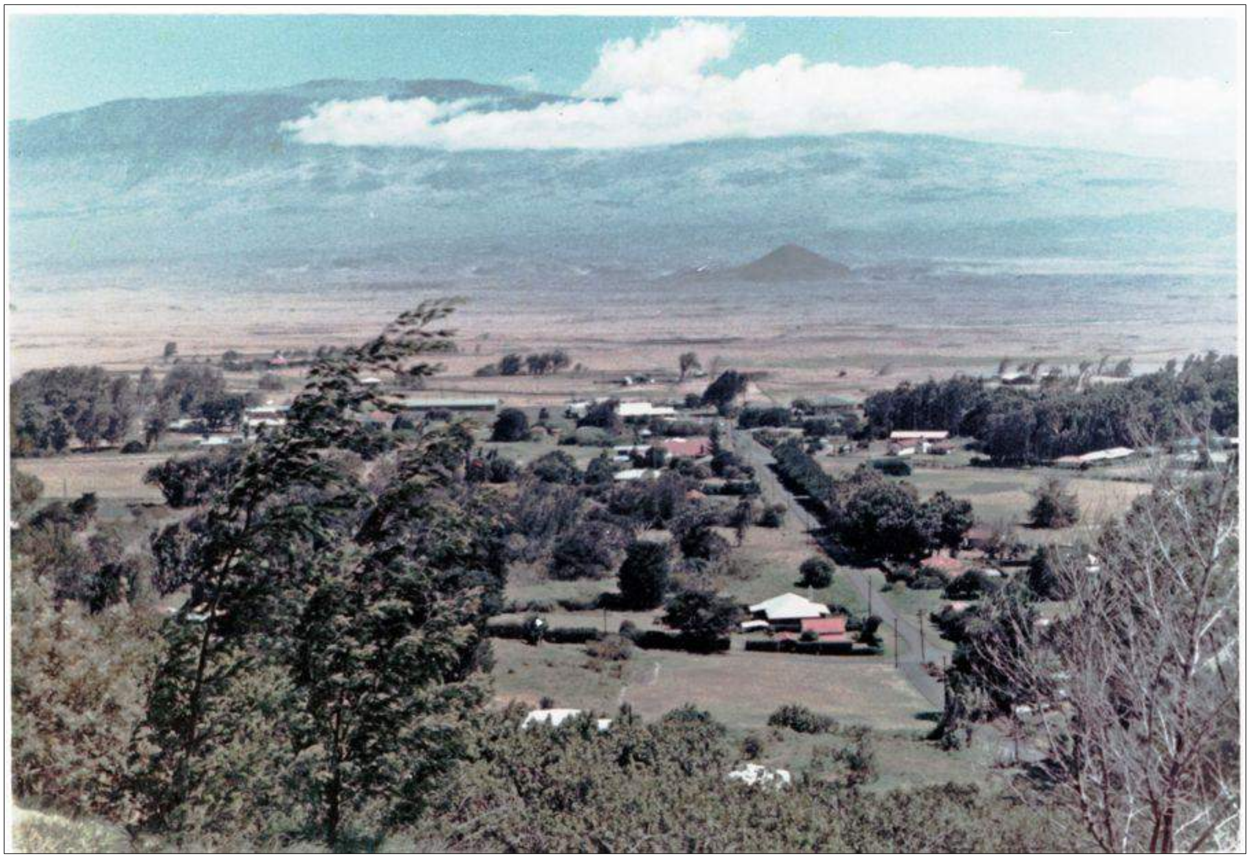


Figure 43. Waimea Town in ca. 1970 (photo courtesy of Kō Educational Center, Honokaʻa).

PREVIOUS ARCHAEOLOGICAL STUDIES

Although no previous archaeological investigations have been conducted within the confines of the current project area, there have been numerous studies conducted in the general vicinity of the current project area and within the greater Waimea Region. Many of these studies have focused specifically on the Lālāmilo agricultural field system, a large complex of Precontact agricultural features and associated habitations that were used into Historic times (Barrera and Kelly 1974; Barrera 1993; Ching 1979; Clark 1981; Clark 1987; Clark et al. 1990; Hammatt and Shideler 1989; Haun et al. 2003; Rechtman 2000). These studies were all conducted to the south and west of the current project area. Feature types identified within the Lālāmilo field system include terraces, mounds, enclosures, field boundaries (*kuaiwi*), irrigation ditches (‘*auwai*), stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and various other miscellaneous types (Haun et al. 2003). Areas associated with the agricultural fields were later utilized for military training and cattle ranching, with sites and features relating to those repurposed functions being interspersed with the Precontact agricultural fields and habitations. To assist in generating a set of expectations regarding the nature of historic properties that may be encountered within the current project area, the results of the most proximate and relevant studies (Table 2 and Figure 44) that have identified findings are discussed in detail below. Not pictured in Figure 44 is the project area for an AIS of a portion of Māmalahoa Highway (Site 30187) between Mud Lane and Mānā Road conducted by LaChance et al. (2017), who found no intact constructed elements of the original Māmalahoa Highway. Based on studies conducted elsewhere on the island, Site 30187 was determined eligible for the National Register of Historic Places (Log No. 2017.00231; 00232; 00233; 00234;00235, Doc. No. 1703JLP07). Contributing character defining features of the historic property include the highway's linear route, bridges, culverts, drainage headwalls, and rock walls.

Table 2. Selected previous archaeological studies conducted in the general vicinity of the project area.

Year	*Author(s)*	*Type of Study*
1992	Thompson and Rosendahl	Inventory Survey
1996	Erkelens	Reconnaissance Survey
1998	Erkelens	Survey and Testing
1999	Wolforth	Data Recovery
2000	Wolforth	Reconnaissance Survey
2001	Magnuson and Athens	Burial Testing and Monitoring
2004	Clark and Rechtman	Inventory Survey
2005	Burtchard and Tomonari-Tuggle	Data Recovery
2006	Clark and Rechtman	Archaeological Monitoring
2007	O’Day and Rieth	Monitoring and Emergency Data Recovery
2008	Clark and Rechtman	Inventory Survey
2009	Macak et al.	Archaeological Assessment
2009	Yucha et al.	Inventory Survey
2009	Wilkinson et al.	Archaeological Monitoring
2010	McIntosh et al.	Inventory Survey
2012	Rechtman	Burial Site Component of a Preservation Plan
2012	Rieth and Filimoehala	Monitoring and Emergency Data Recovery
2013	Rechtman	Inventory Survey and Testing
2014	Haun and Henry	Inventory Survey and Testing
2016	Tam Sing and Rechtman	Archaeological Monitoring
2016	Tam Sing and Rechtman	Archaeological Assessment
2017	Tam Sing et al.	Archaeological Monitoring
2018	Tam Sing and Barna	Inventory Survey
2019	Barna	Field Inspection
2020	Barna	Field Inspection

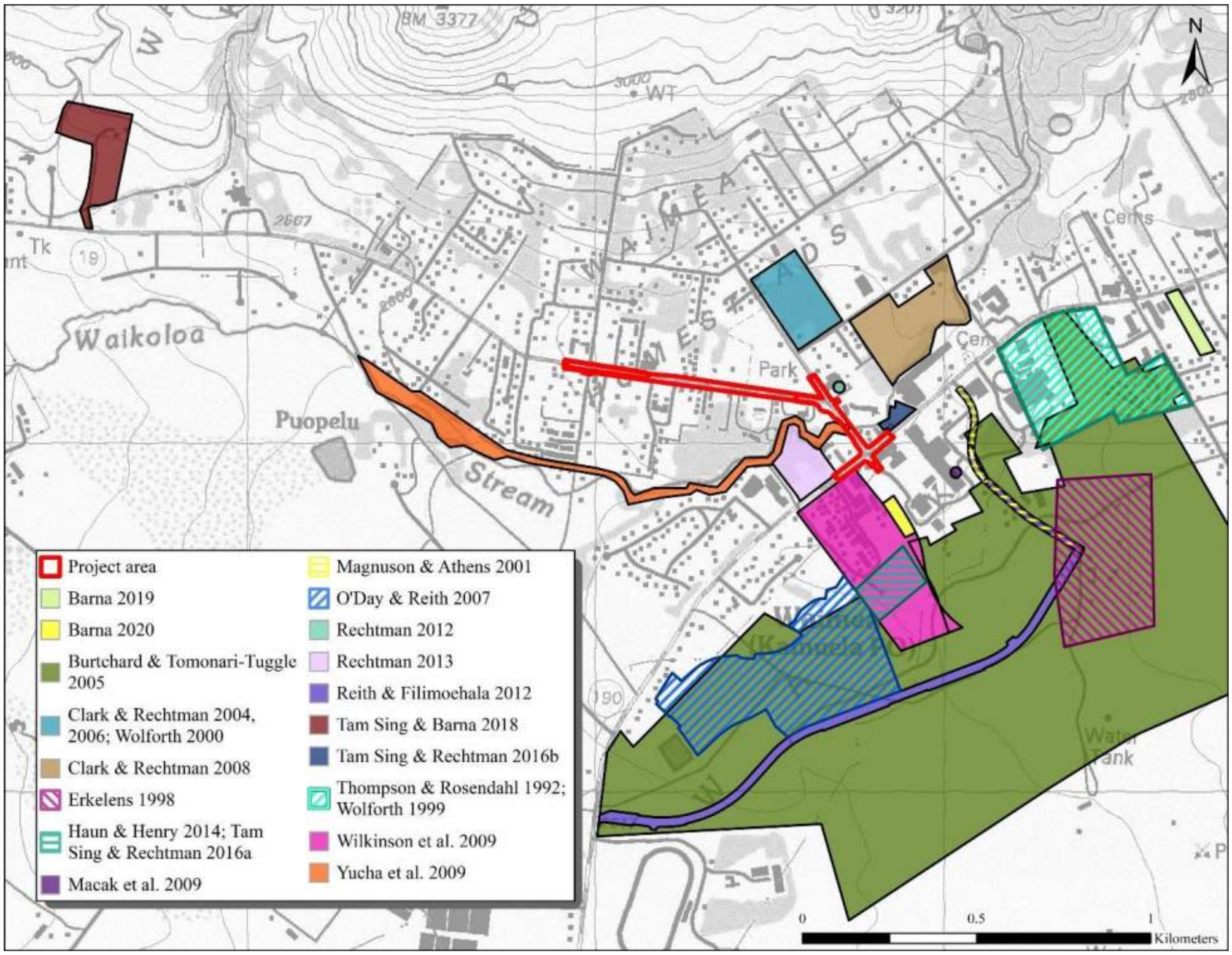


Figure 44. Previous archaeological studies conducted in the vicinity of the current project area.

In 1992, Paul H. Rosendahl, Inc. (PHRI; Thompson and Rosendahl 1992) conducted an Archaeological Inventory Survey (AIS) of seven potential locations of the North Hawai‘i Community Hospital. All of these parcels were located to the southeast of the current project area on TMKs: (3) 6-7-002:013 and 017, (3) 6-7-003:011, and (3) 6-8-001:001, and 002 (see Figure 44). Four of the parcels examined by Thompson and Rosendahl (ibid.) contained the remains of a Precontact *‘auwai* system (Site 16095), and one of the parcels contained the remains of an agricultural complex (Site 18054). Several manually excavated units were dug, however, no significant cultural material was recovered. Three backhoe trenches were also excavated, one in particular was oriented specifically to bisect one of the ditches (Ditch D) identified during the fieldwork. One radiocarbon date obtained from charcoal in the base of the *‘auwai*, which yielded a calibrated age range of A.D. 770 to 1020.

In 1996, Archaeological Research and Consulting Services, Inc. (ARCH; Erkelens 1996) conducted an archaeological reconnaissance survey of four known burial sites (the Bright Family burial site, the Duncan/Lanakila burial site, the Yutaka Pen burials, and the Pu‘ukapu Homesteads Lot burials) situated within the proposed Waimea Town Center project area and Pu‘ukapu Homesteads on TMKs: (3) 6-4-002:014 and 017 and (3) 6-4-001:042 located to the southeast of the current project area (see Figure 44). The purpose of the reconnaissance survey was to locate unmarked burials within the confines of each known burial area based on additional information supplied by lineal descendants. Erkelens (1996) did not identify any new burials associated with the known burial locations, however, he did note the location of two burial areas adjacent to the proposed Waimea Town Center project area, indicating that the burial area south of the North Hawai‘i Community Hospital was associated with the Kaanaana family. Additionally, the Kaanaana family is associated with the Duncan/Lanakila burial site (Site 19416) which was consisted of 16 individual graves within two adjacent enclosures situated within Land Grant 5977 which was awarded to Ella Duncan in 1915.

In 1998, International Archaeological Research Institute, Inc. (IARII; Erkelens 1998) conducted an archaeological survey and subsurface testing of the proposed 385-acre Waimea Town Center property for Parker Ranch, located southeast of the current project area on TMK: (3) 6-7-002 (see Figure 44). They identified five sites including three nineteenth century house lots (including two LCAw. parcels and a Grant parcel) covering an area of 26.6 acres (Site 8812), a Historic cemetery (Site 19416), and four Historic structures grouped into three sites (Sites 19417, 19418, 19419). Twenty-four backhoe trenches were excavated at the five recorded sites. The skeletal remains of two individuals and a large number of Historic artifacts were discovered during the subsurface excavations. This led the researchers to suggest that there was the likelihood of encountering more unmarked burials within the study area during ground disturbing activities and further monitoring and burial testing was recommend for the study area. The additional work did not result in any additional findings (Magnuson and Athens 2001).

During the mid-1990s, IARII also conducted data recovery investigations (Burtchard and Tomonari-Tuggle 2005) at several sites within the proposed Waimea Town Center development area located to the south of the current project area (see Figure 44). Their work was focused on gathering data on the development of the agricultural systems and associated habitations within their project area; more specifically, assessing the antiquity of irrigated fields on the Waimea plains. Burtchard and Tomonari-Tuggle (2005) concluded that while traditional agriculture may date back to the A.D. 1400s in this area, it consisted on non-irrigated fields; and the formal irrigation systems that characterize the Waimea Agricultural System are a nineteenth century development associated with commercial agriculture.

In 1999, PHRI (Wolforth 1999) conducted archaeological data recovery excavations at Site 16095 on TMK: (3) 6-7-002:013, one of the parcels investigated by Thompson and Rosendahl in 1992 east of the current project area (see Figure 44). The primary focus of the excavations was to establish a date of construction and use of the *'auwai*. The system was also mapped in detail. Based on five radiocarbon dates, pollen and macrobotanical analysis, stratigraphic contexts, and historical documentary research, Wolforth (1999) concluded that the earliest use of the *'auwai* was likely sometime after A.D. 1175, and that it continued to be used into the Historic Period.

In 2004, Rechtman Consulting, LLC conducted an AIS (Clark and Rechtman 2004) of three parcels within the Waimea Homesteads (TMKs: (3) 6-5-004:029, 030, 050), northeast of the current project area. The parcels were previously subject to a reconnaissance survey by Scientific Consultant Services, Inc. in 2000 (Wolforth 2000) (see Figure 44). As a result of the survey, a single archaeological site (Site 24168) was recorded. Site 24168 consisted of Parcel 030 (LCAw. 3674) in its entirety and included the remains of a Historic dwelling and several associated features, including a stone walkway, a concrete foundation of a small outbuilding, a stone and mortar construction that formerly anchored a post or pole, an outbuilding that possibly functioned as a bathhouse, a trash dump, and four scattered sections of an iron fence that once enclosed a Historic burial. The burial had been removed from the property and re-interred prior to the Clark and Rechtman (2004)) study. Site 24168 was awarded to Barenaba as LCAw. 3674, and likely saw nearly continuous use of the parcel from the pre-*Māhele* times until the early 1960s. The ground surface in the vicinity of the site was littered with Historic and Modern era remains.

Rechtman Consulting, LLC (Clark and Rechtman 2006b) conducted archaeological monitoring of their 2004 survey area for the proposed development of the Waimea Parkside Residential Subdivision located northeast of the current project area (see Figure 44). As a result of monitoring, a small stone concrete construction along the southern boundary of Parcel 030 that was previously concealed with soil was identified. This new feature, a koi pond, was subsequently designated as Feature H of Site 24168. Additionally, Clark and Rechtman (ibid.) recovered two adze fragments from isolated locations in the development area.

In 2007, IARII (O'Day and Rieth 2007) conducted archaeological monitoring and emergency data recovery associated with the development of Luala'i Subdivision located to the southwest of the current project area (see Figure 44). They investigated Site 21873, the remains of a mid-19th century residence previously documented by Burtchard and Tomonari-Tuggle (2005). As a result of the emergency data recovery of Site 21873, O'Day and Rieth (2007) uncovered a historic cemetery as well as several subsurface charcoal deposits associated with an *imu* and a hearth which were submitted for radiocarbon dating. Radiocarbon dating results from the hearth ranged from the 14th to the 15th century, while results from the *imu* yielded dates ranging from the late 17th century to the early 20th century.

In 2006, Rechtman Consulting, LLC (Clark and Rechtman 2006a) conducted an AIS of a roughly 13.6-acre property (TMK: (3) 6-5-004:025 and 026) located to the east of the current project area (see Figure 44). As a result of the survey, four archaeological sites were identified: Site 26680, two segments of a Historic wall; Site 26681, a Historic wall; Site 26682, an *'auwai*; and Site 26683, a Historic structure likely associated with the U.S. Military. In addition to a surface survey of the parcel, Clark and Rechtman (ibid.) excavated five mechanical backhoe trenches (BT 1-4) within their study area. While BT 1-3 were devoid of cultural material and subsurface features, the excavation of BT-4 revealed fragments of a concrete flume consistent with the approximate location of the eastern end of Site 26682, which had been previously covered by bulldozer push.

In 2009 Cultural Surveys Hawaiʻi, Inc. (CSH) conducted an AIS (Yucha et al. 2009) of portions of several parcels comprising almost 9 acres of the Waimea Trails and Greenway Project along the banks of Waikōloa Stream (TMKs: (3) 6-5-003:004 (por.), 005 (por.), 007 (por.), 044 (por.), (3) 6-6-003:006 (por.), and 013 (por.) located west of the current project area (Figure 44). As a result of the study, three sites were identified. Site 50-10-06-26871 was recorded as two remnant features (a paved roadway and a concrete stream crossing associated with WWII Camp Tarawa activities. Site 26872 was assigned to a water transport ditch known historically as the Akona ʻAuwai. Site 26873 is a relatively intact concrete stream ford and associated roadway. Sites 26871 and 26872 were determined significant under Criteria a and d, and Site 26873 was concluded to be significant under Criterion d. The concrete stream crossing of Site 26871 and Site 26872 were slated for preservation and no further work was recommended for the other features and sites. Within Lanakila Park, a stone terrace located along Waikoloa Stream was determined not to be a historic property.

In 2009, CSH monitored the placement of six large capacity septic tanks along with 47 meters of trenching on TMK: (3) 6-7-002:015 for Waimea Elementary and Middle School, located to the southwest of the current project area (see Figure 44). While they did recognize that Waimea Elementary School is on the Hawaiʻi Register of Historic Places (Site 7523), they reported that "no significant cultural materials [sic] and/or subsurface features were encountered during the monitoring work" (Wilkinson et al. 2009:ii). They further recommended that "although no cultural layers or materials were discovered during the DOE wastewater system improvements at Waimea Elementary and Middle School, in the future, if any subsurface activities are conducted on-site archaeological monitoring is recommended" (Wilkinson et al. 2009:39)..

In 2012, IARII (Rieth and Filimoehala 2012) conducted archaeological monitoring and emergency data recovery associated with the construction of the Parker Ranch Connector Road located to the south of the current project area (see Figure 44). As a result of monitoring, 126 archaeological features at sixteen sites were documented, the majority of which consisted of Precontact hearths of temporary habitation sites associated with dryland agricultural activities. Historic material was encountered which believed to either be associated with nineteenth century residences or Camp Tarawa. No burials were encountered during the fieldwork.

A 5.2-acre portion of the Waimea Elementary and Middle School campus was the subject of a subsequent AIS (Haun and Henry 2011) (see Figure 44). Historical records indicated that late nineteenth/early twentieth century land use in their project area consisted of activities relating to agriculture (sections of possible *ʻauwai*) and commercial ranching, however, no Historic Period artifacts associated with the military were encountered during the survey. Rather, the fieldwork identified two discontinuous segments of a curvilinear depression (possible *ʻauwai*) in the southern portion of the project area. Historical background research backhoe trenching indicated that portions of a small network of ditches (SIHP 50-10-06-30172) fed by larger Waikōloa-fed ditches (Lyons, Akona, and Lanakila) were present within the project area. The location of a "Branch of Lyons auwai" was tested, but no evidence of that ditch was observed. No buried cultural deposits or artifacts from the Precontact or Historic Periods were observed in any of the trenches.

In 2012, Rechtman Consulting, LLC prepared a burial site component of a preservation plan (Rechtman 2012)for Site 29368, the location of the inadvertently discovered skeletal remains of a single adolescent individual on TMK: (3) 6-5-004:027, located to the northwest of the current project area (see Figure 44). The remains were displaced during electrical trenching activities under a corner of Parker School's Theater Building. The remains were recovered from the trench, and the *in situ* portion of the skeleton was identified and documented. A decision was made in consultation with DLNR-SHPD and the Hawaiʻi Island Burial Council (HIBC) to preserve the remains in place, and to install a preservation buffer around the site extending four feet beyond the location of the remains. A sign indicating the presence of culturally sensitive resources was also to be posted at the preservation area, and the burial site location was to be maintained by Parker School.

The following year in 2013, Rechtman Consulting, LLC conducted an AIS (Rechtman 2013) of a roughly 5-acre property (TMK: (3) 6-5-003:002) for the proposed development of a commercial/retail center, located to the west of the current project area (see Figure 44). The inventory survey identified two previously documented Historic Period sites; Remnant features associated with U.S. Military Camp Tarawa (Site 26871), and remnants of the Akona *ʻAuwai* and a side branching ditch (Site 26872) initially recorded during an inventory survey by CSH in 2009 (Yucha et al. 2009). Historical evidence suggests that the Akona Ditch was constructed in 1845 to bring water to the upstart sugarcane operation at Līhuʻe to the west of the current project area, and that by the late nineteenth century was the head water for the large dendritic irrigation system that serviced the Lālāmilo fields.

In addition to a surface survey of the parcel, Rechtman Consulting, LLC Rechtman (2013) also excavated three controlled test units (TT-1, TT-2, and TT-3) and five soil percolation test trenches (PTs). Two of the three controlled test units (TT-1 and TT-2) were excavated on top of the projected course of the main ditch, and TT-3 was excavated on top of the projected course of the side branch. In all three cases, a buried *ʻauwai* feature was encountered.

In 2015, ASM Affiliates conducted an Archaeological Assessment (AA) (Tam Sing and Rechtman 2016) of a roughly 0.677-acre property for the proposed expansion of the KTA Waimea grocery store parking lot located to the east of the current project area (see Figure 44). Fieldwork for the project included a systematic 100% pedestrian survey of the surface of the project area as well as subsurface testing (mechanical trenching) at five selected locations. As a result of the fieldwork, no surface or subsurface archaeological sites or features were identified within the project area.

In 2016, ASM Affiliates conducted archaeological monitoring (Tam Sing and Rechtman 2016) of 5.5-acres for the development of the Waimea Middle School Eight Classroom Building Project on TMK: (3) 6-7-002:015 located south of the current project area (see Figure 44). As a result of monitoring activities, nine isolated Historic Period artifacts (e.g. intact and fragmented glass bottles, metal chains, pickaxe head, and a panel from a seed trough) were recovered, however no intact buried cultural deposits were identified.

In 2017, ASM Affiliates conducted archaeological monitoring (Tam Sing et al. 2017) of construction activities on 50-acres of Parker Ranch land for the development of Phase I of the Waimea District/Regional Park, located southwest of the current project area (see Figure 44). As a result of the monitoring, 119 Historic and Precontact artifacts were identified and collected, all of which derived from isolated contexts or were associated with previously identified sites. Artifact locations were identified in the access road adjacent to Ala ʻŌhiʻa Road in two distinct concentrations: Concentration 1 and Concentration 2. Artifact types identified in Concentration 1 were determined to be directly associated with a previously identified stone wall (Site 21860) and primarily consisted of nineteenth century ceramics and bottle glass and was interpreted to have been domestic refuse discarded by the former occupants of the site. Alternatively, Concentration 2 was deemed to be temporally and spatially associated with Site 8805 (Camp Tarawa) and contained artifacts dating to the A.D. 1940s. Additionally, four sets of human skeletal remains were inadvertently discovered during the course of monitoring, two of which were identified in a primary context and two which were concluded to have been secondarily deposited. Two sets of remains were preserved in place and two were relocated to a designated preservation area. Aside from the inadvertent burial discoveries, no new archaeological sites were encountered during monitoring activities.

In 2018, ASM Affiliates (Tam Sing and Barna 2018) conducted an AIS of TMK: (3) 6-5-006:005, a 9.363-acre parcel located northwest of the current project area (see Figure 44). As a result of the survey, two previously unrecorded archaeological sites were identified. The first of these, Site 30917, consisted of a remnant Historic boundary wall separating the subject parcel from four residential parcels located to the west. It consisted of two Historic (i.e., as originally constructed) segments and two modern (reconstructed in 1993) segments. The second site, Site 30918, consisted of a ditch remnant formerly utilized to water agricultural fields that were formerly located adjacent to the parcel. Tam Sing and Barna (2018) related that at least half of Site 30918's original length was removed during construction activities that occurred in 1993. Both sites were evaluated as significant under Criterion d, and it was concluded that the proposed subdivision of the subject parcel would result in "no historic properties affected."

Most recently in 2020, ASM Affiliates conducted a field inspection (Barna 2020) of TMK: (3) 6-7-002:054, a 1.127-acre property located within the Waimea Town Center located just south of the current project area to facilitate the transfer of the parcel from Parker Ranch to the Department of Education (see Figure 44). As a result of the field inspection, a highly disturbed 5.8-meter-long by 0.9 to 1.2-meter-wide and 45 to 50 centimeters deep linear depression representing a segment of the previously identified Lyon's ʻAuwai (Site 9179) was observed along the western parcel boundary. Based upon the poor condition of the *ʻauwai* remnant, it was concluded that although it was previously determined to be significant under Criterion d for its information content, it suffered from a severe loss of integrity of multiple categories. Thus, it was concluded that the proposed land transfer would result in a determination of "no historic properties affected."

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An Archaeological Inventory Survey for the Waimea Roadway Improvements Project

TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.)

Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

DRAFT VERSION

Prepared by:

Benjamin Barna, Ph.D.

and

Lauren M.U. Kepaʻa, B.A.

Prepared for:

SSFM International

99 Aupuni Street
Hilo, HI 96720

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ASM affiliates

Archaeology • History • Anthropology • Architectural History

Hilo Office: (808) 969-6066 Fax: (808) 443-0065
507-A E. Lanikaula Street, Hilo, HI 96720

Honolulu Office: (808) 439-8089 Fax: (808) 439-8087
820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 34580.00

An Archaeological Inventory Survey for the Waimea Roadway Improvements Project

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Lālāmilo Ahupuaʻa
South Kohala District
Island of Hawaiʻi

ASM affiliates

EXECUTIVE SUMMARY

At the request of SSFM International, Inc., on behalf of the State of Hawai‘i Department of Transportation (HDOT), ASM Affiliates (ASM) conducted an archaeological inventory survey (AIS) of a roughly 4.0-acre project area associated with the Waimea Roadway Improvements Project. HDOT proposes to make multimodal safety and operations improvements to existing roadways using state and local financial resources. The proposed project includes improvements to existing State-owned roadways (Lindsey Road, Kawaihae Road, and Māmalahoa Highway) in Waimea and on portions of Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, and 6-5-004:027.

The results of the literature search indicate that although the current project area was not included in the Waimea Field System field complexes defined by Clark (1983), other archaeological studies in Waimea have identified surface and subsurface archaeological sites and features associated with Hawaiian occupation of the Waimea Plain dating from the 1400s through the twentieth century, along with deposits left by ranching activity and World War II-era military activities at Camp Tarawa. Subsurface historic properties have also been identified in the vicinity of the current project area, and have included habitation sites and both Precontact and Historic period burials with little or no surface indications. The alignment of the Māmalahoa Highway (SIHP 50-10-06-30187) is included in the project area. Most of the current project area, however, consists of existing paved roads and previously disturbed portions of the right-of-way. The proposed roundabout would extend into Lanakila Park and cause ground disturbance within the boundaries of a former *kuleana* parcel (LCAw. 3479 to Olepau). The *kuleana* parcel is known to have been a *pāhale* or house lot occupied at least as early as the mid-nineteenth century, and almost certainly earlier than that. During the twentieth century this parcel was developed, gradually acquiring five buildings used for lodging and a variety of commercial activities. Two of these buildings appear to have been at least partially located within the current project area. In 1959, the buildings were demolished for the creation of Lanakila Park.

Fieldwork for the current study was conducted on March 6, 2020, and March 25, 2022. Benjamin Barna, Ph.D. (principal investigator) and Lauren M. U. Kepa‘a, B.A. conducted the fieldwork. A total of 24 person-hours were expended on the fieldwork. Pedestrian survey investigated 100% of the project area. Subsurface testing consisting of four backhoe trenches was conducted on a portion of TMK: (3) 6-5-003:005 to identify subsurface archaeological features.

During the current fieldwork, one historic property were identified on TMK:(3) 5-6-003:005. Site T-1 is a multicomponent site containing architectural and archaeological features representing two distinct periods of land use on TMK: (3) 5-6-003:005 during the twentieth century. The younger component of the site is Lanakila Park, which was constructed in 1962. The older component of the site is a buried rubbish deposit associated with residential and commercial use of the parcel between the 1920s and the 1940s. The Lanakila Park component consists of a level open grassy area with shade trees, a cemented cobblestone walkway, and a wooden covered rest area, all enclosed by a rock and concrete wall along the road and a rock wall along its southern boundary. The buried rubbish deposit contains ceramics, glass containers, household furnishings, and other items dating to the late 1930s and appear to have been discarded around 1943 when a residence on the parcel was converted into a restaurant named the Magnolia Inn. Site T-1 is assessed to be significant under Criterion d for the information yielded during the current study.

Site T-1 is located within the proposed ground disturbance for the project. Because the site has been adequately documented, it is not recommended for further historic preservation work. Therefore the recommended determination of effect for the current project is “no historic properties affected.”

With respect to the potential for additional subsurface archaeological historic properties, prior archaeological studies in the Waimea area have demonstrated that the ability to predict the locations of buried archaeological sites lacking surface features is limited. Archaeological monitoring is recommended as a precautionary identification measure within the project area.

The current study was conducted in support of environmental documentation being prepared to comply with Hawai‘i Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division’s (DLNR-SHPD) HRS Chapter 6E review of the proposed project.

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1. INTRODUCTION

At the request of SSFM International, Inc., on behalf of the State of Hawai‘i Department of Transportation (HDOT), ASM Affiliates (ASM) conducted an archaeological inventory survey (AIS) of a roughly 4.0-acre project area associated with the Waimea Roadway Improvements Project. HDOT proposes to make multimodal safety and operations improvements to existing roadways using state and local financial resources. The proposed project includes improvements to existing State-owned roadways in Waimea and on portions of Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, and 6-5-004:027 as shown in Figures 1, 2, and 3. The current study was conducted in support of environmental documentation being prepared to comply with Hawai‘i Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division’s (DLNR-SHPD) HRS Chapter 6E review of the proposed project. The current AIS was requested by DLNR-SHPD (HIRIS Project 2021PR00941, Doc. No. 2108SN11, see Appendix A) in response the receipt of a literature review and field inspection report (Kepa‘a and Barna 2020), which identified potentially significant historic properties within the project area .

HDOT Highways Division plans to implement safety and operations improvements along existing State-owned roadways in Waimea. Improvements would include installation of a roundabout at the intersection of Kawaihae Road and Lindsey Road and multimodal treatments to Kawaihae Road between Lindsey Road and Opelo Road, and also to the Māmalahoa Highway and Lindsey Road intersection. The roundabout (Figure 4) would be a 125-foot inscribed circle and would include sidewalks, bikeways, and crosswalks. The sidewalk and bikeway would be combined into a single raised sidewalk. The north leg of Lindsey Road would handle the transition into the existing travel way with Parker School’s drop-off lane. Improvements to Kawaihae Road between Lindsey Road and Opelo Road (Figure 5) would include installation of a center turn lane, sidewalks and bikeways on both sides of the road, marked crosswalks with a rectangular rapid flash beacon at Opelo Road, and a gateway feature west of Opelo Road. Recommended improvements to the Māmalahoa Highway and Lindsey Road intersection (Figure 6) include installation of raised pedestrian islands with bollards, reconfigured lanes, and bicycle facilities, as well as optimizing signal timing. The project is currently in the design phase, and the extent and depth of ground disturbance is not yet determined. Ground disturbance, however, is not expected to exceed previous ground disturbance within the State-owned right of way or within portions of adjacent parcels that will be acquired for the project.

This report contains background information describing the location and environment of the project area, a culture-historical context for the project area, a summary of the previous archaeological work conducted in the vicinity, and archaeological expectations based on the results of the background research. This is followed by an explanation of the survey methods, detailed descriptions of the encountered historic properties, along with interpretation, significance evaluations, and proposed treatment recommendations for the identified sites. Finally, a recommended determination of effect for the proposed project is presented.

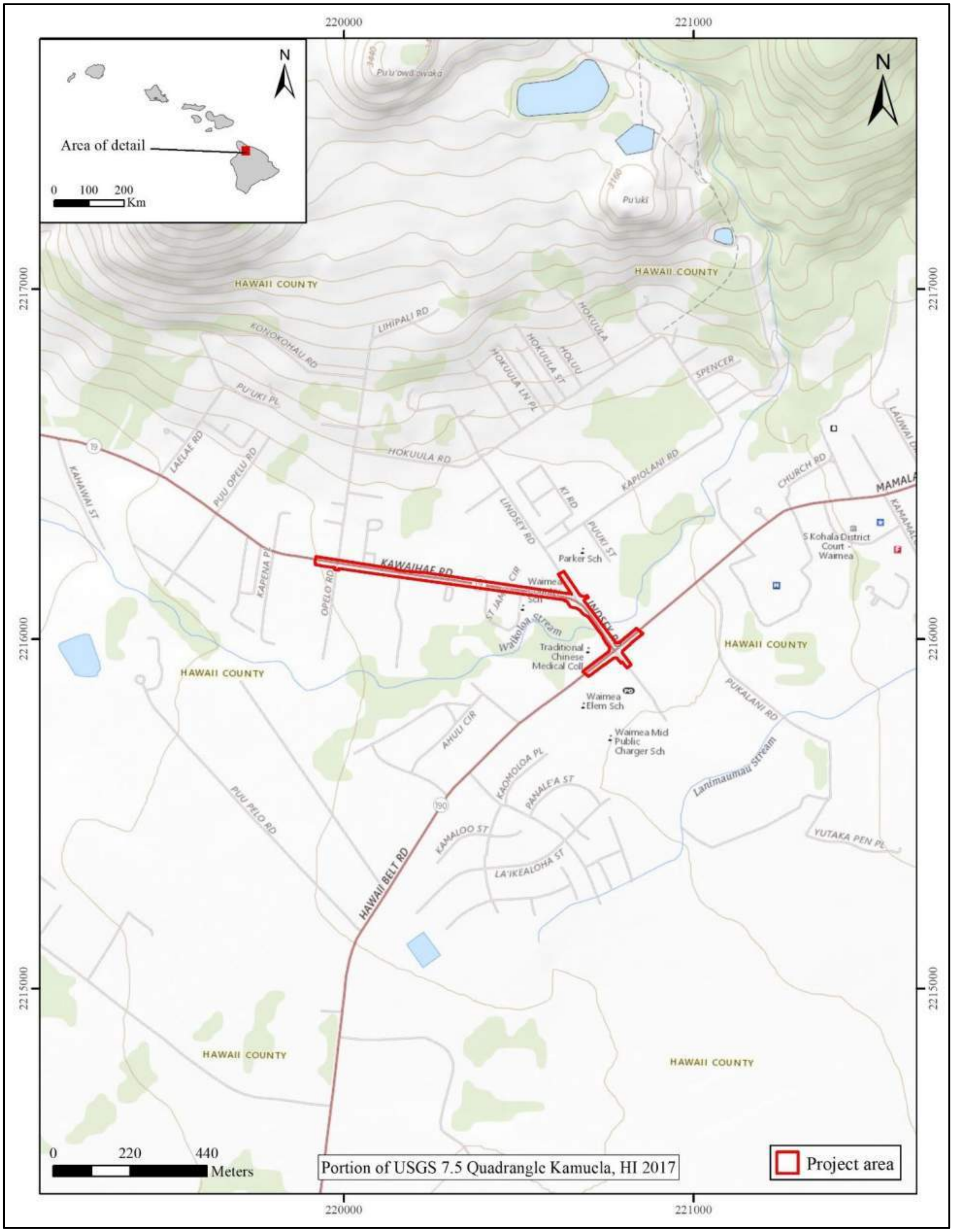


Figure 1. Project area location.

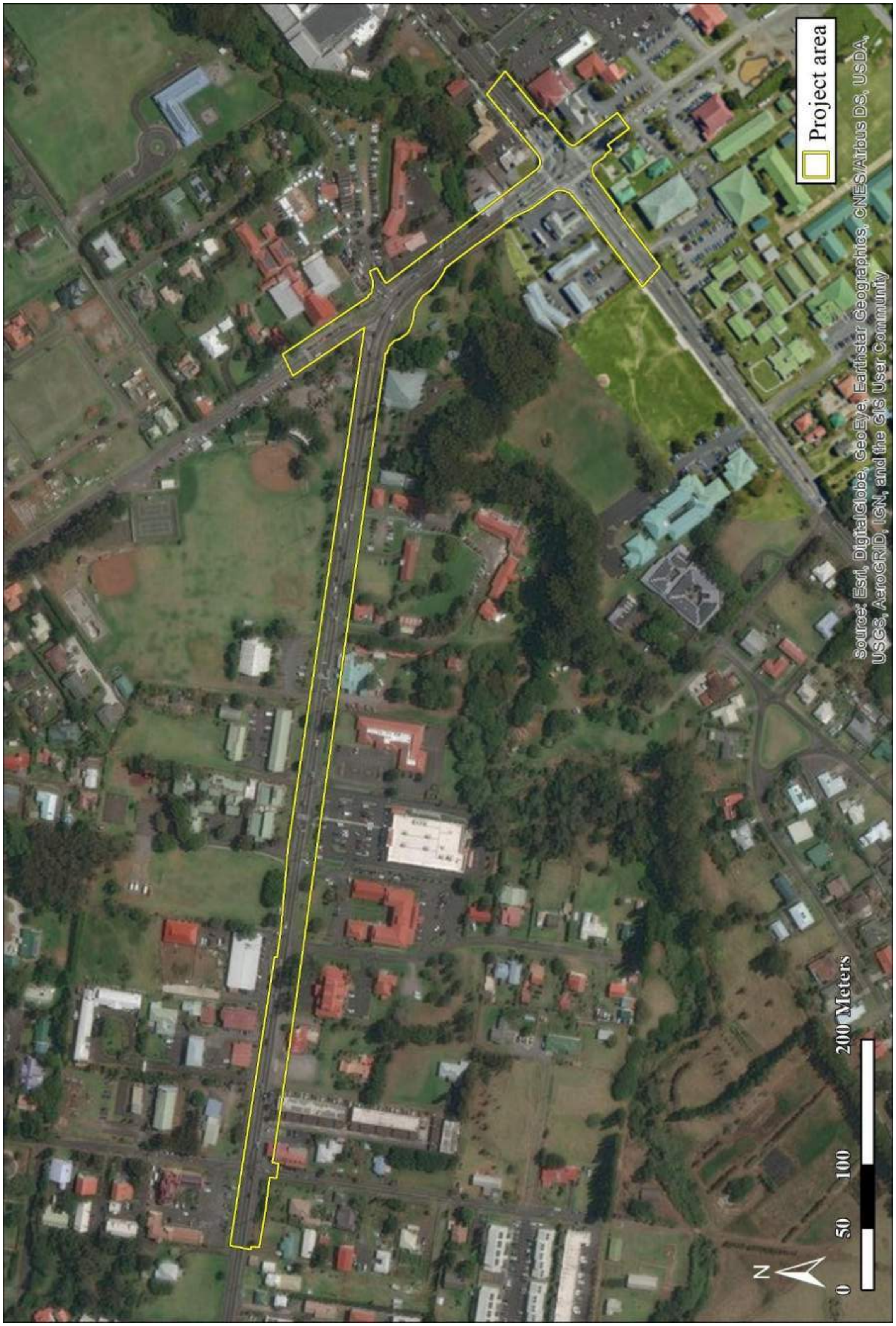


Figure 2. Recent satellite imagery of the project area and vicinity.

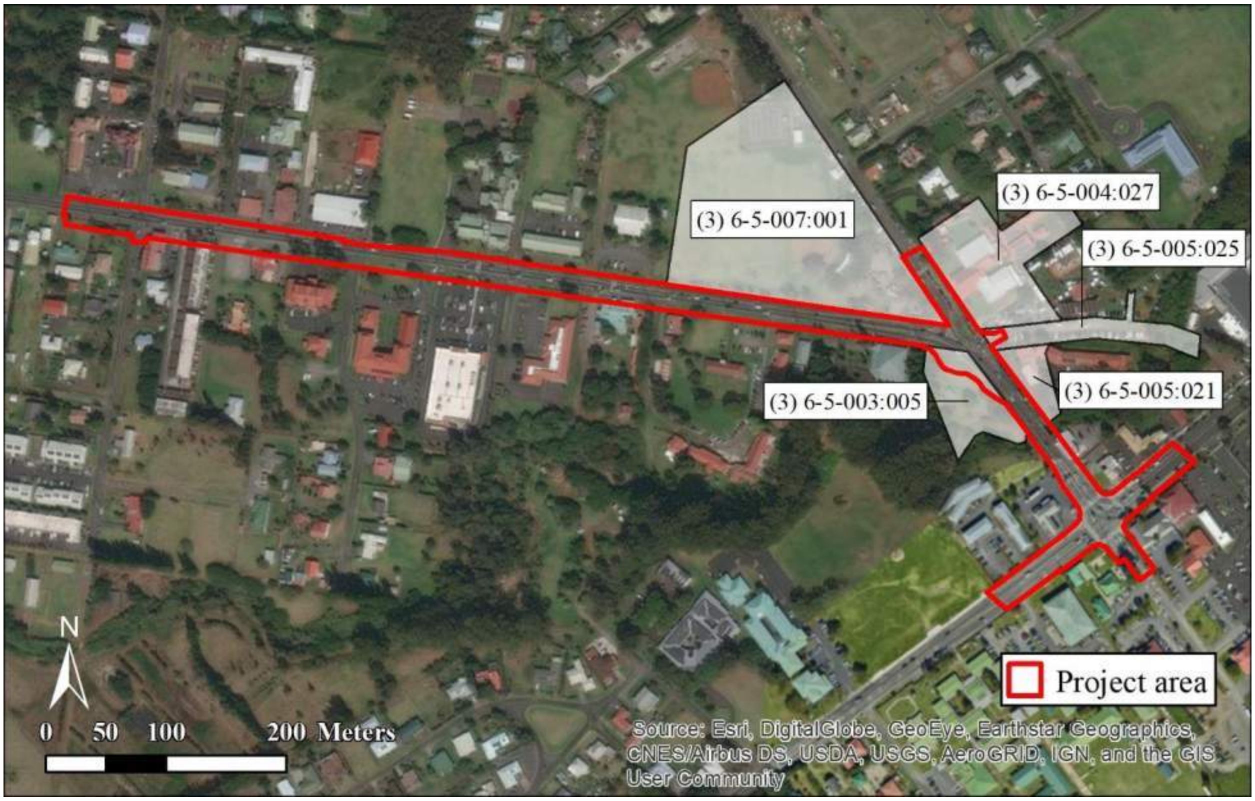


Figure 3. Tax Map Key parcels included in the current project area.

Figure 4. Kawaihae Road and Lindsey Road roundabout conceptual plan.

Figure 5. Kawaihae Road at Opelo Road conceptual plan.

Figure 6. Māmalahoa Highway and Lindsey Road conceptual plan.

PROJECT AREA DESCRIPTION

The current project area consists of approximately 4.0 acres comprising portions of the State-owned right of way for Lindsey Road, Kawaihae Road, and Māmalahoa Highway, along with portions of five TMK parcels (Table 1, see Figure 3) adjacent to the current right of way that will be acquired for the project. The project area is located at elevations ranging from 2,635 to 2,675 feet above sea level on the Waimea Plain, approximately 15.9 kilometers (9.8 miles) from the coast at Kawaihae (to the west) and 13.7 kilometers (8.6 miles) from the coast at Waipiʻo (to the northeast). Surface geology in the current project area is mapped as Hāmākua lava flows of alkali and transitional basalt (symbol Qhm in Figure 7) dating to between 64,000 and 300,000 years ago. Soils in the current project area (Figure 8) are primarily derived from a parent material of volcanic tephra formerly referred to as “Pahala Ash” (Sato et al. 1973:100). In the current USGS soil survey (Soil Survey Staff 2020), the Phase 1 portion and most of the Phase 2 portion of the project area are mapped as Waimea medial very fine sandy loam, 0 to 6 percent slopes (symbol 383 in Figure 8). The far eastern side of the Phase 2 portion of the project area are mapped as Kikoni medial silt loam, 0 to 3 percent slopes (symbol 493 in Figure 8). These soils are highly erodible, susceptible to high seepage loss, and have unstable slopes (Sato et al. 1973), which Burtchard and Tomonari-Tuggle (2005:7) note are “hardly the kind of soils that should be associated with extensive and long-term irrigation.” The climate on the Waimea Plain is generally cool and moist year-round. Mean annual temperatures range between 60 and 70 degrees Fahrenheit, with low temperatures in the winter months reaching the freezing point (Giambelluca et al. 2014). The mean annual rainfall is 833.9 millimeters (32.83 inches), with heavier rain the winter. Waikoloa stream is the prominent hydrological feature near the current project area.

The entire project area has been previously developed. The majority of it contains sixty-foot-wide asphaltic concrete (AC) paved roads. Outside of the paved travel lanes on Lindsey Road (Figures 9 through 14) and Māmalahoa Highway (Figures 15 through 19), there are concrete sidewalks for most of the project area’s length. Along Kawaihae Road (Figures 20, 21, and 22), sidewalks are not present. Instead, the road shoulder consists of asphalt or grass, depending on the adjacent parcel. A portion of the project area on Lindsey Road crosses Waikoloa Stream over Waikoloa Bridge (Figure 59), which was widened to its current configuration in the 1970s.

A portion of the project area that could contain the roundabout at the intersection of Lindsey Road and Kawaihae Road extends into Lanakila Park (Figure 24), located on TMK: (3) 6-5-003:005. Within the park, the terrain is flat, apparently graded during the landscaping. Ground cover consists of a manicured grass lawn, with native and introduced ornamental trees planted throughout the park. A concrete and rock wall surrounds the park. There is a cobble-paved walkway that crosses the park, connecting a wooden rest area and concrete benches to park entrances on Lindsey Road and Kawaihae Road.

Table 1. Tax Map Key parcels included in the project area.

TMK	*Owner(s)*	*Notes*
(3) 6-5-003:005	Parker Land Trust	Lanakila Park
(3) 6-5-007:001	State of Hawaiʻi	Waimea Park
(3) 6-5-005:021	Kanilehua Traders LLC, Owyhee Trading Company	
(3) 6-5-005:025	Parker School	
(3) 6-5-004:027	Parker School	

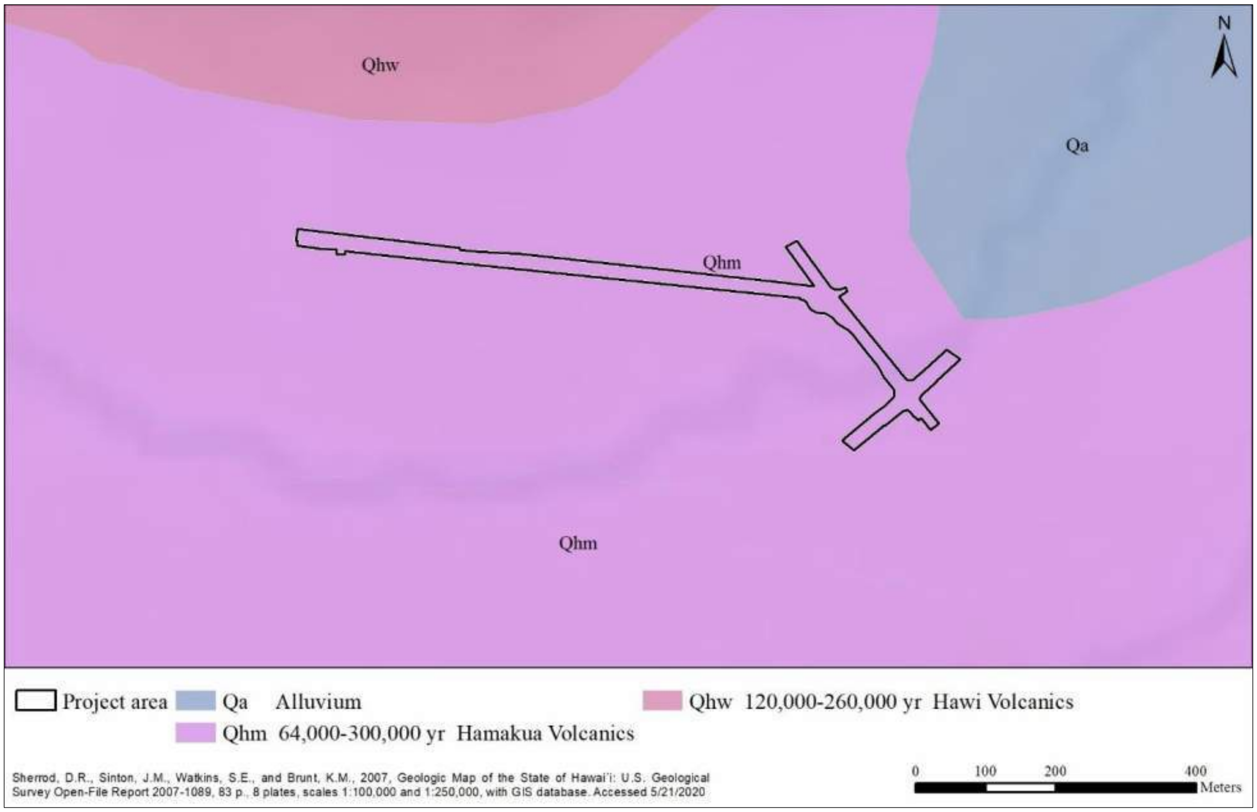


Figure 7. Geology in the current project area.

Figure 8. Soils in the current project area.

Figure 9. Lindsey Road, view to southwest adjacent to Waimea Park.

Figure 10. Kawaihae Road-Lindsey Road intersection, view to southwest adjacent to Parker School.

Figure 11. Intersection of Kawaihae Road and Lindsey Road, view to north from Lanakila Park.

Figure 12. Intersection of Kawaihae Road and Lindsey Road, view to north from Parker School.

Figure 13. Lindsey Road, view northeast toward Parker School.

Figure 14. Lindsey Road, view to southwest from Lanakila Park.

Figure 15. West-bound side of Māmalahoa Highway, view to southwest.

Figure 16. Lindsey Road at Māmalahoa Highway, view to the northwest.

Figure 17. Westbound side of Māmalahoa Highway, view to the northeast.

Figure 18. Eastbound side of Māmalahoa Highway, view to the northeast.

Figure 19. Eastbound side of Māmalahoa Highway, view to the southwest.

Figure 20. Kawaihae Road-Opelo Road intersection, view to the north.

Figure 21. Kawaihae Road-Opelo Road portion of the project area, view to west.

Figure 22. Kawaihae Road-Opelo Road portion of the project area, view to east.

Figure 23. Waikoloa Bridge, view to the south.

Figure 24. Lanakila Park adjacent to the Kawaihae Road-Lindsey Road portion of the project area, view to southwest.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the South Kohala region that includes specific information regarding the known history of Lālāmilo Ahupuaʻa and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the project area.

CULTURE-HISTORICAL CONTEXT

The project area is located on the Island of Hawaiʻi within the District of South Kohala in the *ahupuaʻa* of Lālāmilo. Lālāmilo (Lit., "milo tree branch"; Pukui et al. 1974:128) was described by Handy et al. (1991:528):

> The district of Kohala is the northernmost land area of the island of Hawaii. ʻUpolu Point, the northwesterly projection, fronts boldly out into the Alanuihaha [sic] Channel towards the southeastern coast of Maui, and is the nearest point of communication between the two islands. To the south, along Hawaii's western coast, lies Kona; to the east the rough coast of Hamakua District unprotected from the northerly winds and sea. Kohala was the chiefdom of Kamehameha the Great, and from this feudal seat he gradually extended his power to embrace the whole of the island, eventually gaining suzerainty of all the Hawaiian Islands.

Handy et al. (1991:528) further describe Kohala, and more specifically, Waimea:

> The rugged central area of the district is formed by the mountainous remains (elevation 5,505 feet) of the Kohala dome, the oldest of the island's volcanoes, now long regarded as extinct. The high table land between Mt. Kohala and the vast northern slopes of Mauna Kea, known as Waimea, has one of the finest and most salubrious mountain climates in the Hawaiian Islands, and also offers excellent grazing for cattle. In post-European times it became the seat of the Parker Ranch, one of the largest ranches in the world.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model and amended to include recent revisions offered by Kirch (2011). Re-evaluation and syntheses of genealogical, oral historical, mythological, and radiometric data by Kirch (2011) and others (Athens et al. 2014; Duarte 2012; Wilmshurst et al. 2011) have convincingly argued that Polynesians may not have arrived in the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the previously- accepted chronology alters the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, the Expansion Period to A.D. 1350 to 1650, and the Proto-Historic Period to A.D.1650-1795. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian Kahiki—were the Marquesas and Society Islands (Emory in Tatar 1982:16-18).

The Settlement Period was a time of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984, 2010). According to Fornander (1969), Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, Kanaloa, and Lono; the *kapu* system of law and order; cities of refuge; the *ʻʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Conventional wisdom suggests that the first inhabitants of Hawaiʻi Island focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Kirch 1985).

As time passed a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of the Development Period of the Hawaiian prehistory reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are ʻ*ulu maika* stones and *lei niho palaoa*. The later were status items worn by individuals of high rank, which indicates recognition of status differentiation (Kirch 1985). As population expanded in the Hawaiian Islands so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Once most of the ecologically favorable zones of the windward and coastal regions of the major islands were settled, the more marginal leeward areas were developed. Migrations to Hawaiʻi from the Marquesas and Society Islands may have continued throughout the early Settlement and Development Periods (Kirch 1985, 2012).

In the District of Kohala, the long ridge of the Kohala Mountains extends perpendicular to the predominant northeasterly trade winds, creating an orographic rainfall pattern that separates the district into two distinct environmental zones; a wetter windward zone on the eastern (Hāmākua) side, and a drier leeward zone on the western (Kona) side. The first settlers of this district likely established a few small communities near sheltered bays with access to fresh water primarily in the windward valleys and gulches. The communities would have shared extended familial relations and had an occupational focus on the collection of marine resources. Evidence for early occupation of leeward Kohala was speculated for Kapaʻanui, where Dunn and Rosendahl (1989) reported radiocarbon dates as early as A.D. 461, and from ʻAnaehoʻomalu where Barrera (1971) reported A.D. 900 as the initial date for settlement; however, these early dates should be viewed with suspicion (c.f. Kirch 2011). Other early dates from windward Kohala were reported by Cordy (2000); these sites are believed to have been utilized in the early thirteenth century. Data recovered from Māhukona, along the leeward coast of North Kohala, suggest initial occupation taking place there by about A.D. 1280 (Burgett and Rosendahl 1993:36). Permanent settlement in Kohala has been reported as early as A.D. 1300 at Koaiʻe, a coastal settlement, where subsistence primarily derived from marine resources, but was probably supplemented by small-scale agriculture as well (Tomonari-Tuggle 1988).

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period, and it was during this time that a second major migration settled in Hawaiʻi, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pāʻao settled in the islands during the 13th century. Pāʻao was the keeper of the god Kūʻkāʻilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pāʻao was expelled from his homeland in Tahiti by Lonopele. He prepared for a long voyage and set out across the ocean in search of a new land. On board Pāʻao's canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ʻāʻīpuʻupuʻu*), the chief Pilikaʻaiea (Pili) and his wife Hinaʻaukekele, Nāmauʻu o Malaia, the sister of Pāʻao, and the prophet Makuakaʻūmana. Lonopele did not let Pāʻao leave peacefully, but instead called on the cold north winds to sink his canoes; one of the winds was named "Waikōloa" (Kamakau 1991:5). There are several versions of this story that are discussed by Beckwith (1976), including the version where Moʻokini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pāʻao are said to be deposited in a burial cave in Kohala in Puʻuwepa [possibly Puʻuepa?] (Kamakau 1964:41). The Pili line's initial ruling center was likely in Kohala too, but Cartwright (1933) suggests that Pili later resided in and ruled from Waipiʻo Valley in the Hāmākua District. Ethnohistorical traditions (Fornander 1969) indicate that Waipiʻo Valley was associated with at least nine successive Pili line rulers of Hawaiʻi Island, from Kahaʻimoeleʻa to ʻUmi (from roughly A.D. 1460 to 1620).

Heiau construction flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and evidence suggests that substantial changes were made to the political system as well. Within Kohala, for example, the Great Wall complex at Koaiʻe is organized with certain platforms in the complex physically separated from contemporaneous features. Griffin et al. (1971) interpret these separate spaces as symbolizing class stratification.

The period from A.D. 1300–1500 was characterized by population growth as well as expanded efforts to intensify upland agriculture. Rosendahl (1972) has proposed that settlement in leeward Kohala at this time was related to seasonal, recurrent occupation, and that coastal sites were occupied in the summer to exploit marine resources, while upland sites were being occupied during the winter months with a primary focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976:118). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupuaʻa* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation to permanent dispersed occupation of both coastal and upland areas.

According to Kirch's (1985) model, the concept of the *ahupuaʻa* was established sometime during the A.D. 1400s, adding another component to an already well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa* or lesser chiefs, who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupuaʻa* generally speaking, are wedge-shaped subdivisions of land that radiate out from the center of the island, typically extending from the mountain into the sea. Their boundaries are often defined by the topography of the land and its geological features. In these land units the native tenants tended fields and cultivated crops necessary to sustain their families, and the chiefly communities with which they were associated. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people (*maka‘āinana*), who lived in a given *ahupua‘a* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment, and supplying the needs of the *ali‘i* (see Kamakau 1992; Malo 1951).

Entire *ahupua‘a*, or smaller portions of the land called *‘ili* were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali‘i-‘ai-ahupua‘a* (chief who controlled the *ahupua‘a* resources). The *ali‘i-‘ai-ahupua‘a* in turn answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* and *‘ohana* who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). The *ahupua‘a* were further divided into smaller sections such as the *‘ili ‘āina, mo‘o ‘āina, paukū ‘āina, kīhāpai, kō‘ele, hakuone*, and *kuakua* (Hommon 1986; Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mō‘ī* (king).

In ancient times, Lālāmilo was an *‘ili* of the *kalana* (or *‘okana*) of Waimea. A *kalana* was treated as a sub-district: smaller than a district (*moku o loko*), but composed of several other land divisions, such as *ahupua‘a* and the more independent *‘ili kūpono*, all of which contributed to its wealth (Maly and Maly 2002). The lands subject to the *kalana* of Waimea were those that form the southern limits of the present-day South Kohala District including ‘Ōuli, Wai‘aka, Lālāmilo, Puakō, Kalāhuipua‘a, ‘Anaeho‘omalu, Kanakanaka, Ala‘ōhi‘a, Paulama, Pu‘ukalani (Pukalani), Pu‘ukapu, and Waikōloa (Figure). In ancient times, Lālāmilo was referred to as Waikōloa Iki, and the neighboring area of Waikōloa was referred to as Waikōloa Nui (Maly 1999). Bernice Judd, a former librarian at the Hawaiian Mission Children’s society, explains that:

> In the early days Waimea meant all the plateau between the Kohala Mountains and Mauna Kea, inland from Kawaihae. This area is from eight to ten miles long and from three to five miles wide. There was no running water on Mauna Kea, so the inhabitants lived at the base of the Kohala Mountains, where three streams touched the plain on their way towards the sea… (Judd 1932:14)

With respect to the Precontact use of the general project area within the various land divisions of Waimea, Clark (1987) offered a regional settlement pattern model that includes four elevationally delimited environmental zones. The Coastal Zone extends up to about 150 feet elevation, and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops and was a locus for the collection of wild floral and faunal resources. The current project area, situated at elevations ranging from 2,635 to 2,675 feet, is perhaps at the interface of Clark’s (1987) Kula and Wilderness Zones.

Ultimately the increased upland population resulted in the creation of the Waimea Field System at elevations ranging from roughly 2,460 to 2,950 feet (750 and 900 meters) above sea level. At these elevations, located in Clark’s (1987) Kula Zone, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Clark (1983) identified four field complexes (Figure 59) in the Waimea area, each containing an extensive network of fields fed by a system of irrigation ditches that drew water from the Waikoloa and Kahakohau Streams. Kirch (1985:231) surmises that the fields were perhaps intermittently irrigated with “simple furrows” that were used to “direct water across the sloping field surfaces.” Recent modelling of water flow in a portion of Field Complex 3 (located west of the current project area) by McIvor and Ladefoged (2018) suggests that intermittent irrigation there may have been used to grow a variety of crops. In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, bananas, sugarcane, coconuts, and *hala* (Haun et al. 2003). According to Barrère (1983:27), “the cultivating places at Waimea were first expanded to supply the chiefs’ needs while sojourned there and at Kawaihae”. The closest documented portion of the Waimea Field System to the current project area is Field Complex 4, which extends south of Māmalahoa Highway between the Parker Ranch racetrack and the Pu‘ukapu Homesteads. This complex contains spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along Waikōloa Stream at the eastern margins of the system (Burtchard and Tomonari-Tuggle 2005).

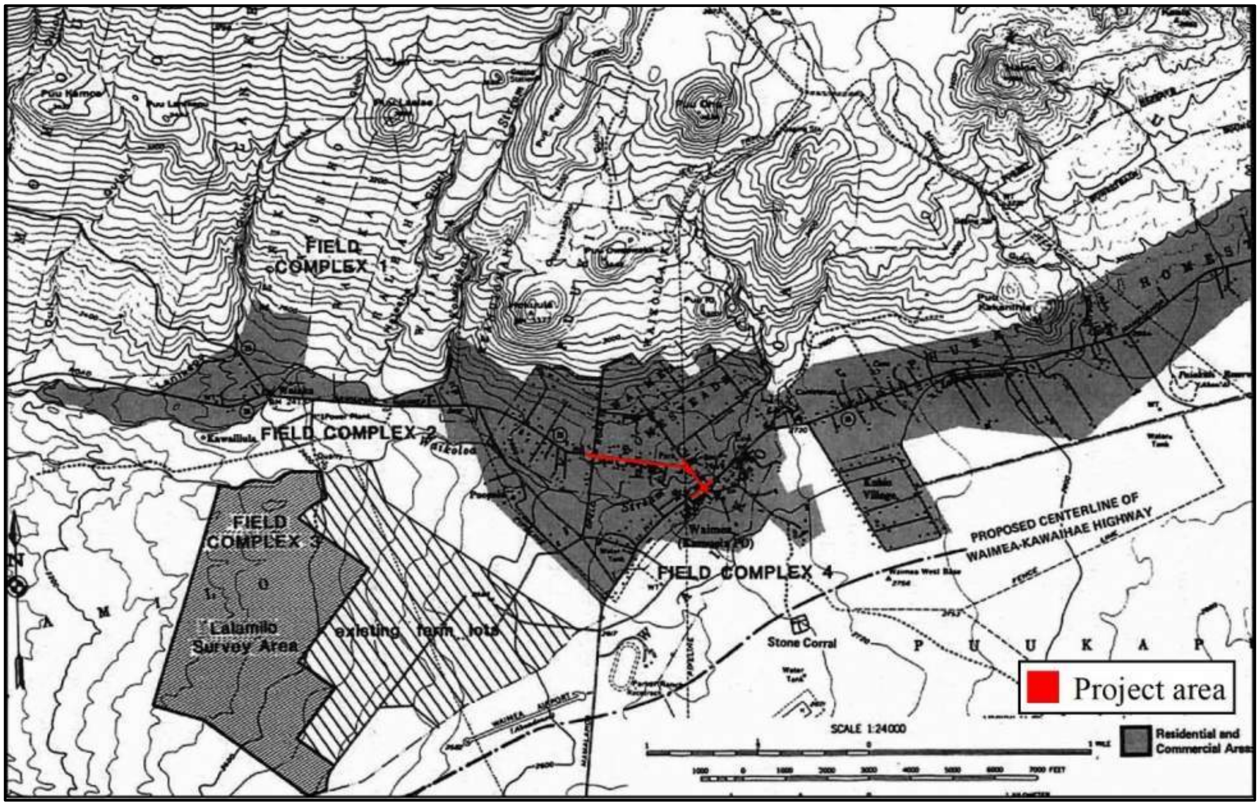


Figure 25. Waimea Field System complexes identified by Clark and Kirch (1983).

By the seventeenth century, large areas of Hawai‘i Island (*moku āina* – districts) were controlled by a few powerful *ali‘i ‘ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ‘Umi a Līloa, a renowned *ali‘i* of the Pili line who ruled from Waipi‘o Valley, is often credited with uniting the island of Hawai‘i under one rule (Cordy 1994). According to Kamakau (1992) ‘Umi was a skilled fisherman, and fishing for *aku*, his favorite fish, often brought him to the beaches of South Kohala from Kalāhuipua‘a to Makaula, where he also fished for *‘ahi* and *kala* with many other famed fishermen and all the chiefs of the kingdom. ‘Umi’s reign lasted until around A.D. 1620, and was followed by the rule of his son, Keawenui a ‘Umi, and then his grandson, Lonoikamakahiki.

During the time of Lonoikamakahiki’s rule, several battles were fought in the general vicinity of the project area. One such battle took place between the army of Lonoikamakahiki and that of his older brother, Kanaloakua‘ana, who rebelled against him. According to Fornander (1880:120–121), Lonoikamakahiki clashed with his brother’s forces at ‘Anaeho‘omalu and then pursued them northward to Kaunaoa between Puakō and Kawaihae, where they fought again. Kanaloakua‘ana then fled inland but was met again by Lonoikamakahiki’s army at Nakikiainihau, Pu‘u Pā (on the Waimea Plain southwest of the current project area), and at Pu‘ukoholā, each time suffering defeat but managing to retreat. Lonikamakahiki’s army continued to chase the rebel forces, forcing three more skirmishes before finally conquering and slaying their last remnant at Pololū.

Fornander (1916–1917) also records a series of attacks against Lonoikamakahiki by Kamalālāwalu, the *ali‘i nui* of Maui. These battles began along the South Kohala coastline, but culminated in a massive fight on the Waimea Plain. Kamalālāwalu and his army, upon the advice of two advisors named Kauhipaewa and Kihapaewa, proceeded to Hōkū‘ula in Waimea, just north of the current project area. Kamalālāwalu anticipated an easy victory thanks to the intelligence provided by hist two advisors, but unbeknownst to him, Kauhipaewa and Kihapaewa were actually Lonoikamakahiki’s allies who had infiltrated the Maui chief’s camp and gained his trust. Upon awakening the next morning, Kamalālāwalu was stunned to discover that the black lava near the coast had turned red with warriors from all of Hawai‘i Island, who marched through the night and “covered the whole of the grassy plain of Waimea like locusts” (Kamakau 1961:58). As Fornander (1916-1917:229) recounts,

> that night and including the following morning the Kona men arrived and were assigned to occupy a position from Puupa to Haleapala. The Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia [Puukakanihia], while those of Kohala guarded from Momoualoa to Waihaka."

Seeing that he was surrounded and outnumbered, Kamalālāwalu met with Lonoikamakahiki to avoid the coming battle, but Lonoikamakahiki, enraged at the manner in which his ally Kanaloakuaʻana had been slain earlier in the invasion, denied him. Kamalālāwalu general Makakuikalani positioned his men and was met by Lono's warrior, Puapuakea at Waikakanilua and Puʻuʻoaʻoaka:

> The battle of Puoaoaka [Puʻuoaoaka] was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger for the slinging of stones that would fall like raindrops from the sky. The stones would fall about with a force like lightening, breaking the bones into pieces and causing sudden death as if by bullets.
>
> Maui almost won in the first battle because of Hawaii's lack of a strong champion. Maka-ku-i-ka-lani [representing Maui] was first on the field and defied any man on Hawaii to match strength with him. Maka-ku-i-ka-lani tore Hawaii's champion apart. When Puapua-kea arrived later by way of Mauna Kea, those of Hawaii rejoiced at having their champion. Maka-ku-i-ka-lani and Puapua-kea matched their strength in club fighting on the battle site before the two sides plunged into the fight. (Kamakau 1961:58-59)

Puapuakea was the eventual victor of this fight, and once Maui's champion had been killed,

> the two sides began to fight. Short and long spears were flung, and death took its toll on both sides. The Maui men who were used to slinging shiny, water-worn stones grabbed up the stones of Puʻoaʻoaka [sic]. A cloud of dust rose to the sky and twisted about like smoke, but the lava rocks were light, and few of the Hawaii men were killed by them. This was one of the things that helped to destroy the warriors of Kama-lala-walu: They went away out on the plain where the strong fighters were unable to find water. (Kamakau 1961:59-60)

The warriors of Maui were put to flight, retreating to the coast, where Kamalālāwalu and nearly all of the invaders, with the exception of his son Kauhiakama, were executed (Kamakau 1961:60).

During the eighteenth century, Waimea became the home of Alapaʻinui, the son of a former Kona war chief, who eventually reigned over the entire island (Kamakau 1961). Alapaʻinui invaded Hawaiʻi Island from Maui, where he had been living since the death of his father. His first victories were against the chiefs of Kona and Kohala, and from there he later gained control of the Hilo and Kaʻū Districts. After gaining control of the Island, Alapaʻinui is said to have lived in Waimea for a time:

> Alapaʻi dwelt in Hilo for a year and then went to live in Waipiʻo. Shortly after, he and the chiefs moved to Waimea and others went by canoe to Kawaihae. From Waimea, he went to Lanimaomao, where he fell ill. (Kamakau 1961:77)

At Lanimaomao, Alapaʻinui appointed his son Keaweʻōpala to be ruler over the islands. Many of the chiefs who had been deprived of their lands by Alapaʻinui battled against Keaweʻōpala (Kamakau 1961). It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupuaʻa* of Kokoiki, near the Moʻokini Heiau (Kamakau 1961). There is some controversy about the year of his birth. Kamakau (1961:67-68) places it on a stormy night in the month of Ikuwa of 1736, but based on several lines of evidence, Makemson (1936) places it during Makaliʻi in 1758. Kalaniʻōpuʻu, one of the hereditary heirs to the land of Hawaiʻi, defeated Keaweʻōpala in South Kona and became the ruler of Hawaiʻi Island. Kalaniʻōpuʻu's reign was marked by near-constant warfare as he invaded Maui and defended himself from rebellions by Maui and Hawaiʻi *aliʻi* (Kamakau 1961). In A.D. 1775 Kalaniʻōpuʻu and his forces from Hāna, Maui, raided and destroyed the neighboring district of Kaupō, and then launched several more raids on Molokaʻi, Lānaʻi, Kahoʻolawe, and parts of West Maui. It was at the battle of Kalaeokaʻilio that Kamehameha, a favorite of Kalaniʻōpuʻu, was first recognized as a great warrior and given the name of Paiʻea (hard-shelled crab) by the Maui chiefs and warriors. During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi. Kalaniʻōpuʻu was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

The Arrival of Captain Cook and the Reign of Kamehameha I

The arrival of foreigners in the Hawaiian Islands marked the beginning of drastic changes in Hawaiʻi's culture and economy. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas due to war and disease, yet increase in others, with relatively little change in material culture. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with foreign ships. There was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983).

Captain James Cook and his crew on board the ships the H.M.S. Resolution and Discovery first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniʻōpuʻu, who was still at war with Kahekili, visited Cook on board the Resolution off the East coast of Maui. Kamehameha observed this meeting but chose not to participate (Jarves 1847). The expedition did not explore inland to Waimea, but while sailing up the Kohala coast, Lt. King recorded his observations of that part of the countryside:

> Koaara [Kohala] extends from the Westernmost point to the Northern extremity of the island; the whole coast between them forming an extensive bay, called Toe-yah-yah [Kawaihae], which is bounded to the North by two very conspicuous hills. Toward the bottom of this bay there is foul, corally ground, extending upward of a mile from the shore, without which the soundings are regular, with good anchorage, in twenty fathoms. The country, as far as the eye could reach, seemed fruitful and well inhabited, the soil being in appearance of the same kind with the district of Kaoo [Kaʻū]; but no fresh water is to be got here. (King 1784:106)

After the death of Captain Cook at Kealakekua and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1961). While he was living in Kona, famine struck the district. Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. While in Kohala, Kalaniʻōpuʻu proclaimed that his son Kiwalaʻō would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication Kalaniʻōpuʻu set out for Hilo to quell a rebellion by a Puna chief named ʻĪmakakoloʻa.

In 1790, John Young and Isaac Davis, sailors on board the ships *Eleanora* and *Fair American*, which were trading in Hawaiian waters, were detained by Kamehameha I and made his advisors. The story of their detention begins when the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui] as retribution for the theft of a skiff and the murder of one of the sailors. The *Eleanora* then sailed to Hawaiʻi Island, where John Young went ashore and was detained by Kamehameha's warriors. The other vessel, the *Fair American,* was captured off the Kona coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1961). Kamehameha, with the aid of Young and Davis and their knowledge of the newly acquired foreign arms, then succeeded in conquering all the island kingdoms except Kauaʻi by 1796. It wasn't until 1810, when Kaumualiʻi of Kauaʻi gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically, initially through deforestation from the collection of sandalwood and then by the introduction of cattle to these lands (Rechtman and Prasad 2006). In 1792, Captain George Vancouver, who had sailed with Cook during his 1778-1779 voyages, arrived at Kealakekua Bay with a small fleet of British ships, where he met with Kamehameha. Vancouver stayed only a few days on this first visit, but returned again in 1793 and 1794 to take on supplies. Vancouver introduced cattle to the Island of Hawaiʻi at Kealakekua during these latter two visits, giving them as gifts to Kamehameha I, who immediately made the cattle *kapu*, thus preventing them from being killed (Kamakau 1961; Vancouver 1984). Some of the offspring of these animals escaped the initial attempts to contain them (Barrère 1983; Bowser 1880; Henke 1929) and spread throughout Kohala, Kona, and the saddle region. In agricultural areas, they wrought havoc on crops and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes.

Hawaiʻi's culture and economy continued to change drastically during Kamehameha's rule as capitalism and industry established a firm foothold in the Islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810.

Kamehameha, who resided on the Island of O‘ahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food and fish (Kamakau 1961). This new burden added to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau Kamakau (1961:204) indicates that, “this rush of labor to the mountains brought about a scarcity of cultivated food … The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ‘Ama‘u, or Hapu‘u, from the wild plants resorted to.” Once Kamehameha realized that his people were suffering, he “declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land” (Kamakau 1961:202). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua-Kona, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but also continued to enforce the rigid *kapu* system.

When Kamehameha I died on May 8, 1819, however, the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha’s death, a period of *‘ai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered (Kamakau 1961). Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu, and rather than re-establish the *kapu*,

> Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief’s tabu and the freeing of the eating tabu. The *kahu* said to the chief, “Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!” and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali‘i consented to the free eating and it was accepted on Kauai (Kamakau 1961:225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstituted the eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kūkā‘ilimoku, was dismayed by his cousin’s (Liholiho) actions and revolted against him, but was defeated.

With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai‘i to Kaua‘i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. By December of 1819, Kamehameha II had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *‘aumakua* worship, to continue (Kamakau 1961; Oliver 1961). With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawai‘i. They arrived in Kailua-Kona on March 30, 1820, to a society with a religious void to fill. Many of the *ali‘i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopted their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the demands of the *ali‘i* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali‘i* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai‘i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, the missionary William Ellis described Waimea as a fertile, well-watered land “capable of sustaining many thousands of inhabitants” (Ellis 1831:399). The population was concentrated in three villages, Keaalii, Waikoloa, and Pu‘ukapu, each located where major streams reached the plain (Figure 26). Ellis notes that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. In the time since Kamehameha I’s death, the harvesting of sandalwood had once again been forced upon the *maka‘āinana*. During his travels along the coast of Kohala, Ellis noted that most of the villages were empty as the men of the region had been ordered to the mountains by the King to collect sandalwood. He wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young… Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 1831:396–397)

Taro was one of the foods that the Waimea lands were known for. Dry taro was planted along the lower slopes of the Kohala Mountains on the Waimea side, and on the plains south and west of the town (Handy et al. 1991:532). On his second visit to Waimea town, William Ellis (1831:354) made the following observation:

> The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants. About noon they [Messrs. Bishop and Goodrich] reached the valley of Waimea, lying at the foot of Mouna-Kea [sic], on the north-west side. Here a number of villages appeared on each side of the path, surrounded with plantations, in which plantains, sugar-cane, and taro were seen growing unusually large.

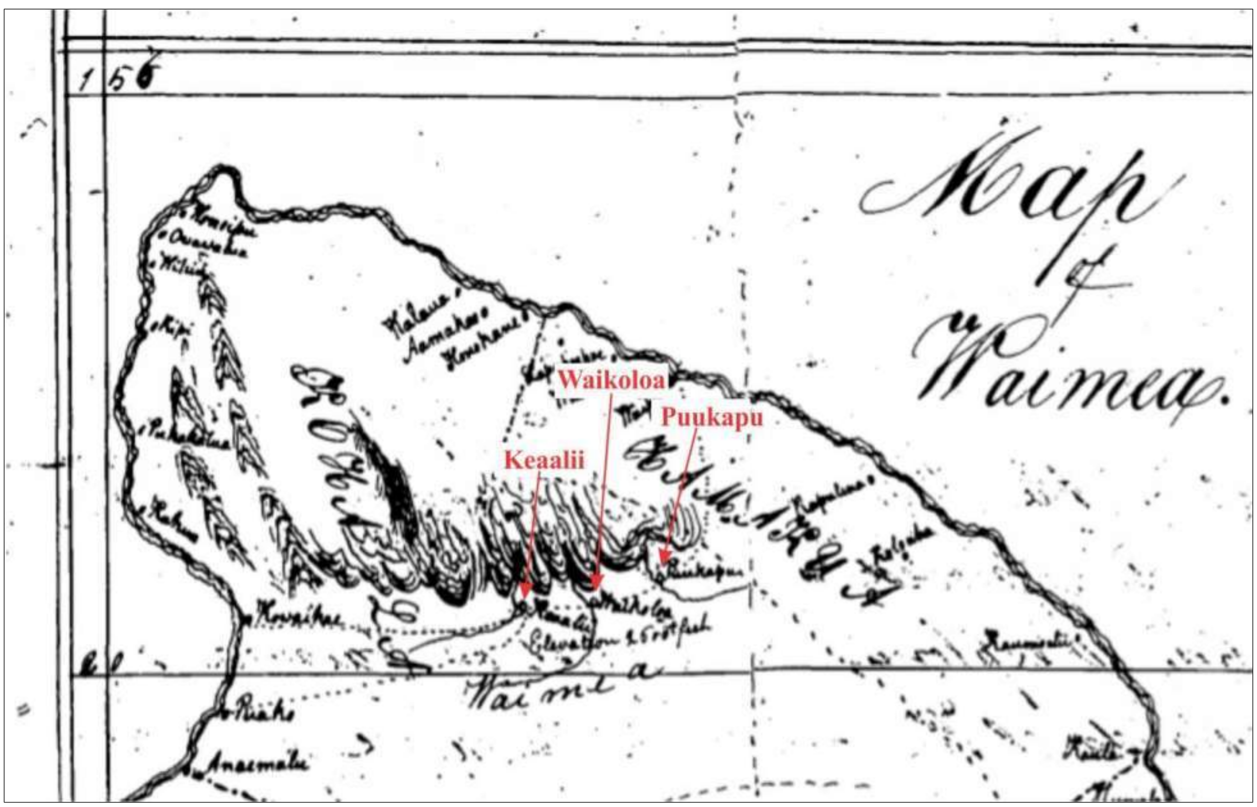


Figure 26. Portion of a Map of Waimea ca. 1830 (after Andrews et al. 1830).

The Early Development of Cattle Ranching in Waimea

Ellis (1831:402) describes a journey by one of his travelling companions to Mauna Kea, and the early use of the herds of cattle that were by that time roaming the mountain side:

> Although there are immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the native vessels. But this is attended with great labour and expense. They first carry all the salt to the mountains. When they have killed the animals, the flesh is cut off their bones, salted immediately, and afterwards put into small barrels, which are brought on men's shoulders ten to fifteen miles to the sea-shore.

In 1822 John P. Parker, originally of Newton, Massachusetts, was one of the early foreigners granted permission to hunt bullock for the crown (Brennan 1974). The wild cattle were often captured in bullock pits seven to eight feet long by four feet deep that were covered over with sticks and a thin layer of dirt; they were also hunted with guns, and in later years, after the arrival of *vaqueros* from Central and South America, lassoed from horses (Frost and Frost 1977; Wilkes 1845). By about 1830 Parker, would go on to found Parker Ranch, which would eventually grow to become the largest cattle ranch on the island (Henke 1929). In that same year, the appointed governor of Hawai‘i Island, Kuakini, moved to the town of Waimea (Figure 27) to oversee and improve on the government cattle industry. He ordered the construction of corrals and had a twelve mile stretch of trail between Waimea and Kawaihae widened (Escott 2008). The 1835 missionary census lists 6,175 people living in Kohala and another 1,396 people, including 500 men, 510 women, and 386 children, living in Waimea (Schmitt 1977). Despite the eventual prominence of ranching in Waimea, at the time Lorenzo (Lyons 1837:1) reported that "The beef establishment has lost some of its charms; & the attention of the people is more directed to the cultivation of the soil - a great portion of Waimea is being surrounded by a stone wall – to form an extensive garden from which all graminivorous animals are to be excluded & which is to be cultivated by the people for their own benefit as well as that of the chiefs." Foreigners appear to have been somewhat transient during this period, as Lyons (1841:13–14) notes:

> There was a time when the foreign population numbered about 70 - & their children 30. But the number has considerably diminished & it is always fluctuating - sometimes more & sometimes less. They belong to 6 or 7 different nations & are variously employed – beefcatchers - sugar manufacturers - shoemakers, merchants - tanners - lawyers - blacksmiths - -combmakers - masons - doctors - saddlers - farmers & what not.

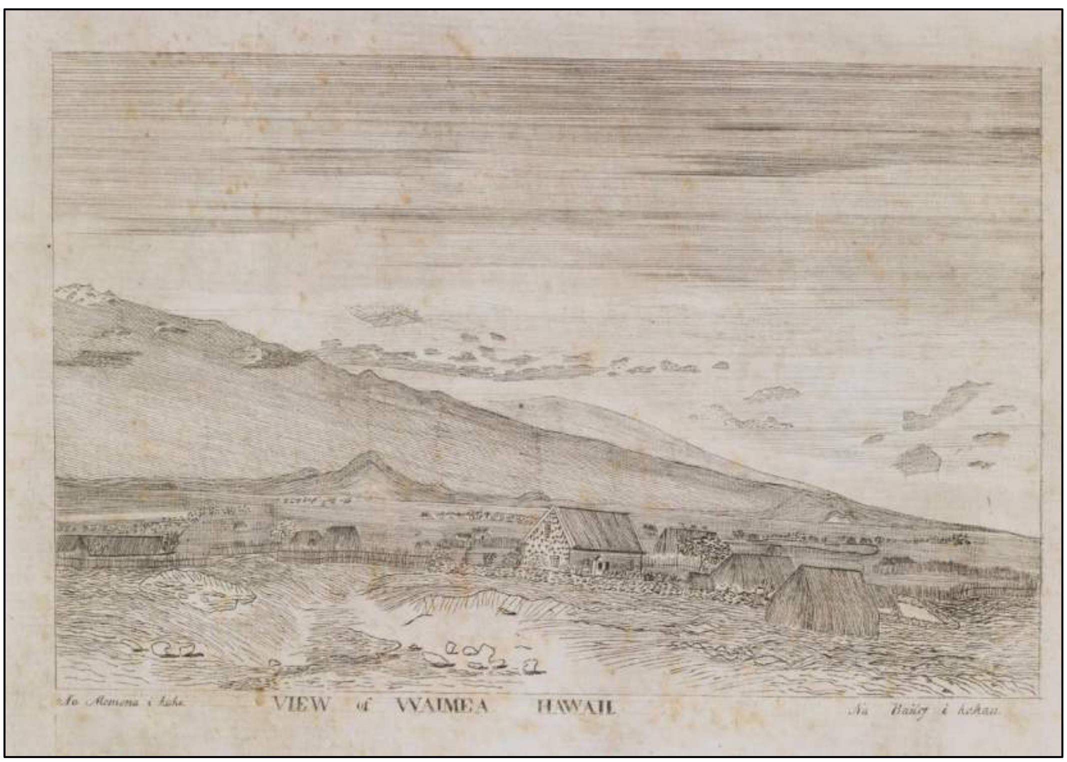


Figure 27. "View of Waimea Hawaii" circa 1840 (Hawai‘i Mission Houses Museum).

By 1840, bullock hunting had drastically reduced the population of wild cattle on Hawai‘i Island, so much so that a five year *kapu* was placed on hunting them solely for their hides and tallow (Bergin 2004). This led to further efforts to tame, brand, fence, and herd privately owned cattle (Wilkes 1845). For a while, agricultural products from Waimea replenished the cargo ships at Kawaihae Harbor, and in the late 1840s many of the potatoes grown in the Waimea area were shipped to California to help feed the gold rush (Haun et al. 2003), but the decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, ultimately led to a period of economic hardship and population decline in the Waimea area (Escott 2008).

At about this time, a Honolulu merchant named William French constructed his residence, currently known as the historic Spencer House, at Pu‘uloa to the northeast of the Lindsey Road-Māmalahoa Highway portion of the current project area. French operated a store in Kawaihae and another, a “thatched hut” at Pu‘uloa where he “employed a saddle-maker and operated a tannery” under the management of Parker, who “kept busy supervising this operation and collecting beef tallow, and leather to supply the needs of French’s growing business” (Wellmon 1973:50). Despite a lack of money in Waimea at the time, store did well for both French and Parker, as Wellmon (1973:50-51)

> There was no surplus of currency in Waimea at this time, and most of the business at the Puuloa store consisted of bartering for goods and services. Long-term credit and buying on time was the rule rather than the exception in these transactions. . . French supplied Parker with different goods in exchange for his services and produce. Parker used these goods himself or exchanged them with those who worked for French and those who paid the store in money or goods.

Francis Allyn Olmsted (1841:230), an American author, journeyed to Waimea in 1840 and described French’s storefront and the colorful *vaqueros* and bullock hunters who frequented the store:

> About eight o’clock, we came up with a collection of thatched houses, towards the principal of one which we directed our steps, which was a store belonging to Mr. French of Honolulu. Here a novel scene presented itself to us. In front of the door, a bright fire was blazing in a cavity in the earthern floor, displaying in strong light the dark features of the natives congregated around it in their grotesque attitudes. Immediately back of these, a group of fine looking men, in a peculiar costume, were leaning against the counter of the store. Some of them were Spaniards from California, and they were all attired in the poncho, an oblong blanket of various brilliant colors, having a hole in the middle through which the head is thrust. The pantaloons are open from the knee downwards on the outside seam. A pair of boots armed with prodigiously long spurs completed their costume. They were bullock hunters, employed in capturing the wild bullocks that roam the mountains, and had just returned from an expedition of eight or ten days, in which they had been very successful.

Travel in and out of Waimea during this period was accomplished by one of four main roads (Figure 28), which connected the town to Kohala, Kawaihae, Hāmākua, and Parker’s residence at Mānā. As the decade wore on, however, the population of Kohala began a rapid decline, and settlement patterns changed significantly. Leeward inhabitants relocated to the wetter windward slopes of North Kohala and the Waimea plain, abandoning their agriculturally marginal areas in favor of wetter sugarcane lands more productive farmland. According to (Tomonari-Tuggle 1988:author-year), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. (Tomonari-Tuggle 1988:33) clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali‘i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment.

These population shifts were accompanied by an overall decline in the number of people living in Kohala. Contemporary observers and modern scholars (see Burtchard and Tomonari-Tuggle 2005) offer several explanations, including the decline of the whaling industry, a *kapu* on killing wild cattle (Wilkes 1845), dissatisfaction with William Beckley’s appointment as *konohiki* (Doyle 1953), and disease (HSA 1848), and epidemics that raged through the islands in 1848 and 1849. The population reduction in Waimea as documented by missionaries was tremendous, as the Rev. Lorenzo Lyons expressed, “if the decrease of local people continues the same, how many years before they are all dead, without any left?” (Schmitt 1973:29). Similarly, an 1848 description of the Waimea population cited by McEldowney (1983:432) laments that “it can scarcely be said that there is any native population at all.”

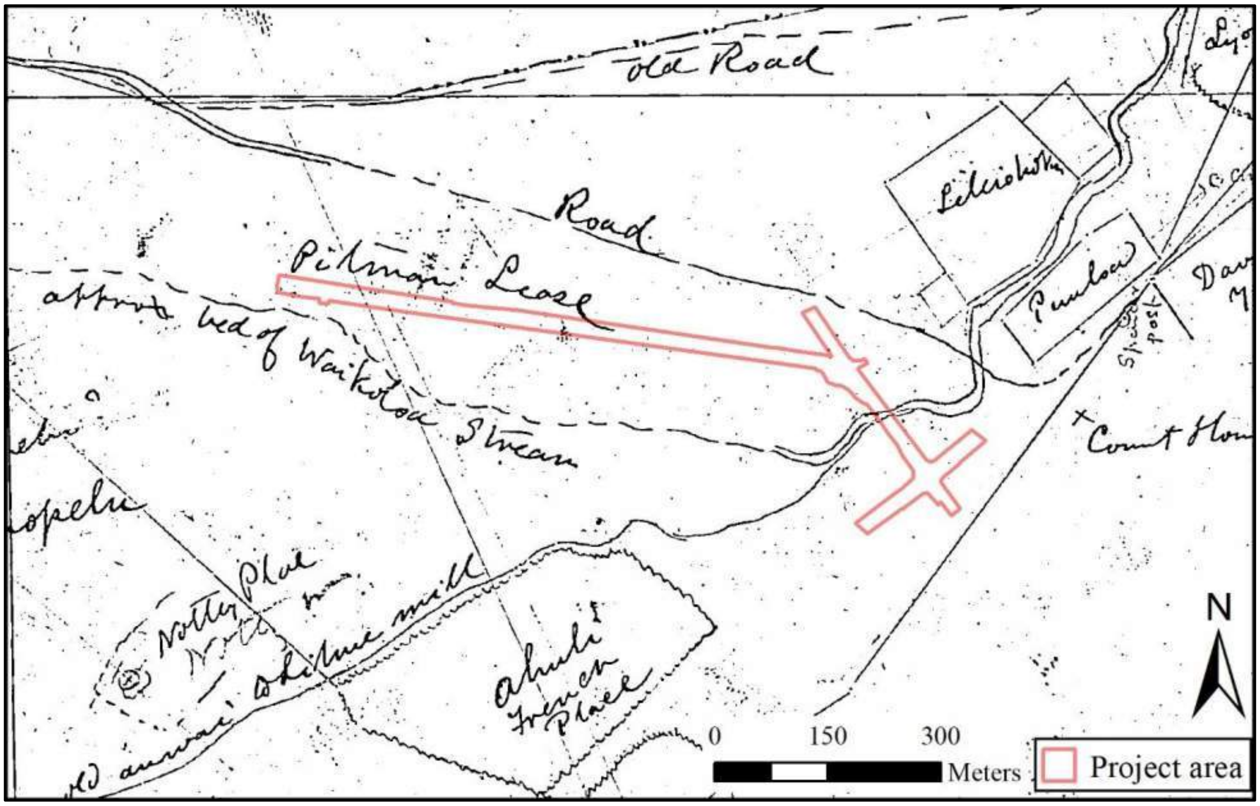


Figure 28. Detail of Registered Map 673 Part 1 showing roads exiting Waimea ca. 1887 –note “approximate” location of Waikoloa Stream (Wall and Lyons 1887).

The Legacy of the *Māhele ʻĀina* of 1848

In 1848, the Hawaiian system of land tenure was radically altered by the *Māhele ʻĀina*. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. As a result of the *Māhele*, all land in the Kingdom of Hawaiʻi came to be placed in one of three categories: (a) Crown Lands (for the occupant of the throne); (b) Government Lands; and (c) *Konohiki* Lands (Chinen 1958:vii; 1961:13). All lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission. Laws in the period of the *Māhele* record that ownership rights to all lands in the kingdom were “subject to the rights of the native tenants;” those individuals who lived on the land and worked it for their subsistence and the welfare of the chiefs. During the *Māhele* Kamehameha III retained Waimea as personal property (Crown Lands), and as a result, the detailed information about previous land use and cultural history that can be found in documents created during the *Māhele* is limited for much of Waimea.

The disposition and distribution of *Konohiki* Lands in and around Waimea Town, however, was a complicated issue and a matter of much testimony and debate among Commissioners, *kamaʻāina* informants, and land petitioners. To further complicate the issue, some of the land units within the *kalana* of Waimea were considered *ahupuaʻa* and others *ʻili kūpono.* As a result of the *Māhele* testimony and the Boundary Commission Testimony, many smaller *ahupuaʻa* names were dropped and the relatively independent *ʻili kūpono* were given *ahupuaʻa* status, and except for a portion of the Waikōloa *ahupuaʻa* (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. Almost all of the smaller *ʻili ʻāina* located on the southern slope of Kohala Mountain became Government Land, with two exceptions. The lands of Waiaka 1 and 2, located west of Waiauia, were retained by M. Kamaikui (LCAw. 8516-B:1) and G. Lahilahi (LCAw. 8520-B:2), respectively. Two *ʻili* given to Lunalilo (Pauahi and Lanikepu) were relinquished to the Government, and the rest, including Waiauia and the neighboring lands of Haleaha and Puʻu Ki, and the large *ahupuaʻa* of Lālāmilo, in which the current project area is located, also became government land. Which of the *aliʻi* relinquished these lands were not recorded in the Māhele Book (Soehren 2005).

To preserve the rights of tenants on the land, a program was set up through which they could apply for title to the land where they lived and worked. These awards are referred to as *kuleana,* using the Hawaiian term to describe the relationship of rights and responsibilities held among tenant, *konohiki*, and the land. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848, to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two year term, and the deadline was extended several times, not for new claims, but for the Land Commission to finish its work (Maly 2002) the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenant's rights to the land and its resources, and also the process by which they could apply for, and be granted fee-simple interest in their *kuleana*. The volumes of native registry and testimony collected for the *kuleana* claims provide a snapshot of life in Hawai'i during the middle part of the nineteenth century. Information recorded in these volumes contains the names of smaller land divisions (*'ili*, *mo'o*, etc.) within the *ahupua'a*, ties individual claimants and their families to specific locations within those land divisions, provides background information about when and from whom, the claimants received their lands, and gives accounts of the land use at that time.

Over 140 claims for *kuleana* were made by native tenants within the Waimea area. Nearly all of these claims were for house lots or cultivated sections (Haun et al. 2003). Seventeen *kuleana* were claimed within Lālāmilo (Haun et al. 2003). Four located at the coast (listed as within Puakō) were not awarded, but thirteen in the uplands were. The current project area includes one of these *kuleana* parcels, and likely encroaches on another (Figure 59). LCAw. 3785 as awarded to Olepau on February 11, 1851. The award consisted of a 0.42-acre house lot located at what is now the intersection of Lindsey Road and Kawaihae Road, within Lanakila Park. Olepau's *pāhale* contained two houses. William Beckley, the *konohiki* of Waimea, provided testimony on September 16, 1848. in support of Olepau's claim:

> Hoohikiia o W. Bakle Aolelo maila. Ua ike no au aia i ka ili aina i Kanakanaka, he Pahale, ua paa i ka pa, elua hale maloko, owau wale no na palena a puni, nou aku no kona, ua lohe au he mahikahiki 1848 noi mai oia ieiu, ae aku ou au nona ia wahi, me ku'u keakea ole aku. (Native Testimony Volume 4:40)

Translated into English, the testimony reads:

> <u>W. Bakle </u>[William Beckley] sworn and stated. I have seen in the ili land at Kanakanaka a house-lot which has been enclosed, with two houses in it. The surrounding boundaries are mine only and his [Olepau] interest is from me. I had heard that was an old land belonging to him and when he had asked me in 1848, I consented to let him have that place without any objections.

Land Commission Award 3915 is located adjacent to the east side of Lindsey Road, north of Waikoloa Stream (see Figure 59). This parcel was awarded to Nahoena in 1877, and consisted of a house lot encompassing 6 5/100 acres. According to Native Testimony (Volume 4:9), the awarded parcel was one of three *'apana* claimed.

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite this stated goal, the program provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands, and during the middle to late 1800s Western businessmen established a number of diverse industries on these newly available lands. Letters written at the time of the *Māhele* indicate that by 1848 George Davis Hū'eu had already established a cattle corral, a goat corral, and house lots on lands adjacent to his roughly 95,000-acre Waikōloa award (Maly and Maly 2002). By 1848, John Palmer Parker, founder of the Parker Ranch, had received two acres of land at Mānā where he built a family house and the first ranch buildings (Bergin 2004). In 1850 he purchased 640 acres surrounding the Mānā lands, and in 1851 he purchased another 1,000 acres. The next year, Kamehameha III granted Parker a lease on the lands of Waikōloa (presumably Lālāmilo and neighboring lands to the north and east), some of which would eventually be deeded to the ranch by outright purchase. By the middle of the decade, Parker had turned most of the day-to-day operations of Parker Ranch over to his son, John Palmer Parker II. When John Palmer Parker, died on August 20, 1868, the ranch controlled about 47,000 acres of land in the region (Bergin 2004). These lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr.

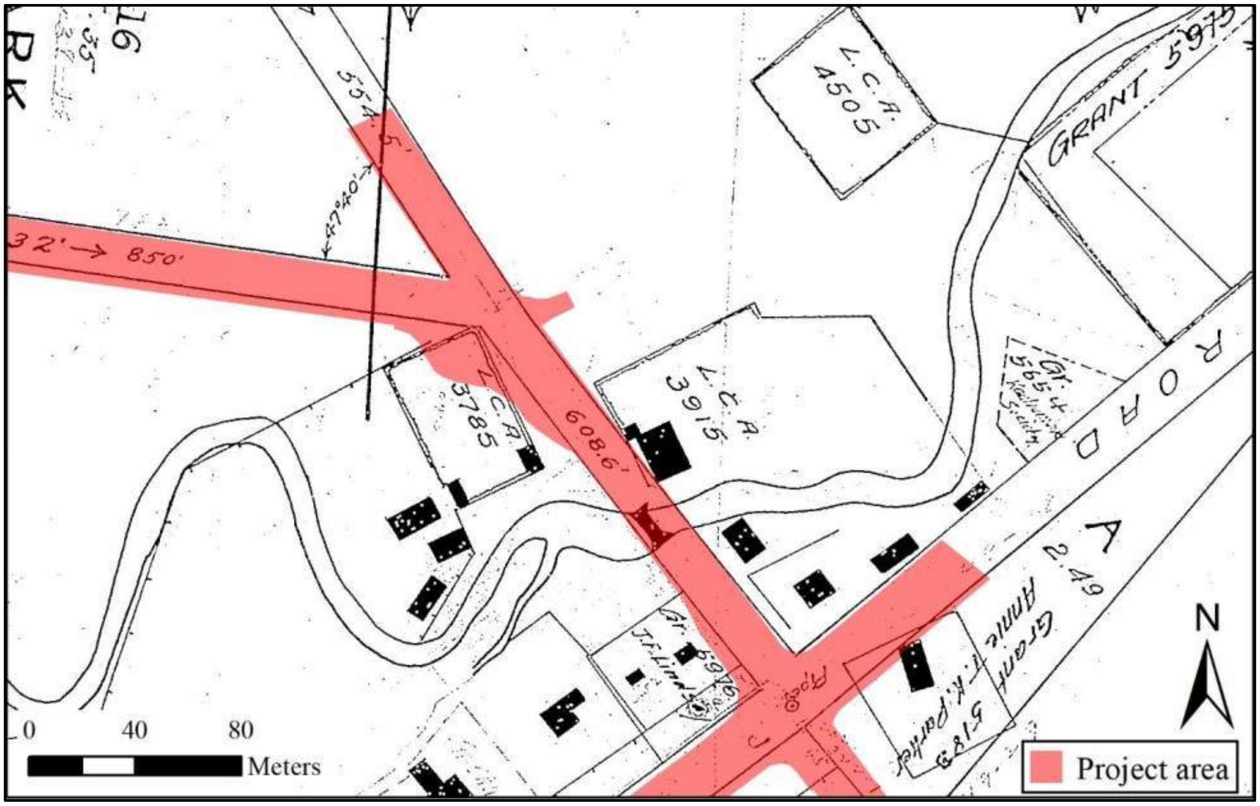


Figure 29. Portion of Registered Map 2470 with LCAw. parcels indicated near the current project area (Rowell and Taylor 1908).

The decades following the *Māhele* of 1848 were characterized by a growing detraction from traditional subsistence activities as the population along the Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up by the burgeoning ranching industry. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements or into dispersed upland habitations where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect their homes and gardens from cattle and other free-ranging animals, but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. The economy also transitioned, becoming cash based and taxes were collected. Foreigners controlled much of the land and most of the businesses, and the native population was largely dependent on these foreigners for food and money (Haun et al. 2003). The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region (McEldowney 1983). Parker Ranch continued to expand their operations in the Waimea area throughout the 1870s and 80s, eventually acquiring the lease to roughly 95,000 acres of Waikōloa that had formerly belonged to the Waimea Agricultural and Grazing Company. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship new managers were brought in to oversee the day-to-day operations at the ranch.

By the early 1900s, the Parker Ranch headquarters were located near what is now the corner of Lindsey Road and Māmalahoa Highway, in the same building as the old store, post office, and restaurant (Maly and Maly 2005). At this time, Parker Ranch was under the direction of Alfred W. Carter, who had been chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. By this time Parker Ranch was operating on several large leased parcels, but the fee simple holdings amounted to only 34,000 acres (Bergin 2004). Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. In 1903, with only a short period left on its lease, Carter acquired nine-tenths interest in the Waikōloa lands from Ms. Lucy Peabody for $112,000, securing important grazing lands for the ranch (ibid.). Soon thereafter, Carter purchased the adjacent lands of ʻŌuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines *makai* of Waimea Town. He also acquired the Puʻuloa Sheep and Stock Company, encompassing over 3,700 acres and including the Keʻāmuku Sheep station in Waikōloa, which he converted to cattle ranching over the next decade. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humuʻula, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

The Waimea Homesteads

Commercial agriculture was enabled by land tenure changes that were implemented after the overthrow of the Monarchy in 1893. Article 95 of the Republic's constitution expropriated the Crown lands from the deposed Queen, and the 1895 Land Act reclassified Crown lands and Government lands into a single category of "Public Lands." This act repealed much of the previous land-related laws, and made some Public Lands available to citizens of the Republic through homestead leases, right of purchase leases, and cash freehold agreements. Between the overthrow and Annexation, 46,594 acres of former Crown Lands were sold by the government (Van Dyke 2008).

In 1908, the Waimea Homesteads (to the north and east of the current project area) were created by the Territory of Hawaiʻi and sold as grants for house lots (Figure 30). Kawaihae Road was straightened and incorporated into the homestead lots, and Opelo Road was laid out about 600 meters southwest of Lindsey Road. Blocks 4, 5, and 6 of the homesteads are located adjacent to the Kawaihae Road-Opelo Road portion of the current project area. At the time that these lots were created, two houses were present on the LCAw. 3785 parcel, one in the southeast corner and one in the southwest corner, outside the current project area (see Figure 30). I

Not long after in 1914, Alfred W. Carter, on behalf of Parker Ranch, filed a petition against the Territory of Hawaiʻi and sixty-two other individuals over the appurtenant water rights to Waikōloa Stream for the purposes of irrigation (Haun et al. 2003). Carter, in an effort to protect the ranch's water-rights, claimed that the Territory had wrongly diverted waters from the stream in 1905 when they dammed it and ran pipes to Waimea Village, lessening the flow of water to the Parker Ranch lands in Waikōloa, Lālāmilo, and ʻŌuli. While the courts ruled that the Territory of Hawaiʻi was the legal owner of the waters of the stream, they also decided that the residents of the *ahupuaʻa* had the right to use such water for domestic purposes. These purposes included watering livestock and irrigation gardens. Testimony in this case was extensive and indicated that from time immemorial Waikōloa Stream had been tapped by a number of ditches or *ʻauwai*, and that the inhabitants of the area relied heavily on the water from Waikōloa Stream for the continued traditional existence. The stream's significant role in the traditional lifestyle of Waimea natives is evident in the *Māhele* records with the prevalence of house lots and houses in the areas surrounding Waikōloa Stream and in the vicinity of the current project area.

The firsthand accounts provided in the testimonies of the residents of the lands describe the Waikōloa Stream *ʻauwai* system and turn of the century agricultural practices in the Waikōloa-Lālāmilo area (Haun et al. 2003). All surplus of the stream waters beyond that needed for domestic use was granted to Carter and the Parker Ranch as landowners. A map of Waimea prepared in 1914 and 1915 (Hawaiʻi Registered Map No. 2576) illustrates the *ʻauwai* network in the greater Waikōloa, Lālāmilo and Puʻukapu areas (Figure 31). While Registered Map No. 2576 shows that these ditches are located south of the current project area, it also includes the names of individuals who purchased Waimea Homestead lots in the vicinity of Opelo Road, many of whom were members of the Lindsey family. Around this same time, as can be seen on the 1916 USGS Waipio quadrangle, a house was added near the center of the LCAw. 3785 parcel—this appears to be the house that would later become the Magnolia Inn during World War II. In addition to the sale of the Waimea Homestead lots on the western side of the project area, a small government-owned lot sandwiched between the LCAw. 3785 parcel and Lindsey Road was sold Land Grant 7224 to Mrs. Minnie Lonohiwa on March 26, 1919 for $66.50 (Rivenburgh 1917).

With the Parker Ranch water rights understood, Carter began improving the ranch's range management practices by adding fence lines for controlled grazing and an improved water distribution system (Bergin 2004). Weed control measures, including the mechanical clearing of pasture and the planting of new grasses for better forage, were also implemented. Throughout the first quarter of the twentieth century, Waimea town remained fairly small, as depicted on an aerial photograph taken in 1925 (Figure 32). In a detail of this photograph (Figure 33), five buildings on the LCAw. 3785 parcel are labeled: (1) a main dwelling, (2) and (3) Parker Ranch cowboy houses, (4) an outhouse and storage building, and (5) a small dwelling identified in later tax records as a photograph studio. By 1932 and 1946, when Carter finalized the acquisition of Kohala Ranch Co. in North Kohala, Parker Ranch had grown to include roughly 327,000 acres of fee lands (Bergin 2004).

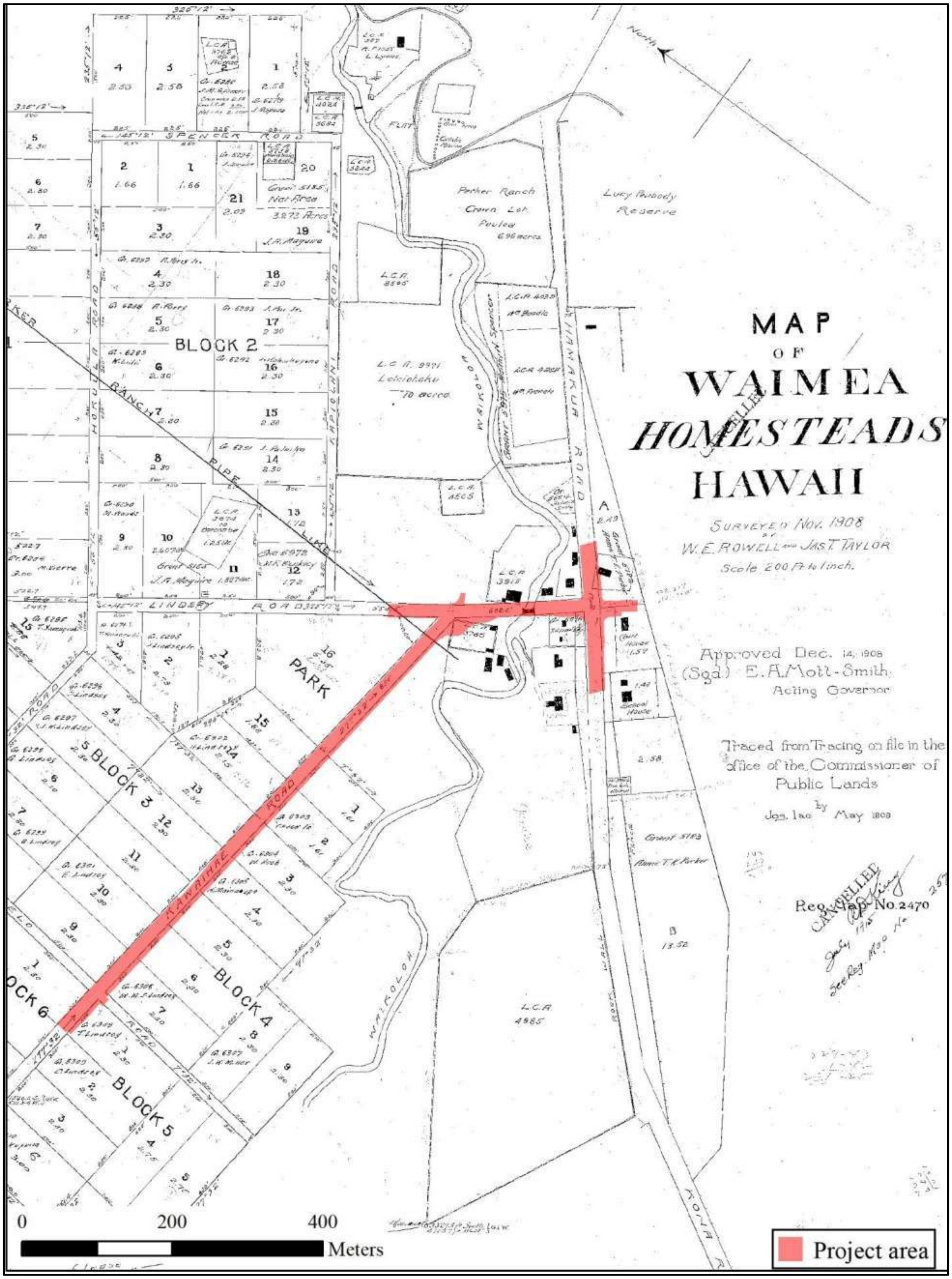


Figure 30. Portion of Registered Map 2470 showing homestead lots (Rowell and Taylor 1908).

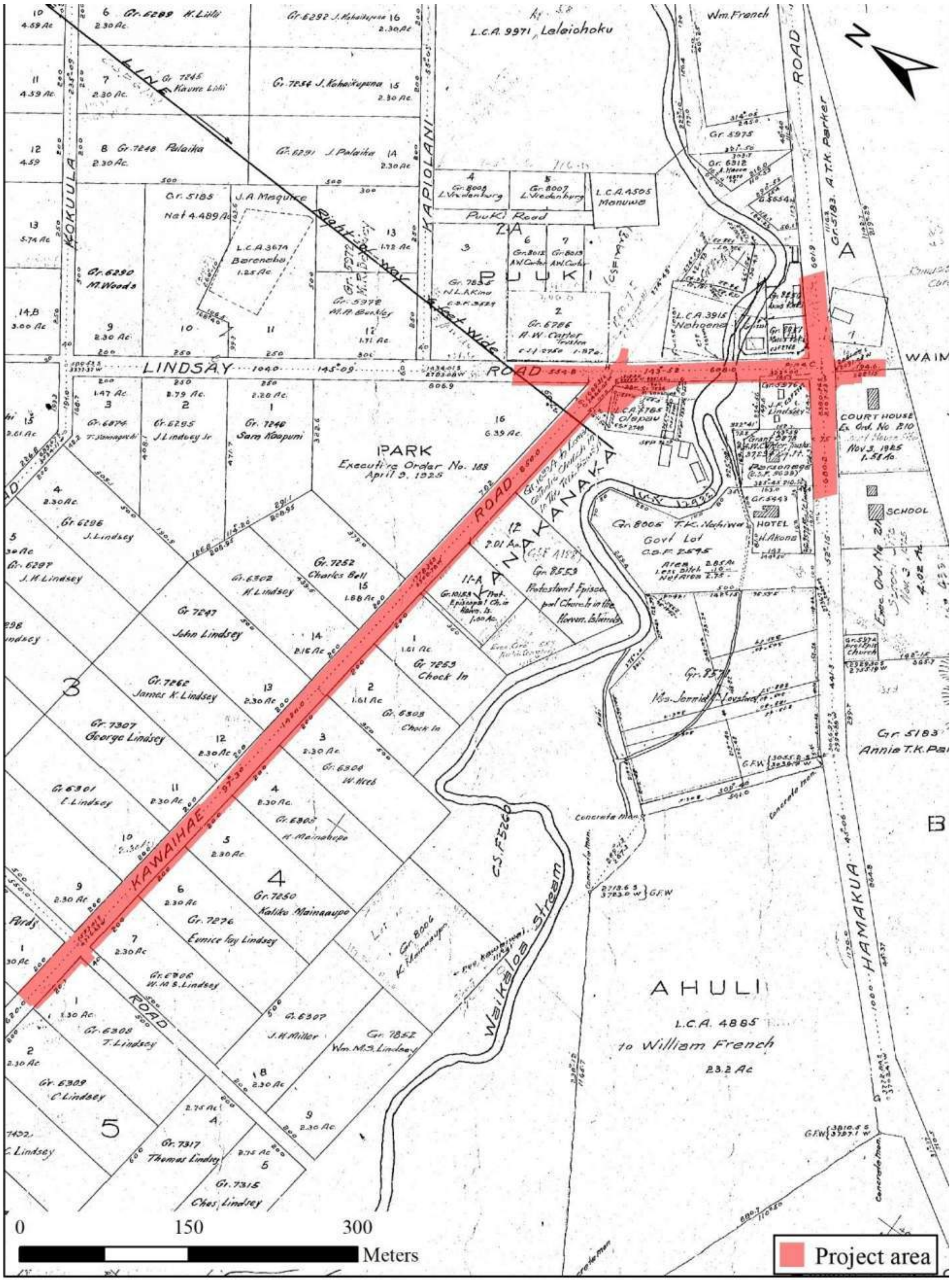


Figure 31. Portion of Hawai‘i Registered Map 2575 (after O'Neal 1915).

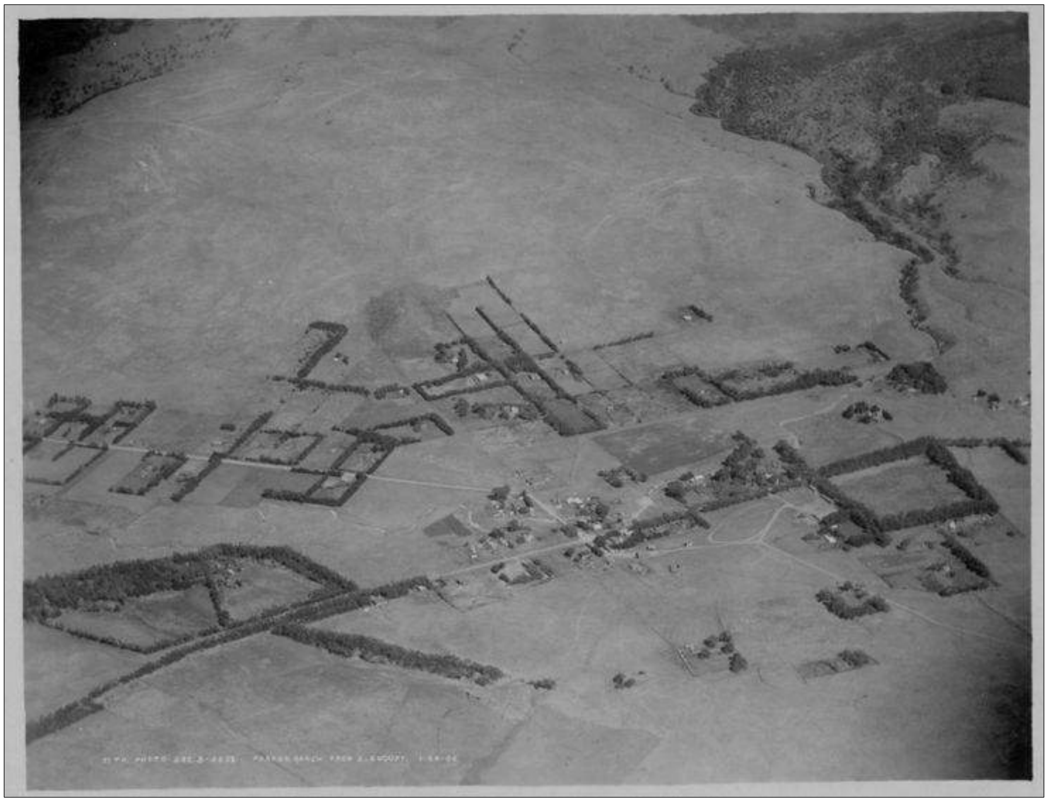


Figure 32. January 28, 1925 aerial photograph of Waimea Town (USAAF 1925).

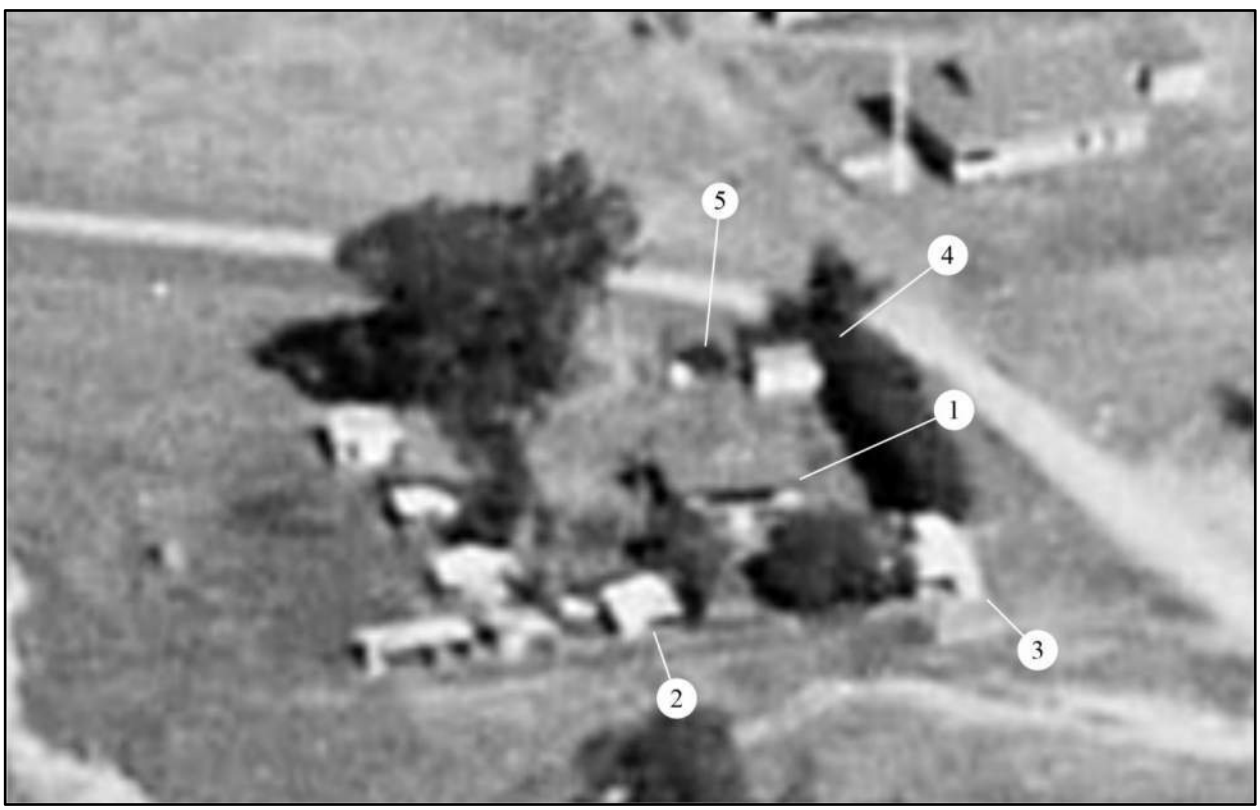


Figure 33. Detail of 1925 aerial photograph of the former LCAw. (USAAF 1925).

In 1933, the Hawaiʻi Belt Road, or Māmalahoa Highway (SIHP 50-10-47-30187) was completed, linking together a single highway around the island (Duensing 2015). The opening of the new highway was quite an occasion, attended by the governor in Kailua. Asa Thurston, waxed poetic in about the opening of the new highway:

> In a literal sense, what has just been completed in North Kona was to make straight in that desert land, through lava flows and over rough places, a highway for all people who wish to make the journey around the Island of Hawaii or who desire to travel from Waimea to this fair land of Kona. Across that desert-land many travelers have made their weary way, first on horses or in wagons from the more settled portions of North Kona, across the lava flow of 1801 and beyond Puuanahulu to the pastures near Waimea, and then in later years have journeyed in automobiles, an experience hard on the nerves of the driver and always hard on the tires of the car, making the trip an unwelcome one. (*The Friend* Vol. CIII, No.7, July 1933:147)

In Waimea, the new highway formally connected the Waimea-Hāmākua Road with the Waimea-Kona Belt Road. The Waimea-Kona Belt Road (SIHP 50-10-20-20855) was twentieth-century modification of ancient *Alaloa*, or foot trail, named Kealakuʻi connecting Waimea with Puʻuanahulu to the south (Maly and Maly 2006). While this trail was known and used in Precontact and early Historic times, nineteenth century sources (e.g., see Figure 28) suggest much of the traffic between Kona and Kohala passed on the coastal road (Maly and Maly 2006), which was accessed from Waimea via Kawaihae. By the turn of the twentieth century, the route to Kona through Puʻuanahulu had become more widely used, leading to the construction of the Waimea-Kona Belt Road (Site 20855) between 1916 and 1922 using prison labor under the direction of Eben Low. As the main thoroughfare through town (see Figure 32). Māmalahoa Highway used this same alignment. Parker Ranch's main store and restaurant were located near the corner of Lindsey Road and the new Māmalahoa Highway (Figure 34).

Figure 34. Entrance to the former Parker Ranch store and restaurant ca. 1930s (photo courtesy of the Kō Education Center, Honokaʻa).

World War II and Post-War Changes

With onset of World War II, the population of Waimea would drastically expand. Beginning in 1941, months before the bombing of Pearl Harbor, the U.S. Army established an infantry headquarters in the Puʻukapu area of Waimea (Bergin 2006) located to the northeast of the current project area. After the United States formally entered WWII, the earlier Army presence in Waimea expanded into one of the largest multi-force (adding the Navy and Marines) U.S. military camps (Camp Tarawa) and training bases in the Pacific. Large areas of the town and the surrounding pastures were turned over to the U.S. Government for campsites (Figure 35) that housed approximately 20,000 soldiers and as firing ranges for training U.S. Marines (Brundage 1971). Maps and photos of Camp Tarawa the extent of the camp (Figures 36 and 37). Pipelines to provide water to the camp were installed along all three roads in the project area as shown in Figure 37. Several U.S. Army installations were located immediately adjacent to the project area, including a recreation field at the current location of Waimea Park, a main hospital in the converted Waimea Ranch Hotel building, and a hospital school at the junction of Lindsay Road and Māmalahoa Highway (see Figure 37). Within a year of the Japanese surrender, the U.S. Military had all but left the town and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry. However, the small town grew throughout the rest of the twentieth century. On the former LCAw. 3479 parcel (by then rented to Parker Ranch), several alterations were made to buildings during this time (Figure 38). The main residence on the parcel was converted to a hamburger stand and restaurant named the Magnolia Inn. The restaurant was run by the Hayashi family, who moved into the building in 1941 (Melrose 1997). Other alterations include additions to the photograph studio building and the storage building.

Figure 35. Camp Tarawa training camp in Waimea—Opelo Road extends toward the upper left from the tent camp (http://www.pacificworlds.com).

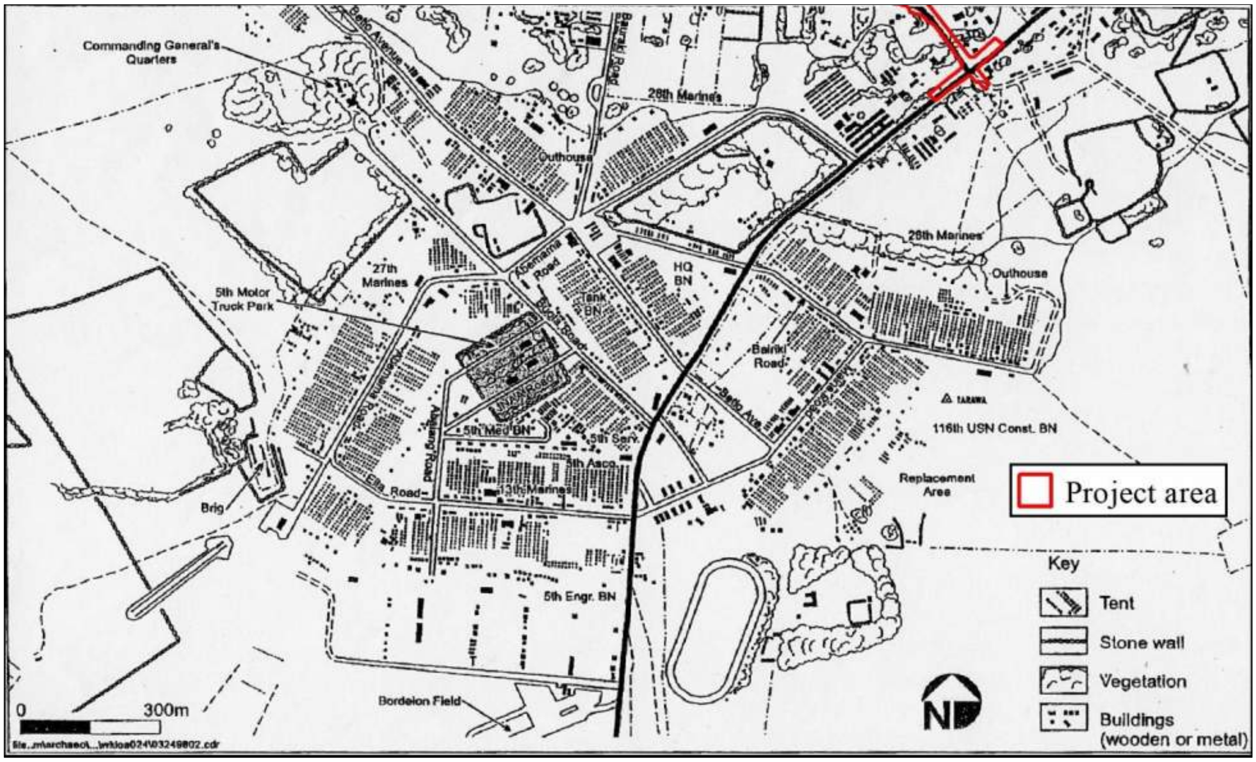


Figure 36. Map of Camp Tarawa ca. 1944 with the current project area indicated (after Nees and Williams 1998:17).

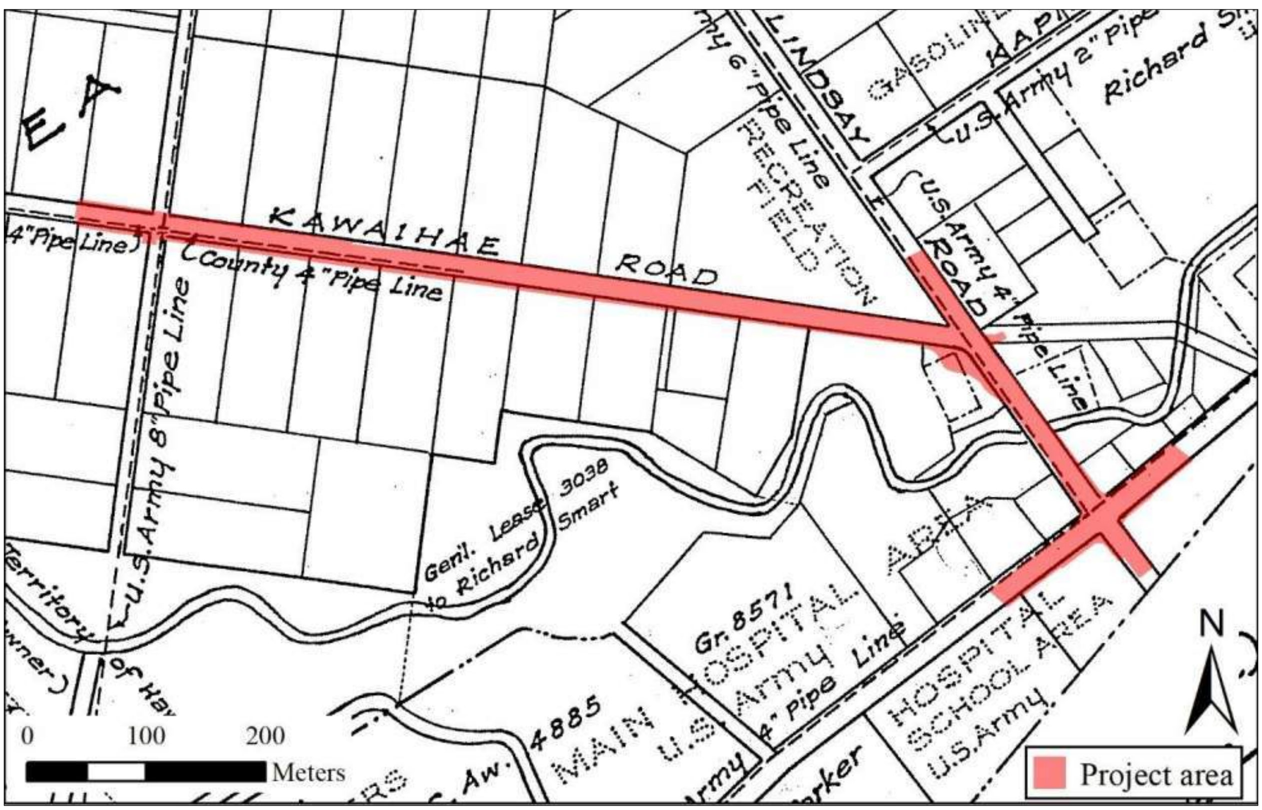


Figure 37. Detail of HTS Plat 411 showing Camp Tarawa infrastructure (after Lane 1945).

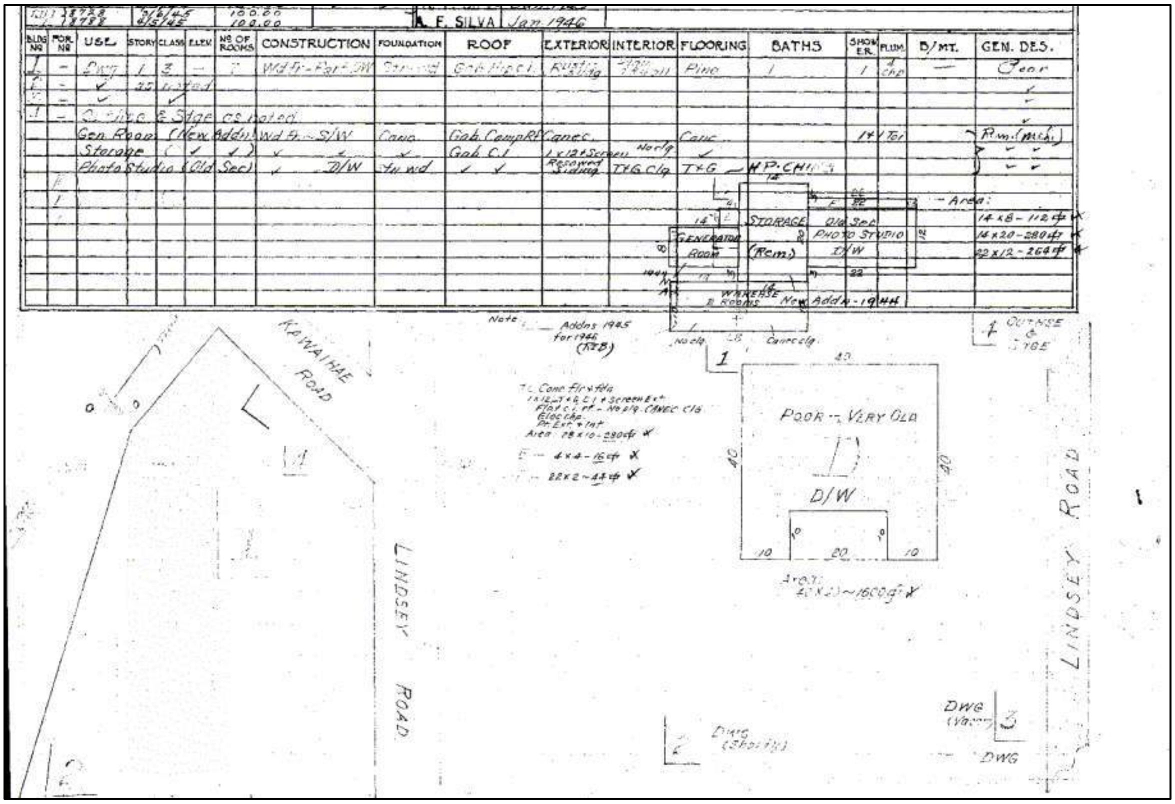


Figure 38. 1946 County of Hawai‘i tax record depicting improvements on the former LCAw. 3479 parcel.

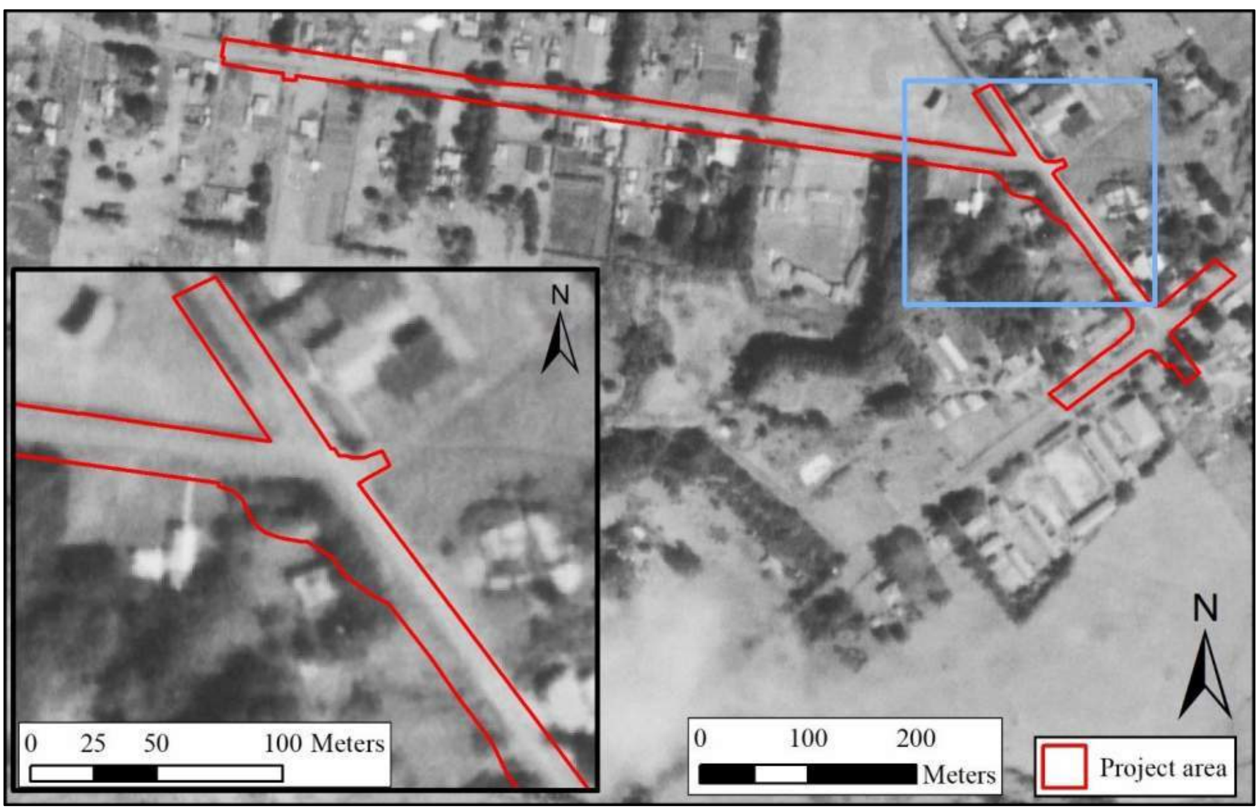


Figure 39. 1954 aerial photograph (USGS 1954) showing the current project area (outlined in red).

While Parker Ranch and the ranching lifestyle persisted as the social and economic center of Waimea, new community infrastructure, including parks, became a vital component of the town's development. Richard Smart, Parker Ranch's sixth-generation heir and now owner of the ranch and its vast land holdings, set aside a park in honor of his beloved maternal grandmother, Elizabeth Jane Lanakila Dowsett (Figure 40), known to Smart affectionately as "Auntie Tootsie" (Nakano 1992:42). It had been Dowsett, who, upon the death of her husband John Palmer Parker III, relinquished her 1/3 interest of Parker Ranch lands to their infant daughter and Smart's mother, Annie Thelma Kahilu‘onāpua‘api‘ilani Parker (Bergin 2004).

Figure 40. Richard Smart and his aunt Tootsie Lanakila Dowsett https://kamuela.com/we-are-one/).

The location chosen for Lanakila Park, named for Richard Smart's grandmother, was the former LCAw. 3479 parcel situated directly west of the junction of Lindsey Road and Kawaihae Road, which Parker Ranch purchased from Mary Kiakona in 1950. The buildings on the lot were demolished in 1959, and the park (Figures 41 and 42) was dedicated in 1962. To mark the occasion, the Hawaii Tribune-Herald (1962) reported:

> Future is Arriving at Kamuela – The open airiness of the western range remains about this still highest town in the 50th State. But the old "Cowtown" look is fast disappearing. One recently polished facet of Waimea village is its tiny but prim and precise Lanakila Park, just so named in honor of Parker Ranch Owner Richard Smart's grandmother. "Tootsie" Dowsett's Hawaiian name was Lanakila. In a program of conscious stewardship, the park with its well-planned plantings of evergreens and mixture of tropicals is shaping up along lines of Kamuela's monarchy theme. Just now in bloom, blue agapanthus harmonize with the background blue and white tool shed. A bandstand and small pavilion are included in future plans.

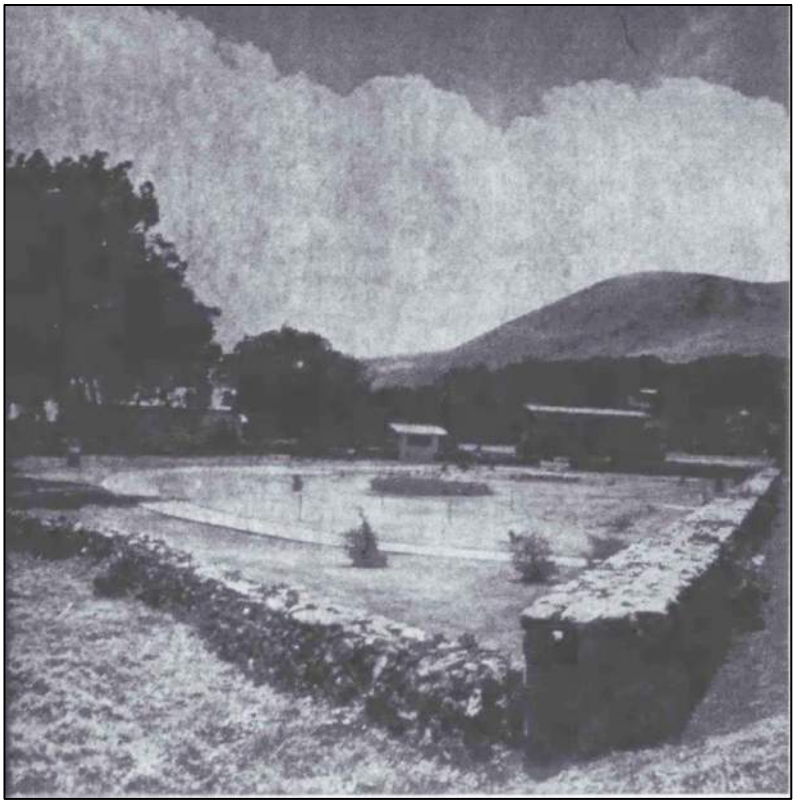
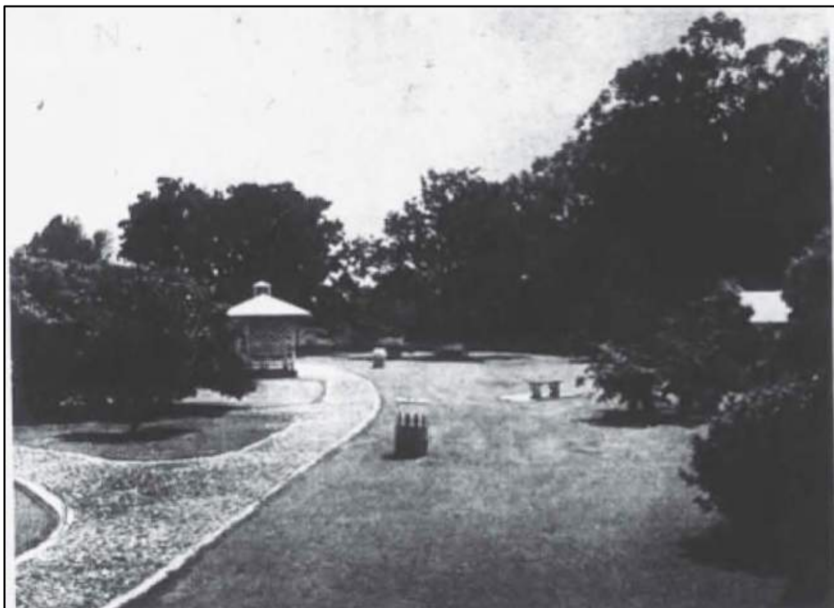


Figure 41. Lanakila Park ca. 1962, view to the northwest from Waikōloa Stream (Hilo Tribune-Herald 1962).



BEAUTIFUL LITTLE LANAKILA PARK—Lanakila Park in the center of Waimea was dedicated in 1962 by Richard Smart as a memorial to his late grandmother, Mrs. John Parker III, the former Elizabeth Lanakila Dowsett. A small bronze plaque in a lava rock column on the grounds bears the appropriate inscription. Reminiscent of the Victorian era, there is a small latticed pergola, picnic shelter, walkways, broad expanses of lawn, a profusion of trees, flowers and over all, a quiet serenity. For public use, the park is about three-quarters of an acre. A circular seat around a spreading tree, stone benches, and rubbish containers painted in scalloped designs are all in keeping with a restful atmosphere. In the early days, the area was a Volcano Stables station, and later several old houses stood there. —T-H photo by Hugh Clark.

Figure 42. Lanakila Park ca. 1968 view to the southwest from Kawaihae Road (Hawaii Tribune-Herald 1968).

Ten years later, State of Hawaiʻi tax records indicate that the park contained much of the same elements as are found today: a cemented cobble stone walkway (visible in Figure 42), the storage shed, a 20x8 foot rest area, an open concrete bench, an open octagon wooden bench around a tree, a plaque, a three-foot tall stone wall along the road (visible in Figure 41), and a two foot tall stone wall around the park's other boundaries. Throughout the 1970s, development in Waimea began to increase and the town center expanded. By the 1970s, the Parker Ranch Center across the street from the current project area had been built (Figure 43), further illustrates the continuing urbanization and increasing community infrastructure such as cemeteries, parks, schools, and the expansion of critical infrastructure such as a fire department.

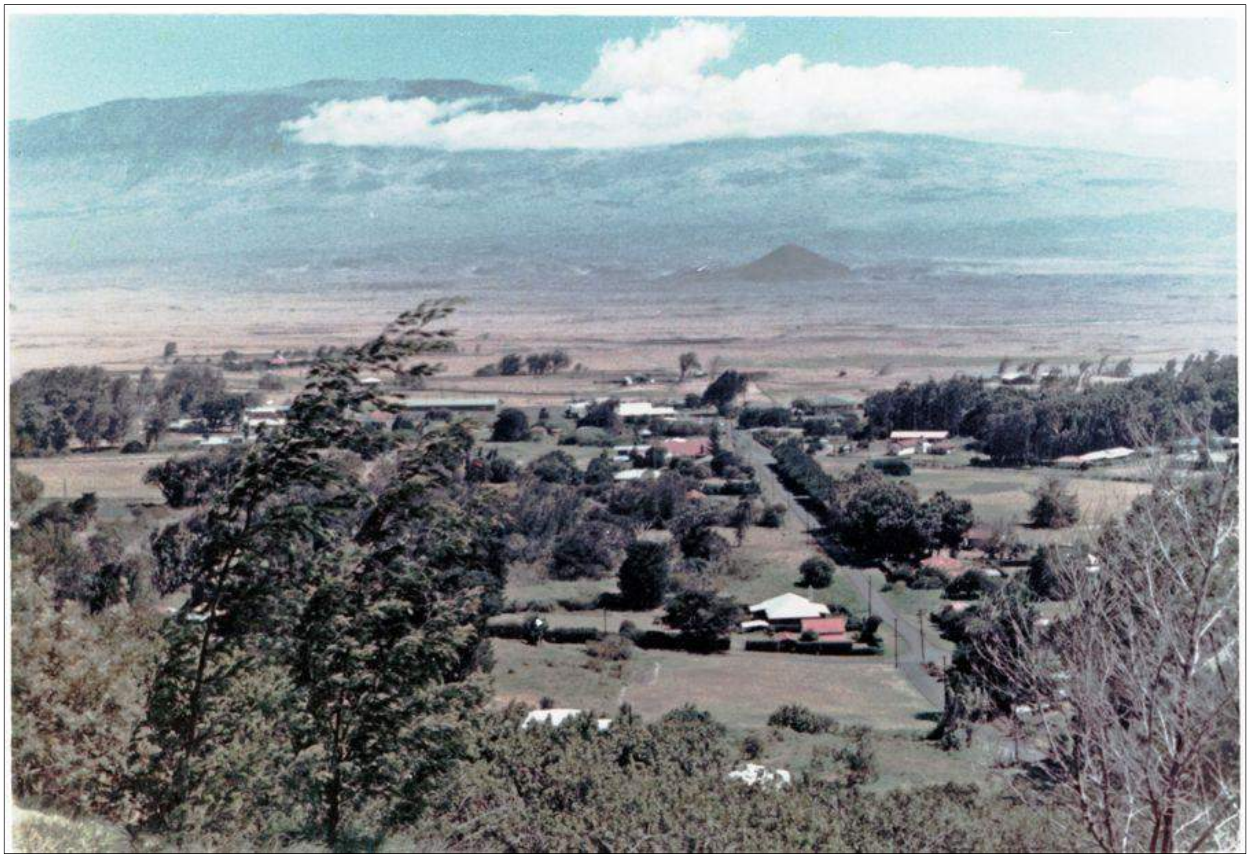


Figure 43. Waimea Town in ca. 1970 (photo courtesy of Kō Educational Center, Honokaʻa).

PREVIOUS ARCHAEOLOGICAL STUDIES

Although no previous archaeological investigations have been conducted within the confines of the current project area, there have been numerous studies conducted in the general vicinity of the current project area and within the greater Waimea Region. Many of these studies have focused specifically on the Lālāmilo agricultural field system, a large complex of Precontact agricultural features and associated habitations that were used into Historic times (Barrera and Kelly 1974; Barrera 1993; Ching 1979; Clark 1981; Clark 1987; Clark et al. 1990; Hammatt and Shideler 1989; Haun et al. 2003; Rechtman 2000). These studies were all conducted to the south and west of the current project area. Feature types identified within the Lālāmilo field system include terraces, mounds, enclosures, field boundaries (*kuaiwi*), irrigation ditches (*ʻauwai*), stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and various other miscellaneous types (Haun et al. 2003). Areas associated with the agricultural fields were later utilized for military training and cattle ranching, with sites and features relating to those repurposed functions being interspersed with the Precontact agricultural fields and habitations. To assist in generating a set of expectations regarding the nature of historic properties that may be encountered within the current project area, the results of the most proximate and relevant studies (Table 2 and Figure 44) that have identified findings are discussed in detail below. Not pictured in Figure 44 is the project area for an AIS of a portion of Māmalahoa Highway (Site 30187) between Mud Lane and Mānā Road conducted by LaChance et al. (2017), who found no intact constructed elements of the original Māmalahoa Highway. Based on studies conducted elsewhere on the island, Site 30187 was determined eligible for the National Register of Historic Places (Log No. 2017.00231; 00232; 00233; 00234;00235, Doc. No. 1703JLP07). Contributing character defining features of the historic property include the highway's linear route, bridges, culverts, drainage headwalls, and rock walls.

Table 2. Selected previous archaeological studies conducted in the general vicinity of the project area.

Year	*Author(s)*	*Type of Study*
1992	Thompson and Rosendahl	Inventory Survey
1996	Erkelens	Reconnaissance Survey
1998	Erkelens	Survey and Testing
1999	Wolforth	Data Recovery
2000	Wolforth	Reconnaissance Survey
2001	Magnuson and Athens	Burial Testing and Monitoring
2004	Clark and Rechtman	Inventory Survey
2005	Burtchard and Tomonari-Tuggle	Data Recovery
2006	Clark and Rechtman	Archaeological Monitoring
2007	O'Day and Rieth	Monitoring and Emergency Data Recovery
2008	Clark and Rechtman	Inventory Survey
2009	Macak et al.	Archaeological Assessment
2009	Yucha et al.	Inventory Survey
2009	Wilkinson et al.	Archaeological Monitoring
2010	McIntosh et al.	Inventory Survey
2012	Rechtman	Burial Site Component of a Preservation Plan
2012	Rieth and Filimoehala	Monitoring and Emergency Data Recovery
2013	Rechtman	Inventory Survey and Testing
2014	Haun and Henry	Inventory Survey and Testing
2016	Tam Sing and Rechtman	Archaeological Monitoring
2016	Tam Sing and Rechtman	Archaeological Assessment
2017	Tam Sing et al.	Archaeological Monitoring
2018	Tam Sing and Barna	Inventory Survey
2019	Barna	Field Inspection
2020	Barna	Field Inspection

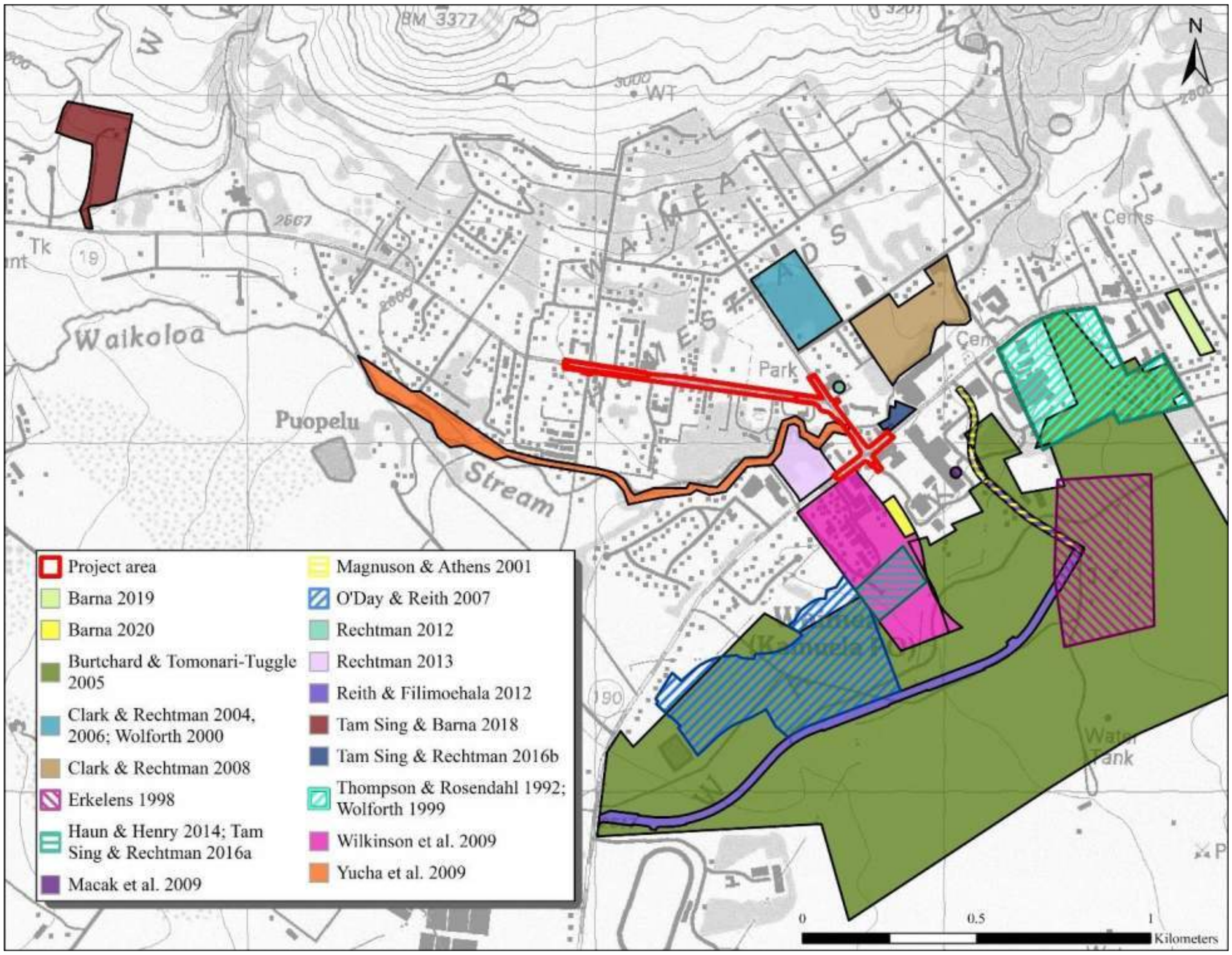


Figure 44. Previous archaeological studies conducted in the vicinity of the current project area.

In 1992, Paul H. Rosendahl, Inc. (PHRI; Thompson and Rosendahl 1992) conducted an Archaeological Inventory Survey (AIS) of seven potential locations of the North Hawai‘i Community Hospital. All of these parcels were located to the southeast of the current project area on TMKs: (3) 6-7-002:013 and 017, (3) 6-7-003:011, and (3) 6-8-001:001, and 002 (see Figure 44). Four of the parcels examined by Thompson and Rosendahl (ibid.) contained the remains of a Precontact *‘auwai* system (Site 16095), and one of the parcels contained the remains of an agricultural complex (Site 18054). Several manually excavated units were dug, however, no significant cultural material was recovered. Three backhoe trenches were also excavated, one in particular was oriented specifically to bisect one of the ditches (Ditch D) identified during the fieldwork. One radiocarbon date obtained from charcoal in the base of the *‘auwai*, which yielded a calibrated age range of A.D. 770 to 1020.

In 1996, Archaeological Research and Consulting Services, Inc. (ARCH; Erkelens 1996) conducted an archaeological reconnaissance survey of four known burial sites (the Bright Family burial site, the Duncan/Lanakila burial site, the Yutaka Pen burials, and the Pu‘ukapu Homesteads Lot burials) situated within the proposed Waimea Town Center project area and Pu‘ukapu Homesteads on TMKs: (3) 6-4-002:014 and 017 and (3) 6-4-001:042 located to the southeast of the current project area (see Figure 44). The purpose of the reconnaissance survey was to locate unmarked burials within the confines of each known burial area based on additional information supplied by lineal descendants. Erkelens (1996) did not identify any new burials associated with the known burial locations, however, he did note the location of two burial areas adjacent to the proposed Waimea Town Center project area, indicating that the burial area south of the North Hawai‘i Community Hospital was associated with the Kaanaana family. Additionally, the Kaanaana family is associated with the Duncan/Lanakila burial site (Site 19416) which was consisted of 16 individual graves within two adjacent enclosures situated within Land Grant 5977 which was awarded to Ella Duncan in 1915.

In 1998, International Archaeological Research Institute, Inc. (IARII; Erkelens 1998) conducted an archaeological survey and subsurface testing of the proposed 385-acre Waimea Town Center property for Parker Ranch, located southeast of the current project area on TMK: (3) 6-7-002 (see Figure 44). They identified five sites including three nineteenth century house lots (including two LCAw. parcels and a Grant parcel) covering an area of 26.6 acres (Site 8812), a Historic cemetery (Site 19416), and four Historic structures grouped into three sites (Sites 19417, 19418, 19419). Twenty-four backhoe trenches were excavated at the five recorded sites. The skeletal remains of two individuals and a large number of Historic artifacts were discovered during the subsurface excavations. This led the researchers to suggest that there was the likelihood of encountering more unmarked burials within the study area during ground disturbing activities and further monitoring and burial testing was recommend for the study area. The additional work did not result in any additional findings (Magnuson and Athens 2001).

During the mid-1990s, IARII also conducted data recovery investigations (Burtchard and Tomonari-Tuggle 2005) at several sites within the proposed Waimea Town Center development area located to the south of the current project area (see Figure 44). Their work was focused on gathering data on the development of the agricultural systems and associated habitations within their project area; more specifically, assessing the antiquity of irrigated fields on the Waimea plains. Burtchard and Tomonari-Tuggle (2005) concluded that while traditional agriculture may date back to the A.D. 1400s in this area, it consisted on non-irrigated fields; and the formal irrigation systems that characterize the Waimea Agricultural System are a nineteenth century development associated with commercial agriculture.

In 1999, PHRI (Wolforth 1999) conducted archaeological data recovery excavations at Site 16095 on TMK: (3) 6-7-002:013, one of the parcels investigated by Thompson and Rosendahl in 1992 east of the current project area (see Figure 44). The primary focus of the excavations was to establish a date of construction and use of the *ʻauwai*. The system was also mapped in detail. Based on five radiocarbon dates, pollen and macrobotanical analysis, stratigraphic contexts, and historical documentary research, Wolforth (1999) concluded that the earliest use of the *ʻauwai* was likely sometime after A.D. 1175, and that it continued to be used into the Historic Period.

In 2004, Rechtman Consulting, LLC conducted an AIS (Clark and Rechtman 2004) of three parcels within the Waimea Homesteads (TMKs: (3) 6-5-004:029, 030, 050), northeast of the current project area. The parcels were previously subject to a reconnaissance survey by Scientific Consultant Services, Inc. in 2000 (Wolforth 2000) (see Figure 44). As a result of the survey, a single archaeological site (Site 24168) was recorded. Site 24168 consisted of Parcel 030 (LCAw. 3674) in its entirety and included the remains of a Historic dwelling and several associated features, including a stone walkway, a concrete foundation of a small outbuilding, a stone and mortar construction that formerly anchored a post or pole, an outbuilding that possibly functioned as a bathhouse, a trash dump, and four scattered sections of an iron fence that once enclosed a Historic burial. The burial had been removed from the property and re-interred prior to the Clark and Rechtman (2004)) study. Site 24168 was awarded to Barenaba as LCAw. 3674, and likely saw nearly continuous use of the parcel from the pre-*Māhele* times until the early 1960s. The ground surface in the vicinity of the site was littered with Historic and Modern era remains.

Rechtman Consulting, LLC (Clark and Rechtman 2006b) conducted archaeological monitoring of their 2004 survey area for the proposed development of the Waimea Parkside Residential Subdivision located northeast of the current project area (see Figure 44). As a result of monitoring, a small stone concrete construction along the southern boundary of Parcel 030 that was previously concealed with soil was identified. This new feature, a koi pond, was subsequently designated as Feature H of Site 24168. Additionally, Clark and Rechtman (ibid.) recovered two adze fragments from isolated locations in the development area.

In 2007, IARII (O'Day and Rieth 2007) conducted archaeological monitoring and emergency data recovery associated with the development of Lualaʻi Subdivision located to the southwest of the current project area (see Figure 44). They investigated Site 21873, the remains of a mid-19th century residence previously documented by Burtchard and Tomonari-Tuggle (2005). As a result of the emergency data recovery of Site 21873, O'Day and Rieth (2007) uncovered a historic cemetery as well as several subsurface charcoal deposits associated with an *imu* and a hearth which were submitted for radiocarbon dating. Radiocarbon dating results from the hearth ranged from the 14th to the 15th century, while results from the *imu* yielded dates ranging from the late 17th century to the early 20th century.

In 2006, Rechtman Consulting, LLC (Clark and Rechtman 2006a) conducted an AIS of a roughly 13.6-acre property (TMK: (3) 6-5-004:025 and 026) located to the east of the current project area (see Figure 44). As a result of the survey, four archaeological sites were identified: Site 26680, two segments of a Historic wall; Site 26681, a Historic wall; Site 26682, an *ʻauwai*; and Site 26683, a Historic structure likely associated with the U.S. Military. In addition to a surface survey of the parcel, Clark and Rechtman (ibid.) excavated five mechanical backhoe trenches (BT 1-4) within their study area. While BT 1-3 were devoid of cultural material and subsurface features, the excavation of BT-4 revealed fragments of a concrete flume consistent with the approximate location of the eastern end of Site 26682, which had been previously covered by bulldozer push.

In 2009 Cultural Surveys Hawai‘i, Inc. (CSH) conducted an AIS (Yucha et al. 2009) of portions of several parcels comprising almost 9 acres of the Waimea Trails and Greenway Project along the banks of Waikōloa Stream (TMKs: (3) 6-5-003:004 (por.), 005 (por.), 007 (por.), 044 (por.), (3) 6-6-003:006 (por.), and 013 (por.) located west of the current project area (Figure 44). As a result of the study, three sites were identified. Site 50-10-06-26871 was recorded as two remnant features (a paved roadway and a concrete stream crossing associated with WWII Camp Tarawa activities. Site 26872 was assigned to a water transport ditch known historically as the Akona ‘Auwai. Site 26873 is a relatively intact concrete stream ford and associated roadway. Sites 26871 and 26872 were determined significant under Criteria a and d, and Site 26873 was concluded to be significant under Criterion d. The concrete stream crossing of Site 26871 and Site 26872 were slated for preservation and no further work was recommended for the other features and sites. Within Lanakila Park, a stone terrace located along Waikoloa Stream was determined not to be a historic property.

In 2009, CSH monitored the placement of six large capacity septic tanks along with 47 meters of trenching on TMK: (3) 6-7-002:015 for Waimea Elementary and Middle School, located to the southwest of the current project area (see Figure 44). While they did recognize that Waimea Elementary School is on the Hawai‘i Register of Historic Places (Site 7523), they reported that “no significant cultural materials [sic] and/or subsurface features were encountered during the monitoring work” (Wilkinson et al. 2009:ii). They further recommended that “although no cultural layers or materials were discovered during the DOE wastewater system improvements at Waimea Elementary and Middle School, in the future, if any subsurface activities are conducted on-site archaeological monitoring is recommended” (Wilkinson et al. 2009:39)..

In 2012, IARII (Rieth and Filimoehala 2012) conducted archaeological monitoring and emergency data recovery associated with the construction of the Parker Ranch Connector Road located to the south of the current project area (see Figure 44). As a result of monitoring, 126 archaeological features at sixteen sites were documented, the majority of which consisted of Precontact hearths of temporary habitation sites associated with dryland agricultural activities. Historic material was encountered which believed to either be associated with nineteenth century residences or Camp Tarawa. No burials were encountered during the fieldwork.

A 5.2-acre portion of the Waimea Elementary and Middle School campus was the subject of a subsequent AIS (Haun and Henry 2011) (see Figure 44). Historical records indicated that late nineteenth/early twentieth century land use in their project area consisted of activities relating to agriculture (sections of possible *‘auwai*) and commercial ranching, however, no Historic Period artifacts associated with the military were encountered during the survey. Rather, the fieldwork identified two discontinuous segments of a curvilinear depression (possible *‘auwai*) in the southern portion of the project area. Historical background research backhoe trenching indicated that portions of a small network of ditches (SIHP 50-10-06-30172) fed by larger Waikōloa-fed ditches (Lyons, Akona, and Lanakila) were present within the project area. The location of a “Branch of Lyons auwai” was tested, but no evidence of that ditch was observed. No buried cultural deposits or artifacts from the Precontact or Historic Periods were observed in any of the trenches.

In 2012, Rechtman Consulting, LLC prepared a burial site component of a preservation plan (Rechtman 2012)for Site 29368, the location of the inadvertently discovered skeletal remains of a single adolescent individual on TMK: (3) 6-5-004:027, located to the northwest of the current project area (see Figure 44). The remains were displaced during electrical trenching activities under a corner of Parker School’s Theater Building. The remains were recovered from the trench, and the *in-situ* portion of the skeleton was identified and documented. A decision was made in consultation with DLNR-SHPD and the Hawai‘i Island Burial Council (HIBC) to preserve the remains in place, and to install a preservation buffer around the site extending four feet beyond the location of the remains. A sign indicating the presence of culturally sensitive resources was also to be posted at the preservation area, and the burial site location was to be maintained by Parker School.

The following year in 2013, Rechtman Consulting, LLC conducted an AIS (Rechtman 2013) of a roughly 5-acre property (TMK: (3) 6-5-003:002) for the proposed development of a commercial/retail center, located to the west of the current project area (see Figure 44). The inventory survey identified two previously documented Historic Period sites; Remnant features associated with U.S. Military Camp Tarawa (Site 26871), and remnants of the Akona *‘Auwai* and a side branching ditch (Site 26872) initially recorded during an inventory survey by CSH in 2009 (Yucha et al. 2009). Historical evidence suggests that the Akona Ditch was constructed in 1845 to bring water to the upstart sugarcane operation at Līhu‘e to the west of the current project area, and that by the late nineteenth century was the head water for the large dendritic irrigation system that serviced the Lālāmilo fields.

In addition to a surface survey of the parcel, Rechtman Consulting, LLC Rechtman (2013) also excavated three controlled test units (TT-1, TT-2, and TT-3) and five soil percolation test trenches (PTs). Two of the three controlled test units (TT-1 and TT-2) were excavated on top of the projected course of the main ditch, and TT-3 was excavated on top of the projected course of the side branch. In all three cases, a buried *ʻauwai* feature was encountered.

In 2015, ASM Affiliates conducted an Archaeological Assessment (AA) (Tam Sing and Rechtman 2016) of a roughly 0.677-acre property for the proposed expansion of the KTA Waimea grocery store parking lot located to the east of the current project area (see Figure 44). Fieldwork for the project included a systematic 100% pedestrian survey of the surface of the project area as well as subsurface testing (mechanical trenching) at five selected locations. As a result of the fieldwork, no surface or subsurface archaeological sites or features were identified within the project area.

In 2016, ASM Affiliates conducted archaeological monitoring (Tam Sing and Rechtman 2016) of 5.5-acres for the development of the Waimea Middle School Eight Classroom Building Project on TMK: (3) 6-7-002:015 located south of the current project area (see Figure 44). As a result of monitoring activities, nine isolated Historic Period artifacts (e.g. intact and fragmented glass bottles, metal chains, pickaxe head, and a panel from a seed trough) were recovered, however no intact buried cultural deposits were identified.

In 2017, ASM Affiliates conducted archaeological monitoring (Tam Sing et al. 2017) of construction activities on 50-acres of Parker Ranch land for the development of Phase I of the Waimea District/Regional Park, located southwest of the current project area (see Figure 44). As a result of the monitoring, 119 Historic and Precontact artifacts were identified and collected, all of which derived from isolated contexts or were associated with previously identified sites. Artifact locations were identified in the access road adjacent to Ala ʻŌhiʻa Road in two distinct concentrations: Concentration 1 and Concentration 2. Artifact types identified in Concentration 1 were determined to be directly associated with a previously identified stone wall (Site 21860) and primarily consisted of nineteenth century ceramics and bottle glass and was interpreted to have been domestic refuse discarded by the former occupants of the site. Alternatively, Concentration 2 was deemed to be temporally and spatially associated with Site 8805 (Camp Tarawa) and contained artifacts dating to the A.D. 1940s. Additionally, four sets of human skeletal remains were inadvertently discovered during the course of monitoring, two of which were identified in a primary context and two which were concluded to have been secondarily deposited. Two sets of remains were preserved in place and two were relocated to a designated preservation area. Aside from the inadvertent burial discoveries, no new archaeological sites were encountered during monitoring activities.

In 2018, ASM Affiliates (Tam Sing and Barna 2018) conducted an AIS of TMK: (3) 6-5-006:005, a 9.363-acre parcel located northwest of the current project area (see Figure 44). As a result of the survey, two previously unrecorded archaeological sites were identified. The first of these, Site 30917, consisted of a remnant Historic boundary wall separating the subject parcel from four residential parcels located to the west. It consisted of two Historic (i.e., as originally constructed) segments and two modern (reconstructed in 1993) segments. The second site, Site 30918, consisted of a ditch remnant formerly utilized to water agricultural fields that were formerly located adjacent to the parcel. Tam Sing and Barna (2018) related that at least half of Site 30918's original length was removed during construction activities that occurred in 1993. Both sites were evaluated as significant under Criterion d, and it was concluded that the proposed subdivision of the subject parcel would result in "no historic properties affected."

Most recently in 2020, ASM Affiliates conducted a field inspection (Barna 2020) of TMK: (3) 6-7-002:054, a 1.127-acre property located within the Waimea Town Center located just south of the current project area to facilitate the transfer of the parcel from Parker Ranch to the Department of Education (see Figure 44). As a result of the field inspection, a highly disturbed 5.8-meter-long by 0.9 to 1.2-meter-wide and 45 to 50 centimeters deep linear depression representing a segment of the previously identified Lyon's ʻAuwai (Site 9179) was observed along the western parcel boundary. Based upon the poor condition of the *ʻauwai* remnant, it was concluded that although it was previously determined to be significant under Criterion d for its information content, it suffered from a severe loss of integrity of multiple categories. Thus, it was concluded that the proposed land transfer would result in a determination of "no historic properties affected."

3. PROJECT AREA EXPECTATIONS

The results of the literature search indicate that although the current project area was not included in the Waimea Field System field complexes defined by Clark (1983)—due to it already having been developed at the time of his study—other archaeological studies in Waimea have identified surface and subsurface archaeological sites and features associated with Hawaiian occupation of the Waimea Plain dating from the A.D. 1400s through the twentieth century, along with deposits left by ranching activity and World War II-era military activities at Camp Tarawa. Subsurface historic properties have also been identified in the vicinity of the current project area, and have included habitation sites and both Precontact and Historic period burials with little or no surface indications. Most of the current project area, however, consists of existing paved roads and adjacent unpaved portions of the right-of-way. Any above-ground historic properties in the unpaved shoulders of the road would most likely be rock walls, although other ranching-related features are also possible. The construction, maintenance, and repairs of these roads, especially in the Lindsey Road-Māmalahoa Highway and the Lindsey Road-Kawaihae Road portions of the project area, most likely has exceeded the anticipated depths of the proposed project. Similarly, modern construction in the right of way for Māmalahoa Highway (Site 30187) has very likely destroyed certain contributing character defining features such as culverts, drainage headwalls, or rock walls within the current project area.

The proposed roundabout would extend into Lanakila Park and cause ground disturbance within the boundaries of a former *kuleana* parcel (LCAw. 3785 to Olepau). The *kuleana* parcel is known to have been a *pāhale* or house lot occupied at least as early as the mid-nineteenth century, and almost certainly earlier than that. During the twentieth century this parcel was developed, gradually acquiring five buildings used for lodging and a variety of commercial activities (Figure 45). Two of these buildings appear to have been at least partially located within the current project area. In 1959, the buildings were demolished for the creation of Lanakila Park. No above-ground historic features other than those built for the park, some of which date to the mid-1960s, are anticipated on this parcel. It is possible that subsurface deposits associated with the Historic period use of the parcel may have survived the ground disturbance associated with the park's construction.

Figure 45. LCAw. 3785 boundary (yellow) superimposed on a the 1925 aerial image (USAAF 1925).

4. FIELDWORK

Fieldwork for the current study was conducted on March 6, 2020, and March 25, 2022. Benjamin Barna, Ph.D. (principal investigator) and Lauren M. U. Kepa‘a, B.A. conducted the fieldwork. A total of 24 person-hours were expended on the fieldwork. The methods used during the fieldwork are described below, followed by a presentation of the fieldwork results and subsequent laboratory analysis of recovered artifacts.

FIELD METHODS

The fieldwork consisted of a pedestrian survey of the entire project area and subsurface testing on a portion of TMK: (3) 6-5-003:005 undertaken to identify subsurface archaeological features.

Pedestrian Survey Methods

The pedestrian survey was conducted on March 6, 2020. The survey consisted of a visual inspection of the entire ground surface (100% coverage) of the project area. Benjamin Barna, Ph.D. conducted the pedestrian survey. The project area boundaries were not marked in the fields, but the boundaries were identified using GPS. To locate the project area boundaries, a shapefile of the project area was provided by the client, and this shape file was uploaded to a handheld tablet computer running ESRI’s Collector application connected to an EOS Arrow 100 GNSS receiver with sub-meter accuracy. The Collector application was set to the NAD 83 Zone 5N datum. The survey focused on portions of the project area located outside of the travel surface of Lindsey Road and Kawaihae Road. Dr. Barna walked transects parallel to the project area boundaries while alongside Lindsey Road and Kawaihae Road. In portions of the project area that extended further than 5-meters from the roads, 5-meter spacing was used to survey the project area. Ground visibility was excellent across the entire survey area for identifying any cultural features that may have been present. Upon completion of the survey each potential feature was returned to and examined more thoroughly. Those features deemed to be historic properties were then cleared of vegetation, photographed (both with and without a meter stick for scale), and described using standardized record forms. The locations of the recorded features were collected using the handheld tablet computer. Site boundaries were defined based upon the spatial arrangement the recorded features and the inferred associations between them

Subsurface Testing

Subsurface testing was conducted March 25, 2022. The purpose of the subsurface testing was to investigate the portion of TMK: (3) 6-5-003:005 located within the project area for subsurface archaeological features. Of particular concern was the mapped location of the former *kuleana* parcel (LCAw. 3479 to Olepau), where it was considered possible that buried deposits associated with the *kuleana* and a historically documented *pāhale*. Four backhoe trenches (BT-1, -2, -3, and -4) were placed to sample space within the former *kuleana* where ground disturbance would occur. The configuration of backhoe trenches relative to historically known features on the parcel is shown in Figures 46, 47 and 48. Figure 59 depicts a schematic representation of the buildings that occupied the parcel prior to 1962. An additional consideration related to the placement of the backhoe trenches was a desire by the landowner (Parker Ranch) to avoid damaging tree roots, existing sidewalks, and other park infrastructure. Each backhoe trench was 4.0 meters long and 60 centimeters wide. The trench locations were marked on the ground with marking paint, and then dug with the excavator to depths between 126 and 253 centimeters. All back dirt was inspected for cultural material. Upon completion of the excavation, scale drawings of the stratigraphic profiles of the trenches were drawn, and each trench was photographed with a meter stick and north arrow for scale and orientation. Intact cultural deposits that were identified during trenching were mapped, documented, and assessed as to their integrity. Any observed associations were be documented, and the surrounding soil was described using standard USDA soil descriptions and Munsell colors. A sample of diagnostic artifacts from each intact deposit was collected for laboratory analysis.

Cultural Material Analysis

All cultural material collected during monitoring was cleaned, weighed, measured, photographed, and cataloged. Analysis included formal description and functional interpretation. The identification of artifacts was made by comparison with reference collections and materials in ASM’s laboratory library. Upon acceptance of the current AIS report, the collected material will be returned to the landowner.

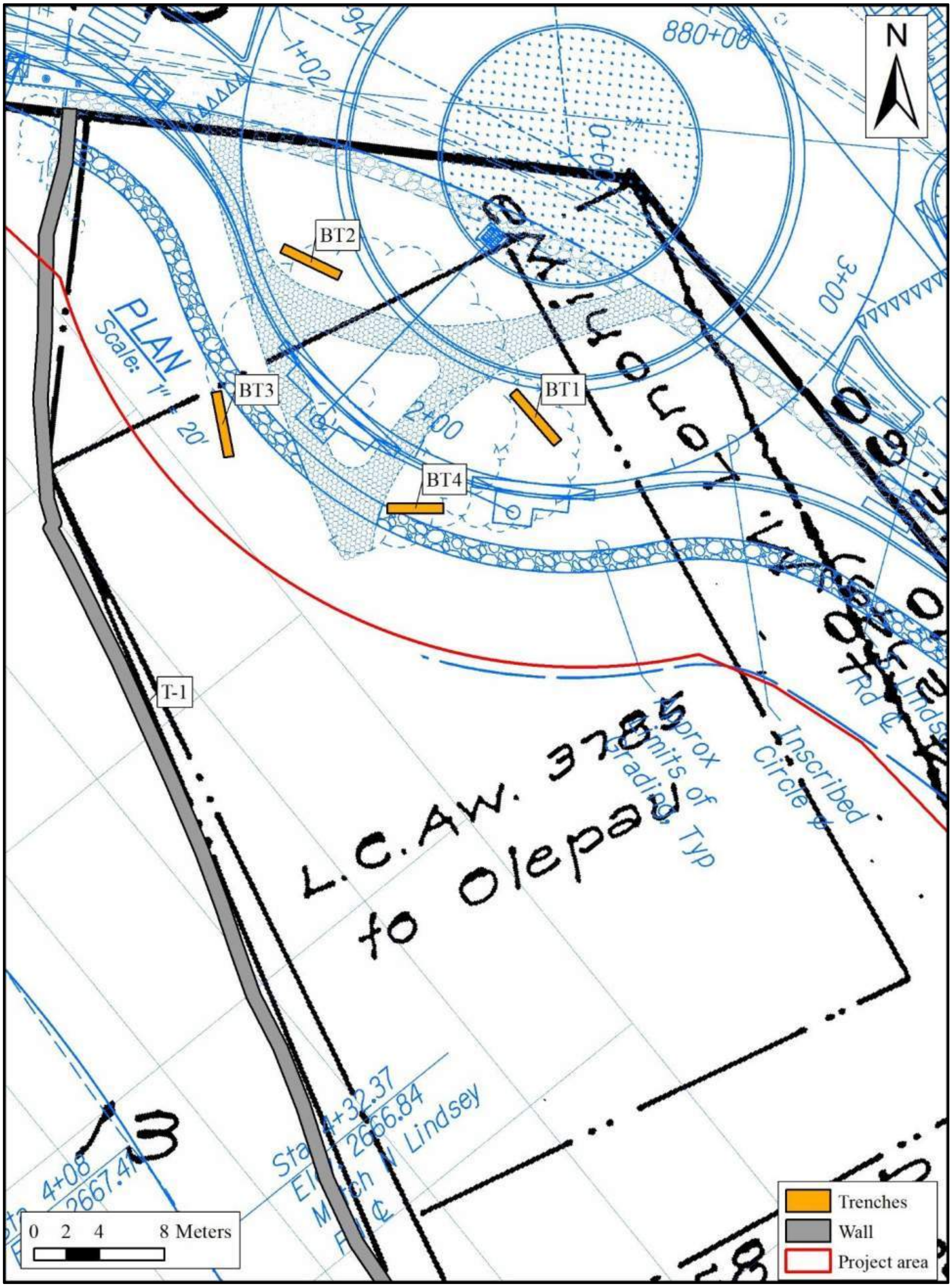


Figure 46. Location of backhoe trenches with development plan drawn in blue and LCAw. 3785 drawn in black.

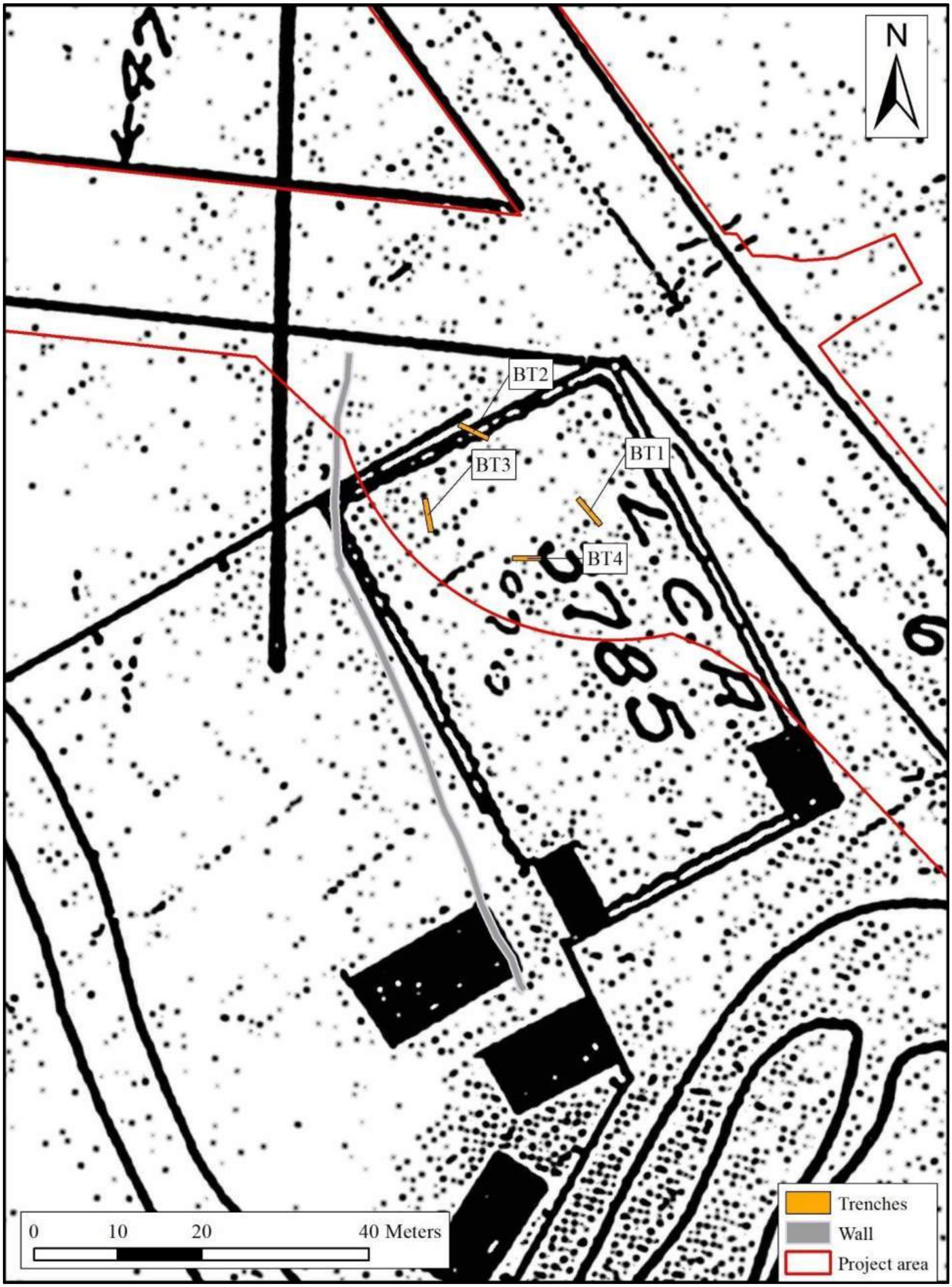


Figure 47. Detail of Registered Map 2470 with trench locations indicated (after Rowell and Taylor 1908).

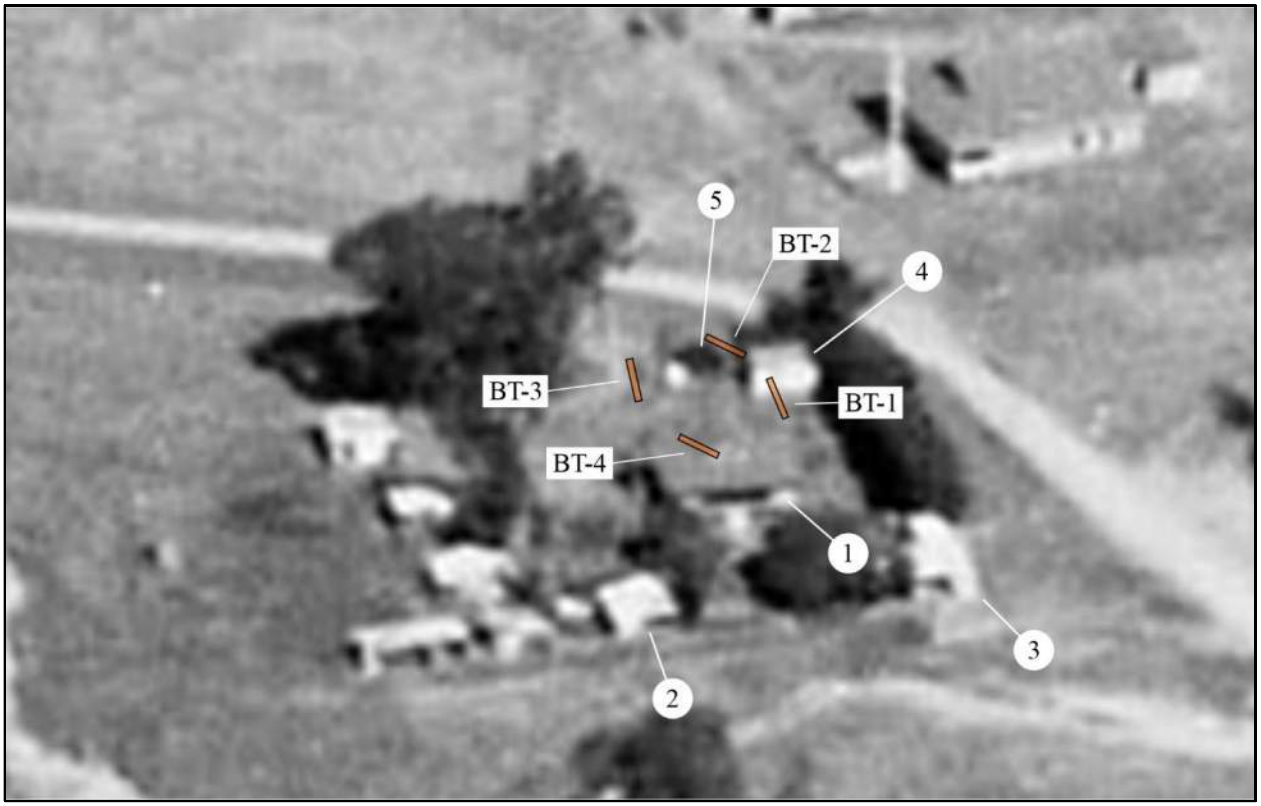


Figure 48. Location of trenches relative to buildings shown in the 1925 aerial image (USAAF 1925).

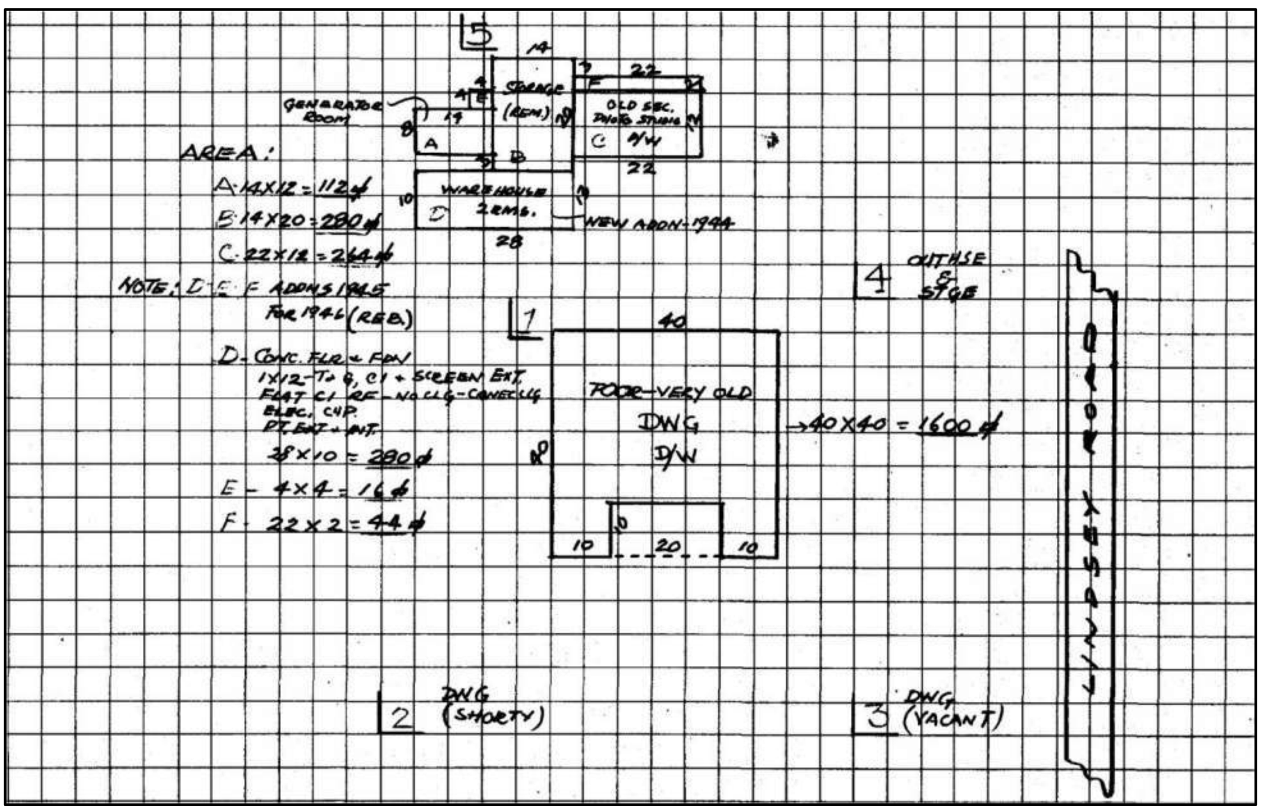


Figure 49. Detail of TMK (3)6-5-03:05 Field Book Building Sheet showing schematic layout of buildings.

RESULTS

During the current fieldwork, one historic property (Table 3) were identified on TMK:(3) 5-6-003:005. Site T-1 is a multicomponent site containing Lanakila Park, which was constructed in 1962, and a buried a buried household rubbish deposit dating between the 1920s and the 1940s. Figure 50 shows the location of Site T-1 relative to the current project area. Elsewhere in the current project area, no historic properties of any kind were observed. The project area on both sides of Kawaihae Road and Opelo Road have been disturbed by roadside improvements to facilitate drainage and access to businesses located on the road. Where there is no sidewalk, the right of way has been graded and is covered with grass. The Māmalahoa Highway portion of the project area is even more developed, with modern concrete sidewalks on either side of the roadway. No historic features of Māmalahoa Highway (Site 50-10-06-30187) were observed. Site T-1 is described in detail below.

Table 3. Historic properties identified

Site No.	*Type*	*Age*	*Function*
T-1	Lanakila Park/ Former residential & commercial lot	1963 to present / 1920s to 1940s	Recreation/ Residential and commercial

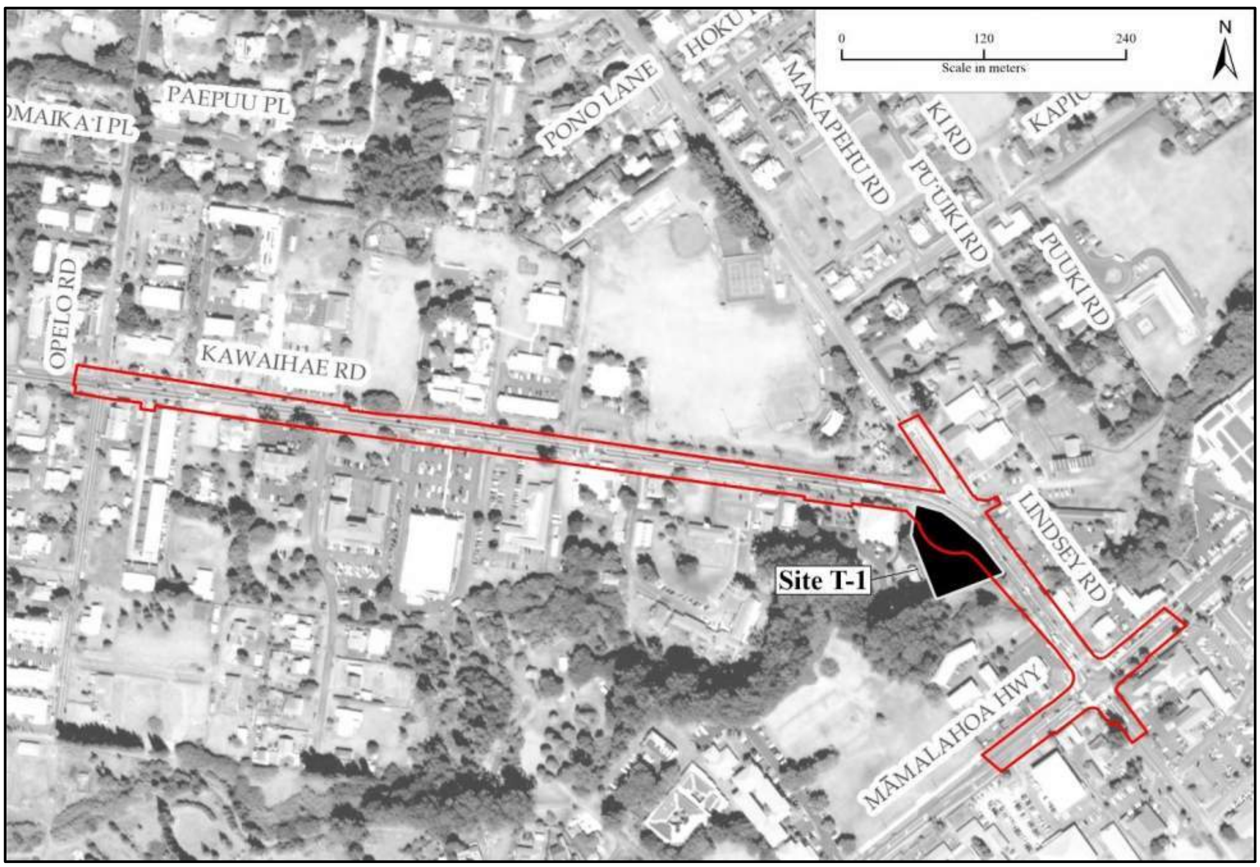


Figure 50. Site location map.

Site 50-10-06-T-1

Site T-1 is a multicomponent site containing architectural and archaeological features representing two distinct periods of land use on TMK: (3) 5-6-003:005 during the twentieth century. The younger component of the site is Lanakila Park, which was constructed in 1962. The older component of the site is a buried rubbish deposit associated with residential and commercial use of the parcel between the 1920s and the 1940s. The site occupies almost the entire 1.04-acre parcel, extending across an area measuring approximately 80 meters (north to south) by 50 meters (east to west). The location of the identified components of the site are shown in Figure 50.

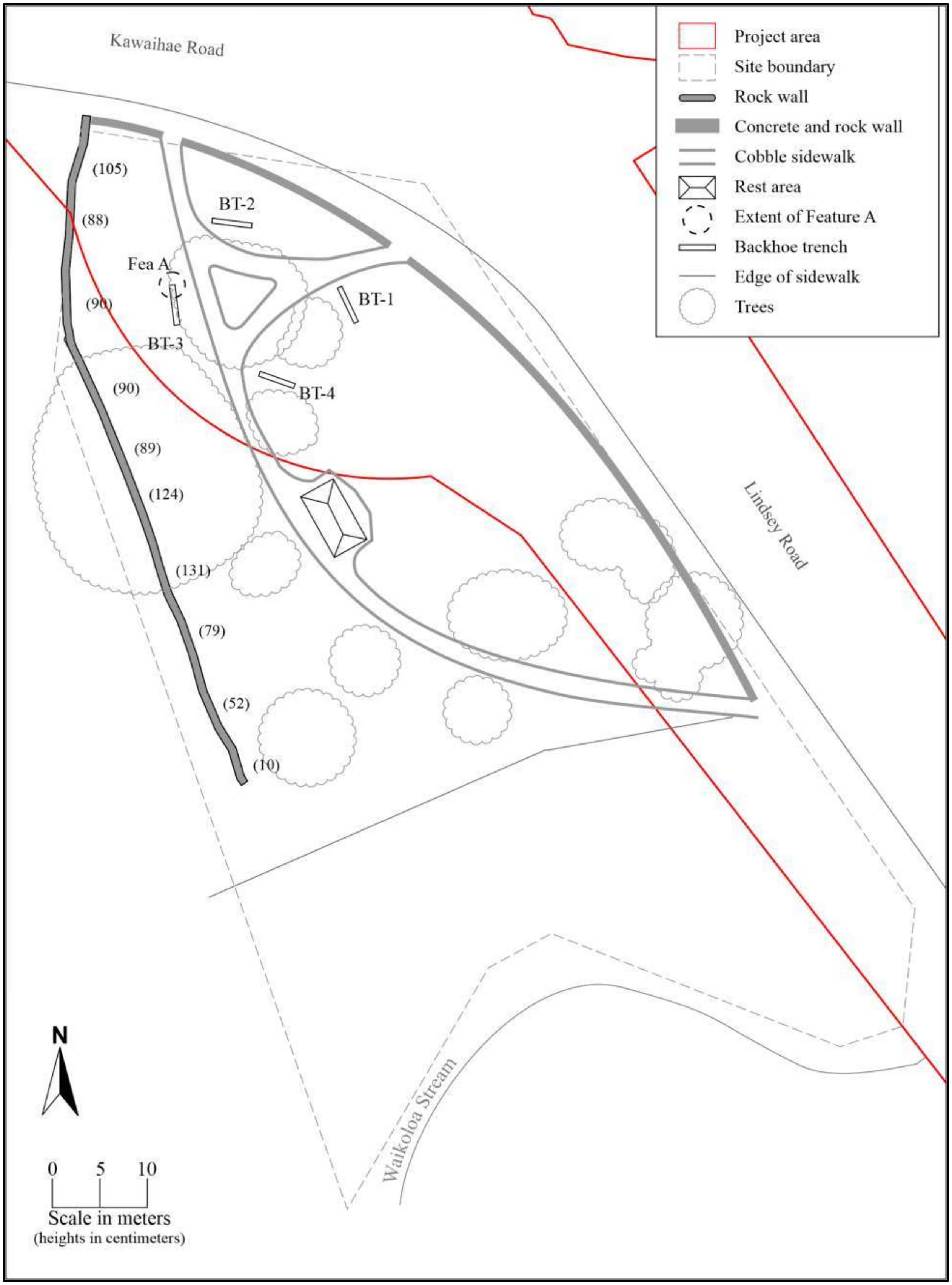


Figure 51. Location of identified sites and features on TMK: (3) 5-6-003:005.

Lanakila Park (1962 to present)

Lanakila Park (Figure 52) comprises the stratigraphically most recent component of Site T-1. The park was constructed in 1962, and thus the age of the park qualifies it as a historic property. The park occupies nearly all of the 1.04-acre parcel, measuring approximately 80 meters by 50.0 meters. It is characterized by a level open grassy area with shade trees, a cemented cobblestone walkway (Figure 53), and a wooden covered rest area, all enclosed by a rock and concrete wall along the road and a rock wall along its southern boundary. A concrete and rock masonry wall curves along the outer boundary of the parcel at the intersection of Lindsey Road and Kawaihae road (Figures 54 and 55). The wall stands 3 feet tall by 3 feet wide. It has three openings that allow access to the park via the cobblestone walkway. On the southern boundary of the parcel, an older rock wall (Figure 56) separates the park from the adjacent parcel. boundary is constructed of rounded to subrounded basaltic cobbles. There are two distinct segments of wall. The longer of the two segments (Figure 57) begins near the southwest corner of the former LCAw. 3785 parcel and extents northwesterly along the parcel boundary for 55 meters. It is core-filled, built with loosely stacked medium to large cobbles edges and filled small to medium cobbles. The wall stands between 10 and 131 centimeters tall (4 to 5 rocks high) and measures between 29.5 and 190 centimeters wide. Collapsed cobbles flank the stacked wall edge for most of the length of this segment, and the southern quarter of this segment has partially collapsed. The wall turns toward the north at a corner in the parcel boundary, and the style of its construction changes from core-filled to stacked. This segment of the wall (Figure 58) stands between 86 and 105 centimeters tall (4 to 5 rocks) and between 80 and 90 centimeters wide. It exhibits less collapse than the other segment, but is partially overgrown with vine. Based on the history of the parcel boundaries, it appears that the wall does not follow the boundary of LCAw. 3785 (see Figure 30), but instead was built to delineate the parcel boundary as it was defined during the sale of Land Grant 7224 in 1919. Of these elements of the park, only a portion of the grassy area, walkway, and the extreme northern end of the rock wall are located within the current project area.

Figure 52. Lanakila Park cobble-paved walkway, view to the south (cf. Figure 42).

Figure 53. Lanakila Park cobble-paved walkway, view to the south (cf. Figure 42).

Figure 54. Lanakila Park rock wall paralleling Lindsey Road, view to the north (cf. Figure 41).

Figure 55. Lanakila Park and rock wall parallel to Kawaihae Road, view to the northwest (cf. Figure 41).

Figure 56. Site T-1 rock wall on western parcel boundary, view to the north.

Figure 57. Site T-1 rock wall on western parcel boundary, view to the west.

Figure 58. Site T-1 rock wall on western parcel boundary, view to the west.

Feature A (circa 1943)

During the subsurface testing, a buried household rubbish deposit (Feature A) was identified near the northwest corner of TMK: (3) 5-9-003:005 (see Figure 50). The deposit was encountered during subsurface testing in BT-3 (Figure 59) at depths between 107 and 230 centimeters below the ground surface, with an estimated horizontal extent of 165 centimeters by 165 centimeters. The deposit was visible primarily in the eastern and southern walls of BT-3, with only the edges of the feature appearing in the western trench wall (Figure 60).

Cultural material recovered from the deposit in BT-3 (Table 4) consisted primarily of discarded glass containers associated with the consumption of beverages and food, along with household products. Other artifacts included fragments of ceramic tablewares, kitchen tools, and household furnishings. A sample of 226 artifacts was selected based on their potential to provide diagnostic information about age and function. Functional categories (based on Barna 2013; Sprague 1981) that were represented included adornment, beverage, food/beverage, household furnishings, hardware, household, kitchenware, medical, personal, and tableware, along with several items of indeterminate function (Table 5). Products represented included locally produced food and beverage items such as milk from the Parker Ranch Dairy; soda water from Hilo, Honokaʻa, and Paʻauilo; sake from Hilo; guava jelly from Honolulu; and Primo beer from Honolulu. Other food and beverage items were nationally marketed items such as Schilling brand spices, Van Camp's tomato ketchup, and Coca-Cola. Beer from Japan (Dai Nippon Brewery) was also represented. Several personal and adornment products were represented, including 13 examples of perfume, nail polish, and cosmetics, along with a bottle of shoe polish. Household cleaners were also represented, including seven Clorox brand quart bleach bottles. Ceramics are a mix of Euro-American vessels (e.g., earthenware plates and platters) and Asian vessels (e.g., porcelain *gowan chawa* [rice bowls]). The overall impression is that the deposit is a trash dump used by the inhabitants of one of the residences known to have been located on the parcel.

Figure 59. BT-3 pre-excavation, view to the west.

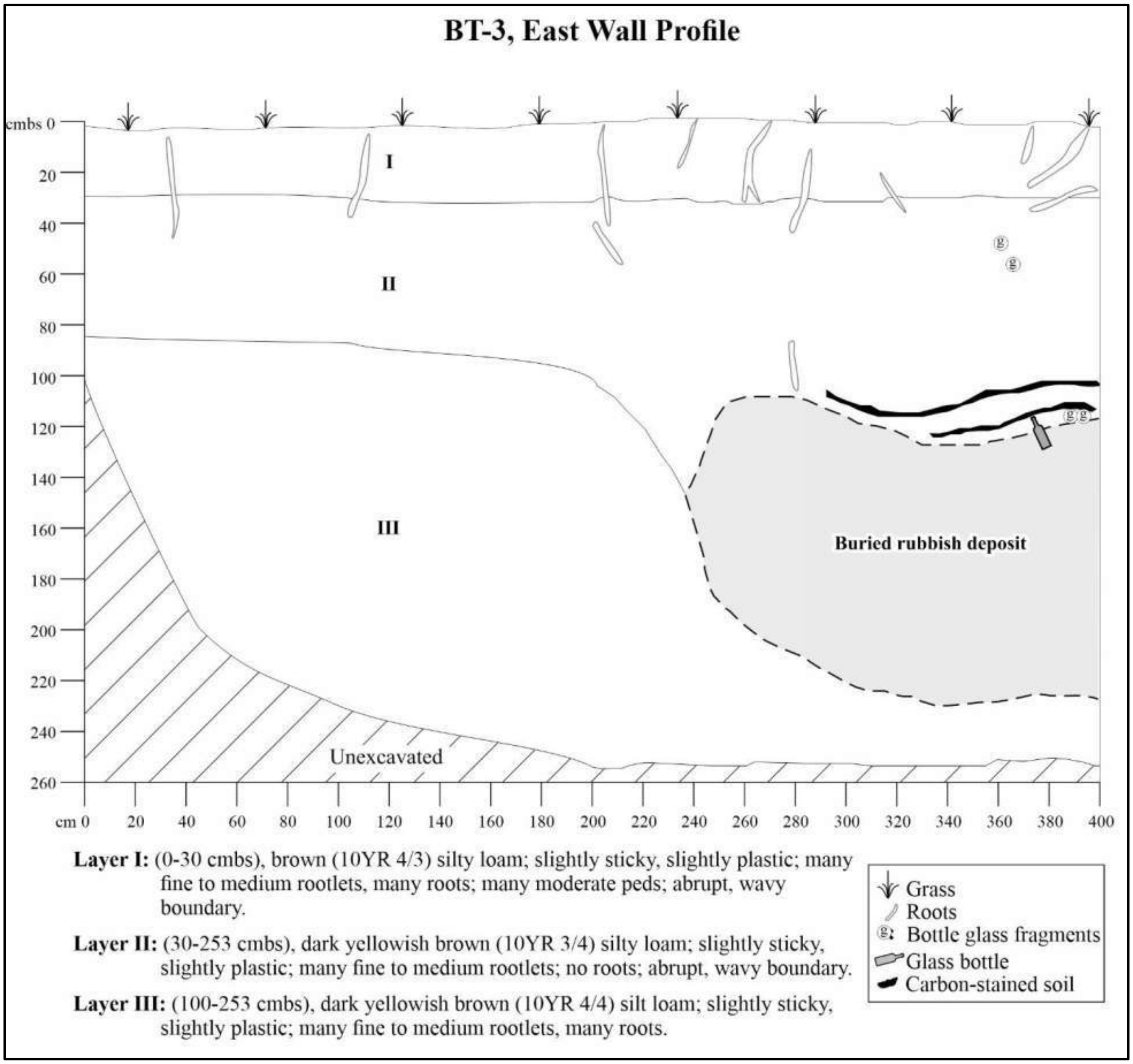


Figure 60. Trench 3 profile.

Figure 61. Trench 3 photo with T-3 deposit at right, view to the west.

Table 4. Summary of diagnostic artifacts recovered from Site T-1.

Material	***Type***	***Count***
Aluminum	bottle cap	3
Aluminum	cap	7
Bakelite	hair comb	1
Brass	plumbing hardware	1
Cloth, Metal	shoe upper	2
Cupric Alloy	kerosene lamp parts	4
Enamelware	bowl	2
Glass	bottle	88
Glass	bottle	1
Glass	bulb	1
Glass	cup	4
Glass	jar	20
Glass	lamp chimney	10
Glass	stopper	1
Glass, Bakelite	bottle with cap	4
Glass, Rubber	bottle and stopper	4
Iron	rod	1
Iron	wall sconce	1
Leather	shoe sole	1
Metal	bottle cap	1
Metal	fragment	2
Metal	hand crank	1
Metal	jar lid	5
Metal	lag bolt	2
Metal	lipstick tube	1
Metal, Glass	kerosene lamp parts	3
Oyster Shell	button	1
Porcelain	bowl	11
Porcelain	plate	3
Refined Earthenware	bowl	7
Refined Earthenware	plate	23
Refined Earthenware	platter	2
Rubber	button	1
Stoneware	crock lid	6
Stoneware	plate	2
Total		226

Of the 226 artifacts sampled, and 121 were temporally diagnostic and manufacturing dates could be determined (Table 6). These dates were determined primarily from makers marks on ceramics and bottles. Sources for this dating information included the Society for Historic Archaeology's bottle identification web page (Lindsey 2014), ceramics dating references (e.g., Allen et al. 2013; Choy 2014; Ross and Campbell 2022), online newspaper advertisements, and ASM Affiliate's reference collection. Of the datable artifacts, nearly all of them were, or were likely, manufactured during the second half of the 1930s. This is especially true for glass containers, of which 59 were marked with manufacturing dates between 1930 and 1939. The ages of the remainder of the datable artifacts could only be determined to age ranges spanning 5 years to several decades, but none older than about 1906 (in this case, Dai Nippon beer bottles which can only be dated between 1906 and 1941). No artifacts potentially dated later than 1950, and very few potentially dated later than 1941.

Maile Melrose's (1997) history of the Magnolia Inn relates that the Hayashi family opened the restaurant during World War II. Tax records for the parcel include an assessment of alterations to the building (the "Magnolia Lunch Rooms") in 1943. Previous to that, the tax records indicate that the dwelling was occupied by Parker Ranch cowboy Sam Liana. The composition of the trash deposit found in BT-3 appears to represent the contents of several different rooms in the house. The manufacturing dates cluster around 1937 but are generally not later than about 1941. Based on this evidence, the deposit represents a single depositional event that occurred just before or just after the Hayashi family moved into the house, when either Sam Liana, Parker Ranch, or the Hayashi family would have discarded items from the Liana household to make room for the Hayashii family and the Magnolia Inn.

Table5. Summary of functional categories represented by diagnostic artifacts recovered from BT-3

Category	*Quantity*
Adornment	8
Beverage	47
Food/Beverage	41
Furnishings	19
Hardware	5
Household	11
Kitchenware	2
Medical	1
Personal	17
Tableware	49
Unknown	26
Total	**226**

Table6. Summary of age ranges of temporally diagnostic artifacts recovered from BT-3

Age range	*Quantity*
1900-1930s	4
1906-1941	5
1911-1940s	2
1920-1949	9
1921-1941	3
1926-1930	1
1930s	2
1933-1970	1
1934	2
1935	1
1935-1936	2
1935-1964	1
1936	5
1936-1955	1
1937	31
1937-1950	1
1938	13
1939	1
1940s	2
1944	1
20th c	33
Total	**121**

Other Subsurface Testing Results

The three other backhoe trenches (BT-1, BT-2, and BT-4) contained minimal artifacts and similar stratigraphy (Table 7). The stratigraphic profiles in each trench contained a relatively thin layer of Post-1963 (Context 1) overlying a layer of dark yellowish brown silty loam (Context 5) with a cobble and small boulder component that increased with depth to about 1 meter below the ground surface. Below about 160 centimeters below surface, the moisture in the soil darkened the matrix slightly. In BT-3, additional stratigraphic units were observed due to the excavation of the pit containing the buried rubbish deposit. Context 2 represents matrix excavated for the trash pit and redeposited during backfilling of the pit (Layer II) and Contexts 3 and 4 represent burning of the trash in the deposit and the deposit itself. Photographs and profile drawings of BT-1 (Figures 62, 63, and 64), BT-2 (Figures 65, 66, and 67) and BT-4 (Figures 68, 69, and 70), along with detailed descriptions of each of these stratigraphic sequences is presented below.

Table 7. Correlated stratigraphy beneath Lanakila Park.

		Layer and Depth (cmbs)							
Context	*Description*	*BT-1*		*BT-2*		*BT-3*		*BT-4*	
1	Post-1963 topsoil (O & A Horizon)	I	0-29	I	0-20	I	0-30	I	0-18
2	Redeposited subsoil					II	30-85	-	-
3	Carbon-stained soil lens	-	-	-	-	-	85-100	-	-
4	Buried rubbish deposit	-	-	-	-	Fea A	85-220	-	-
5	Subsoil	II	29-126	II, III	20-183	III	80-220	II	18-140

Figure 62. BT-1 pre-excavation, view to the north.

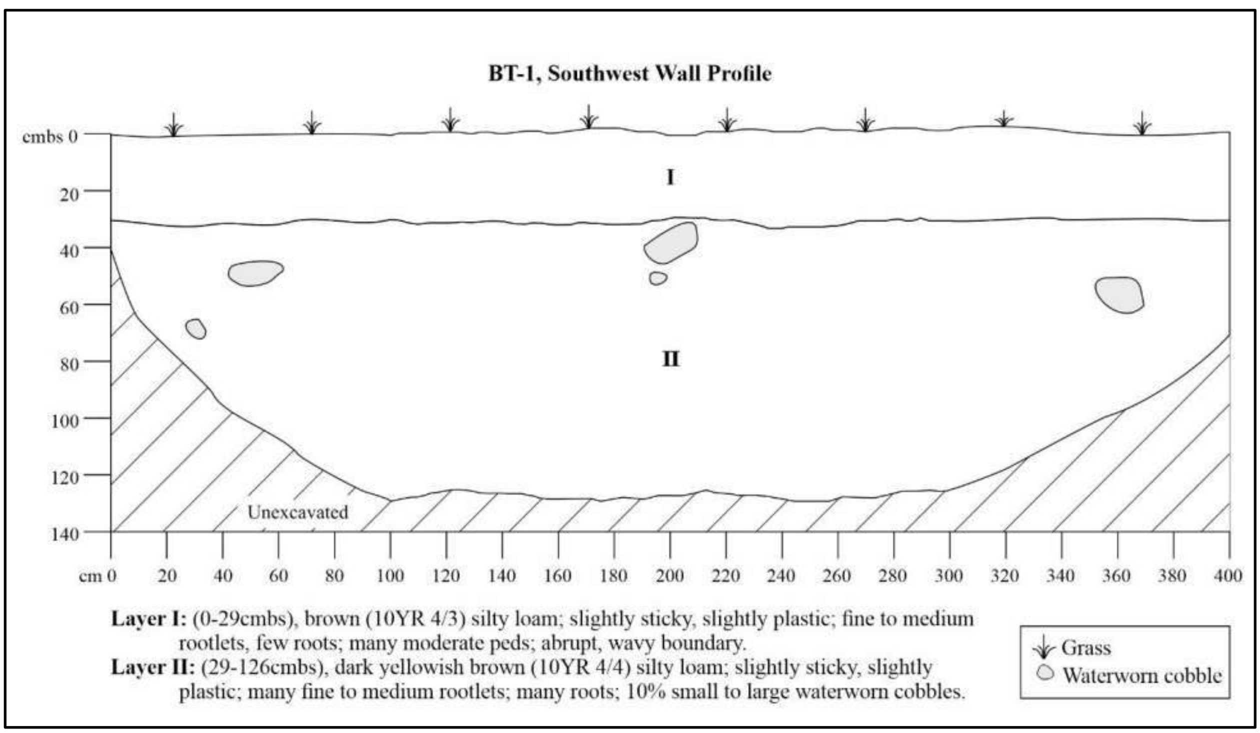
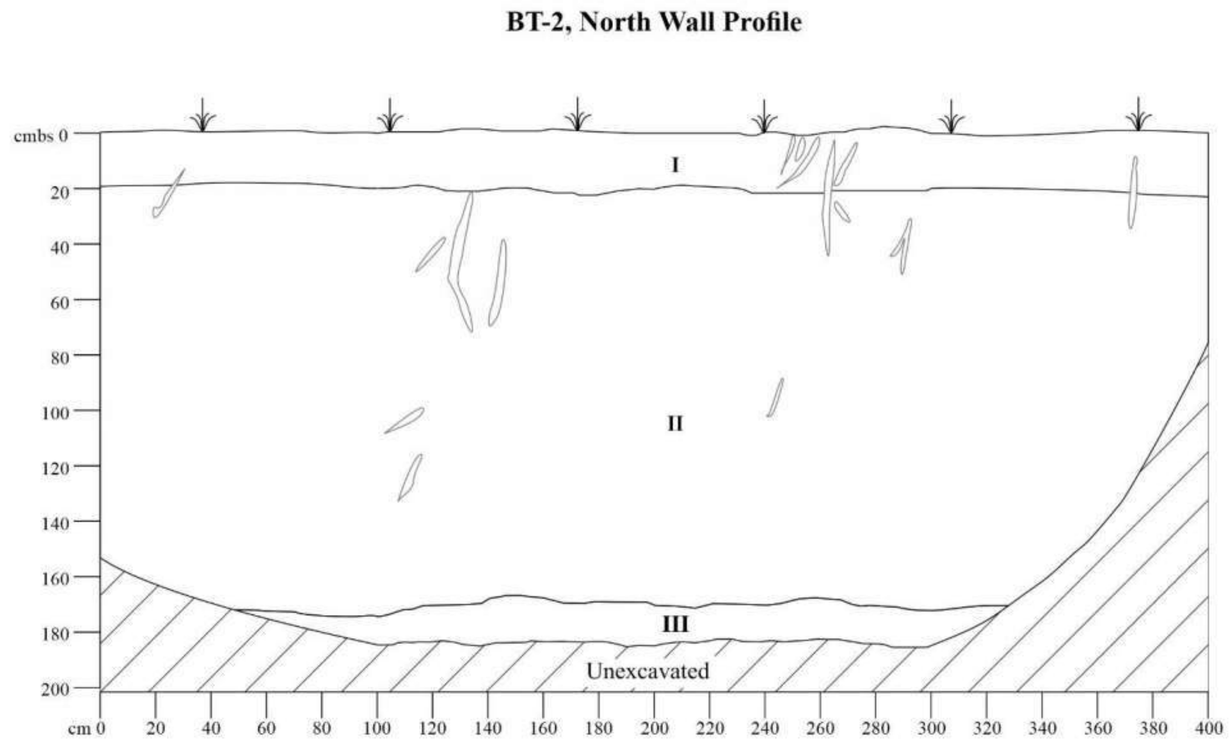


Figure 63. Southwest wall profiles of BT-1.

Figure 64. BT-1 southwest wall, view to the southwest.

Figure 65. BT-2 pre-excavation, view to the south.



Layer I: (0-20cmbs), brown (10YR 4/3) silty loam; slightly sticky, slightly plastic; many fine to medium rootlets, few roots; many moderate peds; abrupt, wavy boundary.

Layer II: (20-173cmbs), dark yellowish brown (10YR 3/4) silty loam; slightly sticky, slightly plastic; many slightly hard peds, many fine to medium rootlets and roots; 0 to 1% small cobbles; indistinct, wavy boundary.

Layer III: (173-183cmbs), dark yellowish brown (10YR 3/6) silty loam; slightly sticky, slightly plastic; many hard peds, many fine to medium rootlets and roots.

Figure 66. BT-2 north wall profile.

Figure 67. BT-2 north wall, view to the north.

Figure 68. BT-4 pre-excavation, view to the north.

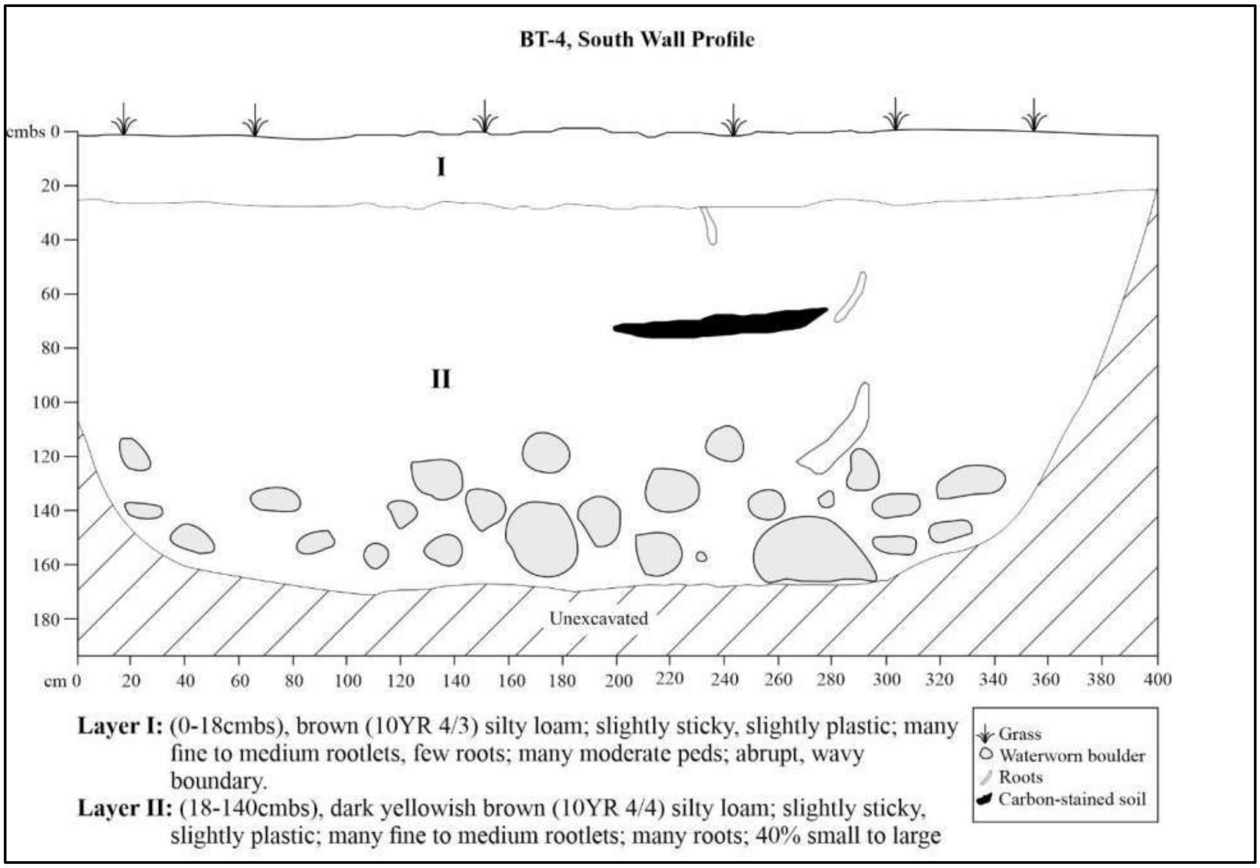


Figure 69. BT-4 south wall profile.

Figure 70. BT-4 south wall, view to the south.

Summary

Site T-1 is a multicomponent site representing occupation of the parcel during the late 1930s/early 1940s, changing parcel boundaries during the early twentieth century, and the use of the parcel to provide open space by Parker Ranch during the 1960s to the present. Subsurface testing did not identify any deposits that could be associated with the *pāhale* known to have been located within the LCAw. 3785 *kuleana* parcel.

The late 1930s/early 1940s component is represented by a buried domestic rubbish deposit. The deposit appears to have been created during the transition from Parker Ranch cowboy Sam Liana's tenancy in the main residence to the Hayashi family's tenancy and conversion of the house to the Magnolia Inn. Datable artifacts from the deposit align well with this transition, which occurred around 1943. As an archaeological deposit, it retains some integrity of all categories, but due to subsurface testing, design, materials, workmanship, and location have been diminished.

The component of the site that documents changing parcel boundaries is the rock wall located on the western parcel boundary. This rock wall does not align with the boundaries of LCAw. 3785, but instead follows the boundary of the current Tax Map Key parcel, which was created through the consolidation of several smaller grant parcels between 1919 and 1950. The wall is in fair condition and was likely altered during the construction of Lanakila Park. It retains good integrity of materials, location, setting, and feeling, with its integrity of design and workmanship likely diminished as evidence by the many collapsed portions.

The most recent component of the site, Lanakila Park, largely retains all categories of integrity; however, several of the original structures are damaged (e.g., there are several portions of the cobble sidewalk that have been repaired or are missing cobbles) or have been removed (e.g., a storage building formerly located to the northwest of the covered rest area.

Overall, Site T-1 retains sufficient integrity to be assessed for its significance, and is assessed to be significant under Criterion d for the information yielded during the current study.

5. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The recorded archaeological site is assessed for its significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-275-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The significance and recommended treatment for the identified site is presented in Table 8 and discussed below.

Table 8. Significance Assessment

Site No.	*Type*	*Age*	*Significance*	*Treatment Recommendation*
T-1	Lanakila Park/ Former residential & commercial lot	1963 to present / 1920s to 1940s	d	No further work

Site T-1 is a multicomponent site representing use of the Lanakila Park parcel throughout the twentieth century. The oldest surviving component may be the rock wall located on its western boundary, which demarcates the final parcel boundary resulting from the gradual consolidation of several smaller pieces of land surrounding the former LCAw. 3785 parcel. The buried rubbish deposit identified in BT-3 provides information about a very specific moment in the history of the parcel, when Parker Ranch cowboy Sam Liana moved out of the main residence and the Hayashi family moved in and converted the house into the Magnolia Inn. The rubbish deposit provides a snapshot of the Liana household ca. 1943, including several food and beverage preferences that include both local, national, and international products as well as personal hygiene preferences. The most recent component of the site, Lanakila Park, physically documents Richard Smart’s affectionate gesture to his grandmother’s memory and the creation of open space within Waimea Town. The site has yielded information that helps to reconstruct this timeline and add to the understanding of the story of a small part of Waimea’s past during two major periods of transition: the onset of World War II and the early implementation of Richard Smart’s plans for Waimea’s future.

For this reason, Site T-1 is assessed to be significant under Criterion D for the information yielded during the current study. The site is adequately documented, and no further work is recommended.

6. CONCLUSION AND RECOMMENDATIONS

As a result of the current study, it appears that the majority of the project area has been previously disturbed. No above-ground historic properties of any kind were observed within the project area within the existing rights-of-way for Lindsey Road, Kawaihae Road, Opelo Road, or Māmalahoa Highway, nor were any identified on TMKs: 6-5-004:027, 6-5-005:021 and 025, or 6-5-007:001. No contributing character defining features of Māmalahoa Highway (Site 30187) were observed in the current project area, except perhaps for the highway's linear route.

Site T-1, Lanakila Park, is located within the proposed ground disturbance for the project. Because the site has been adequately documented, it is not recommended for further historic preservation work. Therefore the recommended determination of effect for the current project is “no historic properties affected.”

With respect to the potential for additional subsurface archaeological historic properties, prior archaeological studies in the Waimea area have demonstrated that the ability to predict the locations of buried archaeological sites lacking surface features is limited. Archaeological monitoring is recommended as a precautionary identification measure within the project area.

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APPENDIX A. SHPD CORRESPONDENCE

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

August 24, 2021

IN REPLY REFER TO:
Project No.: 2021PR00941
Doc. No.: 2108SN11
Archaeology

Jade T. Butay, Director
State of Hawai'i
Department of Transportation (HDOT)
869 Punchbowl St
Honolulu, HI 96813-5097
c/o Jade.Butay@hawaii.gov

Dear Jade T. Butay:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
Initiation of Consultation and Request for Determination
State of Hawai'i Department of Transportation
Waimea Roadway Improvements Project
Project No. HWY-H-01-15
Lalamilo Ahupua'a, South Kohala District, Island of Hawai'i
TMK: (3) 6-5-003:005 por.; (3) 6-5-004:027 por.; (3) 6-5-005:021, 025 por.; (3) 6-5-007:001 por.

This letter provides the State Historic Preservation Division's (SHPD's) review of the State of Hawai'i Department of Transportation's (HDOT) project initiation and request for consultation regarding the proposed roadway improvements project located in Waimea on the island of Hawai'i. The Waimea Roadway Improvements Project (Project No. HWY-H-01-15) includes multimodal safety and operations improvements to the project area's existing roadways in Waimea using State funding. SHPD received the project submittal on August 6, 2021, which included an HDOT project initiation letter dated June 30, 2021, construction designs, and a Literature Review and Field Inspection (LRFI) report (Kepa'a and Barna, April 2020).

Project Description

The HDOT proposes improvements to existing State-owned roadways (Lindsey Road, Kawaihae Road, and Māmalahoa Highway) in Waimea and on portions of the Tax Map Keys (TMKs) parcels. The project will include pavement reconstruction, utility relocation including pole relocation, addition of concrete curb, gutter, and sidewalk, asphalt bike lanes, landscape strips with trees, two-way left turn lane, signage, grade walls, drainage infrastructure (e.g., catch basins, shallow drywells, piping) and lighting. The project will require ground disturbing work with maximum depths varying from 2 ft. to 20 ft. deep as follows: shallow drywells (10 ft.), deep drywells (20 ft.), catch basins and inlets (5-20 ft.), utility poles (10 ft.), signage and roadway reconstruction (3 ft.), fencing and waterlines (5 ft.), and landscaping (2-3 ft.).

Findings

ASM Affiliates (Kepa'a and Barna 2020) prepared the supporting document titled, *An Archaeological Literature Review and Field Inspection for the Waimea Roadway Improvements Project TMKs: (3) 6-5-003:005 (por.), 6-5-004:027 (por.), 6-5-005:021 (por.) and 025 (por.), and 6-5-007:001 (por.) Lālāmilo Ahupua'a South Kohala District Island of Hawai'i.* The report provides a comprehensive historic context of the project vicinity and indicates that no archaeological inventory survey (AIS) studies have been completed within the project area. However, numerous archaeological studies have been conducted to the south and west of the project area, which have resulted in the identification of surface and subsurface historic properties in the vicinity. These historic properties include sites associated with pre-contact Hawaiian occupation of the Waimea Plain from the fifteenth through the twentieth

Jade T. Butay
08/24/2021
Page 2

century. Additionally, ranching activities and activities associated with World War II era military activities associated with Camp Tarawa have been documented.

The LRFI (Kepaʻa and Barna 2020) included a 100% coverage field inspection of the 4.0-acre project. No historic properties of any kind were observed within the project area in the existing rights-of-way for Lindsey Road, Kawaihae Road, Opelo Road, or Māmalahoa Highway, nor were any identified on TMKs: (3) 6-5-004:027, (3) 6-5-005:021 and 025, or (3) 6-5-007:001. The LRFI indicates the presence of two potential historic properties on TMK (3) 6-5-003:005. The first is identified as Lanakila Park built in 1962, that encompasses the entire parcel. The report indicates that there are several features associated within the park complex that could be considered as contributing elements. The second is identified as a dry-stacked rock wall located on the boundary between the park and the Catholic Church on the adjacent parcel [TMK: (3) 6-5-003:029].

Determination

The HDOT requests a determination from SHPD for the need to conduct an AIS for the proposed project. The LRFI indicates the presence of historic properties within the project area and that potential exists for the project to impact Lanakila Park. Therefore, **SHPD requests an archaeological inventory survey (AIS)** with a subsurface testing component be conducted and that an AIS report meeting the requirements of HAR §13-276-5 be submitted to SHPD for review and acceptance prior to initiation of project related work.

The AIS shall be conducted by a qualified archaeologist permitted by the State of Hawaiʻi in order to adequately identify and document any archaeological historic properties that may be present, to assess their significance, to determine the potential impacts of this project on any identified archaeological historic properties, and to identify and ensure appropriate mitigation is implemented, if needed.

SHPD requests the HDOT, and their archaeological firm consult with our office regarding an appropriate testing strategy prior to initiation of the AIS.

SHPD shall notify the HDOT when the archaeological inventory survey report and any required mitigation plans are accepted, and the project initiation process may proceed.

When completed, please submit the draft AIS report to our office via HICRIS Project 2021PR00941 using the Project Supplement option.

Please contact Sean Nāleimaile at (808) 933-7651 or at Sean.P.Naleimaile@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Brian Tyau, Brian.Tyau@hawaii.gov

APPENDIX G

Pre-Assessment Consultation Comments and Responses

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Ms. Jojo Tanimoto
P.O. Box 44337
Kamuela, Hawaii 96743
Email:guavaland622@gmail.com

March 4, 2020

SSFM International, Inc.
% Jennifer Scheffel
99 Aupuni Street, Suite 202
Hilo, Hawaii 967

Re: Waimea Roadway Improvement Project

Dear Ms. Scheffel:
Thank you for the opportunity to make comment on this early draft.

I like the raised Bollard and Pedestrian Island at Mamalahoa Highway/Lindsey Road intersection. However,

- There has been a concern regarding the low spot at the stop light (on the former gas station-on Lindsey Road). When it rains, it becomes a deep puddle and pedestrians get drenched. This problem prevented the service station from doing improvements. Perhaps the raised shoulder can extend to the bridge.
- Another problem for the station was the stabilization of the bridge, on both sides of Lindsey Road.
- There seems a visual risk from exiting the two parking lot(s)-across First Hawaiian Bank. Perhaps the landscaped trees on the shoulder can be removed and some other plant can replace them (like akulikuli flowers).

On Kawaihae Road,
I hope the center arrow lane could alleviate the Longs Drugs exiting traffic from trying "to beat the traffic"; if that lane extends to Longs Drugs. Getting out of Longs Drugs, Hawaiian Style Cafe and the B&B parking lot is a challenge.

If you have any questions, please email me. Mahalo

Sincerely

SSFM International

December 3, 2020 SSFM 2015_157.000

Ms. Jojo Tanimoto
P.O. Box 44337
Kamuela, Hawaii 96743
Email: guavaland622@gmail.com

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Tanimoto,

Thank you for your letter dated March 4, 2020 regarding the subject project.

Thank you for your support of the project. We provide the following responses to your comments:

Mamalahoa Highway/Lindsey Road intersection

- Drainage at the intersection will be addressed as part of the design engineering.
- Improvements to the Lindsey Road bridge are not part of this project. However, your concerns have been noted.
- The existing landscaping is not within the existing road right-of-way and is on the parcel owned by the Bank of Hawaii. Therefore, replacement of the existing landscaping would have to be completed by the Bank of Hawaii. HDOT will coordinate with the landowner regarding the potential to cut back the landscaping to improve safety and sight distance.

Kawaihae Road

- The center arrow lane will extend from the Kawaihae Road/Lindsey Road intersection to Opelo Road, which is expected to improve ingress and egress to Long's Drugs, Hawaiian Style Café, and other businesses along the corridor.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

DAVID Y. IGE
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

March 9, 2020

SSFM International, Inc.
RECEIVED
3.17.2020

Ms. Jennifer Scheffel
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, HI 96720

Dear Ms. Scheffel:

Thank you for your submittal requesting comments to the Pre-Assessment Consultation for Draft Environmental Assessment at Waimea Roadway Improvements Project, Waimea, Island of Hawaii, Hawaii, Tax Map Keys (TMKs): (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, 6-5-004:027.

Project activities shall comply with the following Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control

Should you have any questions, please contact me at (808) 586-4700.

Sincerely,

Jeffrey M. Eckerd
Program Manager
Indoor and Radiological Health Branch

SSFM International

December 3, 2020

SSFM 2015_157.000

Mr. Jeffrey M. Eckerd, Program Manager
State of Hawaii Department of Health
Indoor and Radiological Health Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Eckerd,

Thank you for your letter dated March 9, 2020 regarding the subject project.

Your comment regarding compliance with Chapter 11-46, Community Noise Control, of the Hawaii Administrative Rules has been noted. Community noise permits and/or variances are anticipated to be needed for project construction, and the Hawaii Department of Transportation will comply with all applicable regulations.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

SSFM International, Inc.
Attn: Jennifer Scheffel
99 Aupuni St., Suite 202
Hilo, HI 96720

SSFM International, Inc.
RECEIVED
3.17.2020

Aloha Jennifer,

I am a resident of Waimea and am writing to you with concerns about the proposed improvements for the intersections of Mamalahoa Highway and Lindsey Roads with Kawaihae Road. My major concerns are as follows:

Proposed Roundabout at Kawaihae and Lindsey Roads

1. I don't believe the roundabout at this intersection will ease traffic flow. If a two lane roundabout is planned it may provide additional space for cars to sit during high volume times of the day but that is about it. As most roundabouts have several exit points, diverting traffic off of the main road, this situation only has one at Lindsey Road. I'm not sure of the gain here.
2. Most people who have lived on the island all of their life are unfamiliar with driving on roundabouts. I know this can be partly overcome with education so I would suggest educational materials/sessions should be offered to familiarize everyone with the rules on roundabouts. It should also become part of the driver education exam for new licenses being issued if it isn't already. I come from an area where roundabouts existed all of my life so when I learned to drive I learned how to properly navigate roundabouts. I can see a lot of confusion ensuing with anyone unfamiliar with them without the proper education.
3. The island has a lot of visitors from other countries that drive on the opposite side of the road and I can't imagine what havoc that could cause on a roundabout. I have witnessed visitors driving on the wrong side of the road here or turning into the wrong lane of a road almost causing head-on collisions. A roundabout may be one more source of confusion for them.
4. With the intent to utilize the park that sits next to Annunciation Church for part of the roundabout, I would want the acquisition of that property or any other property involved to be complete, with no outstanding claims or access rights by any other parties, prior to starting anything on this project. I can think of several half-done projects where money was poured into them only to find they cannot be completed due to some ownership issue. A lot of money spent with no available benefits intended by the project.

Intersection at Mamalahoa Highway and Lindsey Road

1. It appears that a right turn from Mamalahoa Highway onto Lindsey Road will not be navigable by trucks with the reduction to one lane. Same for trucks making a right turn from Lindsey Road onto Mamalahoa Highway, although there is only one lane currently there. It seems the proposed bollards will also make it difficult for trucks to make the necessary wide turns.
2. I don't see how this will improve any traffic jams at this intersection during high volume times, especially turning from Mamalahoa Highway onto Lindsey road during morning school traffic. You often can't get through the light to make the turn onto Lindsey or get stuck in the middle of the intersection as the light turns red for you.
3. Same comment as above about any required land acquisitions, right of ways, etc. being resolved prior to beginning the project.

A final comment is that without a bypass around Waimea providing an alternate route I can't see much opportunity for improvement. The turn lane on Kawaihae Road should help move traffic along but traffic will only increase as the years go by. It is disappointing that with the costs of these projects we will not really get much closer to resolving the bigger issue, rerouting traffic so it doesn't have to come through our small town.

Thank you for the opportunity to comment.

Debbie Diehl
PO Box 437386
Kamuela, HI 96743

SSFM International

December 3, 2020 SSFM 2015_157.000

Ms. Debbie Diehl
P.O. Box 437386
Kamuela, Hawaii 96743

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Diehl,

Thank you for your letter received March 17, 2020 regarding the subject project.

We offer the following responses to your concerns regarding the proposed project:

Proposed Roundabout at Kawaihae and Lindsey Roads

1. Based on initial analysis conducted during the Planning and Environment Linkages process, the roundabout is expected to result in a delay reduction in both the AM and PM peak periods, which will reduce congestion at the intersection. A full analysis of traffic operations will be provided in the Draft Environmental Assessment.
2. Prior to construction of the roundabout, a community informational meeting will be held that will include details regarding how motorists, pedestrians, and bicyclists will be required to navigate the roundabout. In addition, an informational video will be posted on the Hawaii Department of Transportation's (HDOT) website.
3. We acknowledge your concern about international drivers.
4. HDOT is currently negotiating with all landowners from whom land acquisition will be required.

Intersection at Mamalahoa Highway and Lindsey Road

1. Turn radius issues will be analyzed during the design engineering phase.
2. The roundabout is expected to result in a delay reduction in both the AM and PM peak periods, which will reduce congestion at the intersection. The improvements to the Mamalahoa Highway and Lindsey Road intersection would reduce congestion through the implementation of optimized signal timing. A full analysis of reducing congestion will be provided in the Draft Environmental Assessment.
3. HDOT is currently negotiating with all landowners from whom land acquisition will be required.

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During the Planning and Environment Linkages (PEL) process, a bypass alternative was also identified. This alternative is independent of the proposed in-town improvements. One of the criteria during the PEL process was to identify projects that could be funded with the available resources within the next two years. The bypass alternative does not have funding within the next two years. Therefore, the bypass project would be undertaken in the future as funding becomes available.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

Dr. Billy Bergin

March 18, 2020

Jennifer M. Scheffel
Senior Environmental Planner
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, HI 96720

SSFM International, Inc.
RECEIVED
3.27.2020

Dear Ms. Scheffel:

Thank you for the March 3, 2020 memo requesting comments regarding the impact of proposed actions pertinent to Lindsey and Kawaihae roads and Mamalahoa Highway here in Waimea.

First, I commend SSFM's thorough handling of the Planning and Environment Linkages (PEL) study for the Waimea Regional Safety Project over the course of the seven community meetings.

Secondly, the impacts are positive to the community in both Phase I and Phase II. The multi-modal treatments to Kawaihae Road; the sidewalks, bikeways and crosswalks are clearly enhancing safety standards.

Lastly, I would presume that final engineering standards applied to the conceptual nature of Phase I and II may bring about some changes that further enhance safety. We look forward to the final iteration of both phases.

Sincerely,

Dr. Billy Bergin

c: Patti Cook

66-1520 PuuHuluhulu Road
Kamuela, Hawaii 96743

SSFM
International

December 3, 2020

SSFM 2015_157.000

Dr. Billy Bergin
66-1520 Puu Huluhulu Road
Kamuela, Hawaii 96743

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Dr. Bergin,

Thank you for your letter dated March 18, 2020 regarding the subject project.

Thank you for your support of the proposed project. As you mention, changes to the conceptual designs are anticipated as design engineering and traffic studies progress.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,
SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

DAVID Y. IGE
GOVERNOR

CURT T. OTAGURO
COMPTROLLER

AUDREY HIDANO
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)20.032

MAR 2 3 2020

SSFM International, Inc.
RECEIVED
3.30.2020

Ms. Jennifer M. Scheffel
Senior Environmental Planner
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, HI 96720

Dear Ms. Scheffel:

Subject: Pre-Assessment Consultation for Draft Environmental Assessment of Waimea Roadway Improvements Project, Waimea, Island of Hawaii, Hawaii, Tax Map Keys (3) 6-5-003:005, 6-5-007:001, 6-5-005:021, 6-5-005:025, 6-5-004:027

Thank you for this opportunity to review and comment during the pre-assessment consultation period for subject project that will be implemented by the State Department of Transportation. We have no comments to offer at this time as the project does not impact any of our facilities or projects.

If there are any questions, please call me at 586-0400, or have your staff call Mr. Brian Isa of the Public Works Division at 586-0484.

Sincerely,

CURT T. OTAGURO
Comptroller

BI:jl

SSFM International

December 3, 2020

SSFM 2015_157.000

Mr. Curt T. Otaguro, Comptroller
State of Hawaii Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810-0119

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Otaguro,

Thank you for your letter dated March 23, 2020 regarding the subject project.

We acknowledge that the State of Hawaii Department of Accounting and General Services has no comments on the proposed project as the project does not impact any of your facilities or projects.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,
SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

DAVID Y. IGE
GOVERNOR
STATE OF HAWAII

JOSH GREEN
LT. GOVERNOR
STATE OF HAWAII

WILLIAM J. AILA, JR
CHAIRMAN
HAWAIIAN HOMES COMMISSION

TYLER I. GOMES
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

March 25, 2020

In reply refer to:
PO-20-051

Ms. Jennifer Scheffel, Senior Environmental Planner
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawaiʻi, 96720

Subject: Pre-Assessment Consultation for a HRS Chapter 343 Environmental Assessment (EA) for the Department of Transportation Waimea Roadway Improvements Project

Dear Ms. Scheffel

The Department of Hawaiian Home Lands acknowledges receiving the request for comments on the above-cited project. After reviewing the materials submitted, this project is located near several DHHL's Homestead Communities. The DHHL homesteads in Kūhiō Villages are the closest and are located less than one mile from the proposed project location. Due to its proximity, the project may impact both our lands and beneficiaries.

DHHL has approximately 30,000 acres in the Waimea Nui region. The Draft EA should assess the proposed project's potential impacts on Hawaiian Home Lands in the region as well as evaluate of the project's consistency with DHHL's General Plan, Hawaiʻi Island Plan, Waimea Nui Regional Plan.

As DOT and its agents develop environmental assessment documents, it is important that DHHL's beneficiaries are informed of potential impacts, proposed mitigations, and evaluation of alternatives to the location and scope proposed. DHHL and homestead associations located in the Waimea region should be included in future consultation conducted regarding this project. A list of DHHL homesteads is located at https://dhhl.hawaii.gov/homestead-associations/. In addition, DHHL encourages DOT and its agents to consult with (N)native Hawaiian organizations when preparing environmental assessments in order to better assess potential impacts to cultural and natural resources, access and other rights of Native Hawaiians.

Mahalo for the opportunity to provide comments. DHHL looks forward to seeing a more detailed evaluation of the project when the draft Environmental Assessment is released. If you have any questions, please call Malia Cox, at 620-9485 or contact via email at malia.m.cox@hawaii.gov.

Aloha,

William J. Ailā Jr., Chairman
Hawaiian Homes Commission

Copy: Jim Dupont, DHHL-West Hawaii District Office via email
Waimea Hawaiian Homesteaders Association via email

SSFM International

December 3, 2020

SSFM 2015_157.000

Mr. William J. Aila Jr., Chairman
Hawaiian Homes Commission
State of Hawaii Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaii 96805

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Aila,

Thank you for your letter dated March 25, 2020 regarding the subject project.

Potential impacts to Department of Hawaiian Home Lands' homesteads and beneficiaries will be analyzed in the Draft Environmental Assessment (EA). The Draft EA will also evaluate the project's consistency with the DHHL's General Plan, Hawaii Island Plan, and Waimea Nui Regional Plan.

A Cultural Impact Assessment is being prepared for inclusion in the Draft EA. This document will be prepared in compliance with the State Historic Preservation Division's 1997 *Guidelines for Assessing Cultural Impacts,* which includes the identification and consultation with individuals and organizations with knowledge of the area potentially affected by the proposed action.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,
SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

SSFM International, Inc.
RECEIVED
4.9.2020

April 1, 2020

SSFM International, Inc.
Attention: Jennifer Scheffel
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

Re: Pre-Assessment Consultation for a Draft Environmental Assessment for the Waimea Roadway Improvement Project, Waimea, Island of Hawaii, TMKs 6-5-003:005, 5-5-007:00, 6-5-005:021, 6-5-005:025, an 6-5-004:027

Dear Ms. Scheffel:

The Hawaii State Department of Education (HIDOE) has the following comments for the preparation of a Draft Environmental Assessment (DEA) on the proposed Waimea Roadway Improvement Project (Project). According to the information provided, the Hawaii State Department of Transportation will implement multimodal safety and operational improvements to Kawaihae Road, Lindsey Road, and Mamalahoa Highway located at Waimea, Island of Hawaii, TMKs 6-5-003:005, 5-5-007:00, 6-5-005:021, 6-5-005:025, an 6-5-004:027.

The Phase II Mamalahoa Highway and Lindsey Road intersection improvements appear to be in the vicinity of Waimea Elementary School (School). The DEA should identify anticipated short term and long term impacts to the School from the Project.

The HIDOE will provide further comments after reviewing the DEA.

Thank you for the opportunity to comment. Should you have questions, please contact Robyn Loudermilk, Acting Land Use Planner of the Facilities Development Branch, Planning Section at (808) 784-5093 or via email at robyn.loudermilk@k12.hi.us.

Respectfully,

Kenneth G. Masden II
Public Works Manager
Planning Section

c: Janette Snelling, Complex Area Superintendent, Honokaa-Kealakehe-Kohala-Konawaena Complex Area

SSFM International

December 3, 2020

SSFM 2015_157.000

Mr. Kenneth G. Masden II, Public Works Manager
Planning Section
State of Hawaii Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Masden,

Thank you for your letter dated April 1, 2020 regarding the subject project.

The Draft Environmental Assessment (EA) will identify potential short-term (construction) and long-term impacts along the project corridor and at project intersections. In addition, a Maintenance of Traffic plan will be prepared prior to any construction to minimize impacts during construction.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From: Whitworth, Natalie <Natalie.Whitworth@hawaiicounty.gov>
Sent: Tuesday, April 21, 2020 3:15 PM
To: Jennifer Scheffel
Subject: Pre-Assessment Consultation for Draft EA -Waimea Roadway Improvements Project

Hi Jennifer,

I am aware the 30-day comment period for the Pre-assessment has come and gone, but please accept our comments:

1. All earthwork and grading shall conform to Chapter 10 – Erosion and Sedimentation Control – of the Hawaii County Code.
2. All work within the County Right-of-Way shall conform to Chapter 22 – County Streets – of the Hawaii County Code.
3. Special Flood Hazard Area AE may affect the subject project as designated on the Flood Insurance Rate Map by the Federal Emergency Management Agency. Improvements in a floodplain shall conform to Chapter 27 – Floodplain Management – of the Hawaii County Code.
4. Please note that Parker School is proposing to install a mini-roundabout at the intersection of Lindsey Road and Kapiolani Road. Please ensure there are no conflicts with that design and that it is considered in the EA.

Please provide us with a copy of the EA when it is completed for our review and comment. Should you have any questions on this matter, please let me know.

Thank you,

Natalie Whitworth, P.E.
Civil Engineer V
Department of Public Works, Engineering Division
74-5044 Ane Keohokalole Highway, Bldg. D
Kailua Kona, HI 96740
Phone: 323-4853

SSFM International

December 3, 2020 SSFM 2015_157.000

Ms. Natalie Whitworth, P.E.
County of Hawaii Department of Public Works
Engineering Division
74-5044 Ane Keohokalole Highway, Bldg. D
Kailua Kona, Hawaii 96740
Email: Natalie.Whitworth@hawaiicounty.gov

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Whitworth,

Thank you for your email dated April 21, 2020 regarding the subject project.

Thank you for your comments regarding compliance with various County of Hawaii regulations. The Hawaii Department of Transportation (HDOT) will comply with all applicable County regulations, including Chapter 10, Chapter 22, and Chapter 27 of the Hawaii County Code.

The proposed mini-roundabout at Lindsey Road and Kapiolani Road is outside of the proposed project boundary. HDOT will coordinate with Parker School to ensure that there are no conflicts between the two projects.

A copy of the Draft Environmental Assessment (EA) will be provided to the County of Hawaii Department of Public Works, Engineering Division upon its publication.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 8, 2020

SSFM International, Inc.
Attn: Ms. Jennifer M. Scheffel
Sr. Environmental Planner
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

via email: jscheffel@ssfm.com

Dear Ms. Scheffel:

SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project** located at Waimea, Island of Hawaii; TMKs: (3) 6-5-003:005; (3) 6-5-007:001, (3) 6-5-005: 021, (3) 6-5-005:025, and (3) 6-5-004:027 on behalf of State Department of Transportation

Thank you for the opportunity to review and comment on the subject matter. The Land Division of the Department of Land and Natural Resources (DLNR) distributed or made available a copy of your request pertaining to the subject matter to DLNR's Divisions for their review and comments.

With the Governor's stay at home order issued in March and extended through the end of May 2020, staff have been working from home, which has been challenging.

At this time, enclosed are comments from the (a) Engineering Division, (b) Land Division-Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION

2020 MAR 13 AM 10: 34

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

'20 MAR 10 AM 10:29 ENGINEERING

March 9, 2020

MEMORANDUM

FROM

~~TO:~~ **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation (via email: DLNR.Intake.SHPD@hawaii.gov)

TO

~~FROM:~~ Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project**
LOCATION: Waimea, Island of Hawaii; TMKs: (3) 6-5-003:005; (3) 6-5-007:001, (3) 6-5-005:021, (3) 6-5-005:025, and (3) 6-5-004:027
APPLICANT: SSFM International, Inc. on behalf of State Department of Transportation

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **April 1, 2020.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Print Name: Carty S. Chang, Chief Engineer
Date: 3/13/20

Attachments
cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Pre-Assessment Consultation for Draft Environmental Assessment for the Proposed Waimea Roadway Improvements Project
TMK(s): (3) 6-5-003:005, (3) 6-5-007:001, (3) 6-5-005:021, (3) 6-5-005:025, and (3) 6-5-004:027
Location: Waimea, Island of Hawaii
Applicant: SSFM International, Inc. on behalf of State Department of Transportation

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM), which can be viewed on our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

Signed: [signature]
CARTY S. CHANG, CHIEF ENGINEER

Date: 3/13/20

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

120

RECEIVED
LAND DIVISION
2020 MAR 12 A 10:22

March 9, 2020

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation (via email: DLNR.Intake.SHPD@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project**
LOCATION: Waimea, Island of Hawaii; TMKs: (3) 6-5-003:005; (3) 6-5-007:001, (3) 6-5-005:021, (3) 6-5-005:025, and (3) 6-5-004:027
APPLICANT: SSFM International, Inc. on behalf of State Department of Transportation

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **April 1, 2020.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: [signature]
Print Name: GORDON C. HEIT
Date: 3/23/20

Attachments
cc: Central Files

SSFM International

December 3, 2020 SSFM 2015_157.000

Mr. Russell Y. Tsuji, Land Administrator
State of Hawaii Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Tsuji,

Thank you for your email dated May 8, 2020 regarding the subject project. We appreciate your distributing our pre-assessment consultation letter throughout the divisions of the Department of Land and Natural Resources. We offer the following response to the comments received from the Engineering Division and Land Division – Hawaii District.

Engineering Division
Thank you for your comments regarding compliance with National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR). An assessment of potential impacts to the project from being within a flood hazard area will be included in the Draft Environmental Assessment (EA) and considered during the design engineering phase of the project.

Land Division – Hawaii District
We acknowledge that the Department of Land and Natural Resources, Land Division – Hawaii District has no comments on the proposed project.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From:	Mina Pasierb
Sent:	Wednesday, March 4, 2020 4:19 PM
To:	Jennifer Scheffel
Subject:	FW: Pre Assessment Consultation for Draft EA

From: Annette Cromwell <ajcmaui3@gmail.com>
Sent: Wednesday, March 4, 2020 4:18 PM
To: Mina Pasierb <mpasierb@ssfm.com>
Subject: Re: Pre Assessment Consultation for Draft EA

The first road with the round about is not necessary and a waste of money. Plane for long range so you don't have to do this
again in 5 years., Sincerely Annette Cromwell

On Wed, Mar 4, 2020 at 8:41 AM Mina Pasierb <mpasierb@ssfm.com> wrote:

Dear Ms. Cromwell,

The State of Hawaii Department of Transportation (HDOT), Highways Division, plans to implement safety and operations improvements along existing State-owned roadways in Waimea.
Please see attached letter.

Thank you,

Mina Pasierb | Project Coordinator

501 Sumner Street, Suite 620 | Honolulu, Hawaii 96817
T 808.531.1308 | D 808.628.5813 | F 855.329.7736
mpasierb@ssfm.com | www.ssfm.com

Commitment To Resilience

SSFM International

December 3, 2020 SSFM 2015_157.000

Ms. Annette Cromwell
Email: ajcmaui3@gmail.com

SUBJECT: Waimea Regional Safety Study
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Cromwell,

Thank you for your email dated March 4, 2020 regarding the subject project.

The purpose of the proposed action is to improve safety and reduce congestion. Roundabouts are a proven safety countermeasure because they reduce the number and severity of conflict points and lower the speed of vehicles moving through the intersection. In addition, the roundabout is expected to result in a delay reduction in both the AM and PM peak periods, which will reduce congestion at the intersection. A full analysis of improving safety and reducing congestion will be provided in the Draft Environmental Assessment (EA).

During the Planning and Environment Linkages (PEL) process, a bypass alternative was also identified. This alternative is independent of the proposed in-town improvements. One of the criteria during the PEL process was to identify projects that could be funded with the available resources within the next two years. The bypass alternative does not have funding within the next two years. Therefore, the bypass project would be undertaken in the future as funding becomes available.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From:	Clemson Lam <c.lam4@hawaiiantel.net>
Sent:	Wednesday, March 4, 2020 1:48 PM
To:	Jennifer Scheffel; Mina Pasierb
Cc:	Otani, Barett; Val Overland; Leningrad Elarionoff; James Hustace
Subject:	Waimea safety improvments

Dear Jennifer,

As a member of the Waimea Trails and Greenways committee I applaud the efforts to increase safety in the village of Waimea by providing safe, well marked, separated conditions for bicycles and pedestrian. In addition to the improvements noted, I would like to see shoulder improvements for bicycles and pedestrians along the Kawaihae Road from Opelo Road all the way to the Waiaka Bridge. This is something we can build upon in future projects.

Thank you for your work on this.

Mahalo,

Clemson Lam

SSFM International

December 3, 2020

SSFM 2015_157.000

Mr. Clemson Lam
Email: clam4@hawaiiantel.net

SUBJECT: Waimea Regional Safety Study
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Lam,

Thank you for your email dated March 4, 2020 regarding the subject project.

Thank you for your support of the project. We have noted your recommendation for future bicycle and pedestrian improvements along Kawaihae Road between Opelo Road and the Waiaka Bridge.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From:	Keith Neal <windrider4002@yahoo.com>
Sent:	Wednesday, March 4, 2020 10:37 AM
To:	Jennifer Scheffel; Mina Pasierb
Cc:	Tim Richards; Amy Seeley; Rep. David A. Tarnas; seninouye@capitol.hawaii.gov
Subject:	Re: Pre Assessment Consultation for Draft EA
Attachments:	200303 Waimea_EA_PreAssessConsult_Keith Neil.pdf

Dear Jennifer and Mina,
While the public safety improvements at Opelo Road are welcome, the other proposed projects either side of the Lindsey bridge are woefully inadequate, disruptive, and does not solve the root cause of congestion on this route.

There must be an additional roadway constructed from Kawaihae Road bypassing Waimea town. Not only is this additional roadway necessary to relieve congestion through Waimea town, it is a public safety issue! In the event of blockage or severe congestion on Kawaihae or Mamalahoa roadways no emergency vehicles can travel on the only cross island route in the north part of the county!

Furthermore, I object to undertaking the proposed projects either side of the Lindsey bridge (attachments 1 & 3) until the bypass roadway is completed.

Sincerely,
Keith Neal
Waimea

On Wednesday, March 4, 2020, 9:11:10 AM HST, Mina Pasierb <mpasierb@ssfm.com> wrote:

Dear Mr. Neil,

The State of Hawaii Department of Transportation (HDOT), Highways Division, plans to implement safety and operations improvements along existing State-owned roadways in Waimea.
Please see attached letter.

Thank you,

Mina Pasierb | Project Coordinator

SSFM International

December 3, 2020 SSFM 2015_157.000

Mr. Keith Neal
Email: windrider4002@yahoo.com

SUBJECT: Waimea Roadway Improvements Project
Waimea, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Neal,

Thank you for your email dated March 4, 2020 regarding the subject project.

Thank you for your support of the safety improvements at Opelo Road. The purpose of the proposed action is to improve safety and reduce congestion. Roundabouts are a proven safety countermeasure because they reduce the number and severity of conflict points and lower the speed of vehicles moving through the intersection. In addition, the roundabout is expected to result in a delay reduction in both the AM and PM peak periods, which will reduce congestion at the intersection. The improvements to the Mamalahoa Highway and Lindsey Road intersection would increase safety for bicyclists and pedestrians by installing raised pedestrian islands with bollards and bicycle lanes. Congestion is expected to be reduced through the implementation of optimized signal timing. A full analysis of improving safety and reducing congestion will be provided in the Draft Environmental Assessment.

During the Planning and Environment Linkages (PEL) process, a bypass alternative was also identified. This alternative is independent of the proposed in-town improvements. One of the criteria during the PEL process was to identify projects that could be funded with the available resources within the next two years. The bypass alternative does not have funding within the next two years. Therefore, the bypass project would be undertaken in the future as funding becomes available.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

December 3, 2020

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From: Val Overlan <val.overlan@pathhawaii.org>
Sent: Friday, March 6, 2020 2:34 PM
To: Clemson Lam
Cc: Jennifer Scheffel; Mina Pasierb; Otani, Barett; Leningrad Elarionoff; James Hustace
Subject: Re: Waimea safety improvments

Hi Jennifer,

I'd like to second Clemson Lam's request for shoulder improvements for pedestrians and cyclists along Kawaihae Road as part of the improvement plans in Waimea.
Thanks so much for the information and the work being done to make our road ways safer for all.

Valerie Overlan

--
Valerie Sagan Overlan
Executive Director
PATH~ Peoples Advocacy for Trails Hawaii
808-854-5045 cell
808-326-7284 office
val.overlan@pathhawaii.org

Become a PATH member and support trails and pathways on Hawaii Island!

www.pathhawaii.org

On Wed, Mar 4, 2020 at 1:48 PM Clemson Lam <c.lam4@hawaiiantel.net> wrote:

> Dear Jennifer,
>
> As a member of the Waimea Trails and Greenways committee I applaud the efforts to increase safety in the village of Waimea by providing safe, well marked, separated conditions for bicycles and pedestrian. In addition to the improvements noted, I would like to see shoulder improvements for bicycles and pedestrians along the Kawaihae Road from Opelo Road all the way to the Waiaka Bridge. This is something we can build upon in future projects.
>
> Thank you for your work on this.
>
> Mahalo,

> Clemson Lam

--
Valerie Sagan Overlan
Executive Director
PATH~ Peoples Advocacy for Trails Hawaii
808-854-5045 cell
808-326-7284 office
val.overlan@pathhawaii.org

Become a PATH member and support trails and pathways on Hawaii Island!

www.pathhawaii.org

December 3, 2020 SSFM 2015_157.000

Ms. Valerie Sagan Overlan, Executive Director
PATH Hawaii
Email: val.overlan@pathhawaii.org

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Overlan,

Thank you for your email dated March 6, 2020 regarding the subject project.

Thank you for your support of the project. We have noted your recommendation for future bicycle and pedestrian improvements along Kawaihae Road between Opelo Road and the Waiaka Bridge.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From: Fujio, Mary <Mary.Fujio@hawaiicounty.gov>
Sent: Monday, March 9, 2020 1:16 PM
To: Jennifer Scheffel
Subject: Waimea Roadway Improvements Project

Good afternoon –

Pursuant to your March 3, 2020, letter soliciting comments for preparation of an EA, our department's Solid Waste Division and Wastewater Division have no comments.

Thank you.

Mary E. Fujio
Private Secretary to William Kucharski, Director
and Diane Noda, Deputy Director
Department of Environmental Management
County of Hawaiʻi
345 Kekūanāoʻa Street, Suite 41
Hilo, Hawaiʻi 96720
Telephone: (808) 961-8099

SSFM International

December 3, 2020 SSFM 2015_157.000

Ms. Mary E. Fujio, Private Secretary
County of Hawaii Department of Environmental Management
Email: mary.fujio@hawaiicounty.gov

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Ms. Fujio,

Thank you for your email dated March 9, 2020 regarding the subject project. We acknowledge that the County of Hawaii Department of Environmental Management's Solid Waste Division and Wastewater Division has no comments on the proposed project.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

Jennifer Scheffel

From: Aaron Stene <aaron@aaronstene.net>
Sent: Thursday, March 12, 2020 8:36 AM
To: Jennifer Scheffel
Subject: Waimea Roadway Improvements Pre-EA

Importance: High

Dear Ms. Scheffel,

Thank you for sending the letter requesting comments regarding the Waimea Roadway Improvements Pre-EA. I don't have any comments about the proposed improvements, but I'll check in about two months to see where things stand.

Aaron
--
Aaron Stene
aaron@aaronstene.net
808-333-0996

This email has been scanned for spam and viruses by Proofpoint Essentials. Visit the following link to report this email as spam:
https://us3.proofpointessentials.com/index01.php?mod_id=11&mod_option=logitem&mail_id=1584038177-b7BFFN7UYYpl&r_address=jscheffel%40ssfm.com&report=1

SSFM International

December 3, 2020 SSFM 2015_157.000

Mr. Aaron Stene
Email: aaron@aaronstene.net

SUBJECT: Waimea Roadway Improvements Project
South Kohala District, Island of Hawaii, Hawaii
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027
Response to Pre-Assessment Consultation Comments

Dear Mr. Stene,

Thank you for your email dated March 12, 2020 regarding the subject project. We acknowledge that you have no comments currently. The Draft EA is in progress and is anticipated to be published in December 2020 or January 2021.

Your letter, along with this response letter, will be included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process. Should you have additional comments or questions regarding this project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

Mahalo,

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Environmental Planner

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APPENDIX H

Comments and Responses on the Draft EA

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Jennifer Scheffel

From: Vares, Kyle <Kyle.Vares@hawaiicounty.gov>
Sent: Monday, March 8, 2021 11:21 AM
To: Jennifer Scheffel
Subject: Waimea Roadway Improvements

Follow Up Flag: Follow up
Flag Status: Flagged

Jennifer,
I have reviewed the proposed roadway improvement project for Waimea. Please assure all Fire Department access road requirements are followed. This is especially true for the roundabout at the Kawaihae Rd. and Lindsey Rd. intersection.
Thanks for reaching out for our input. Let me know if you need anymore information.
Mahalo,
Kyle Vares
Fire Captain
Prevention Bureau

SSFM International
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May 3, 2021 SSFM 2015_157.000

Mr. Kyle Vares, Fire Captain
County of Hawaii
Fire Department
349 Kapiolani Street
Hilo, HI 96720-3998

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Mr. Vares,

Thank you for your email dated March 8, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project.

The design for the roadway improvements, including the proposed roundabout at the Kawaihae Road and Lindsey Road intersection, considered the needs associated with emergency response in and around the area. A large semi-trailer truck was used as the design vehicle for all through movements along the primary corridor while a smaller single-unit truck (similar dimensions to the Fire Engine Ladder Truck) was used to confirm that all turn movements could be made.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M Scheffel

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

DAVID Y. IGE
GOVERNOR

CURT T. OTAGURO
COMPTROLLER

AUDREY HIDANO
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)21.037

MAR 10 2021

Jennifer Scheffel
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720.

SSFM International, Inc.
RECEIVED
3.12.2021

Dear Ms. Scheffel:

Subject: Draft Environmental Assessment for
Waimea Roadway Improvements Project
Waimea, Hawaii
TMK: (3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; 6-5-007:001

Thank you for the opportunity to comment on the subject project. We have no comments to offer at this time as the proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities.

If you have any questions, your staff may email Ms. Gayle Takasaki of the Planning Branch at gayle.s.takasaki@hawaii.gov.

Sincerely,

CHRISTINE L. KINIMAKA
Public Works Administrator

GT:mo
c: Ken Tatsuguchi, DOT Highways

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May 3, 2021

SSFM 2015_157.000

Ms. Christine L. Kinimaka, Public Works Administrator
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810-0119

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Ms. Kinimaka,

Thank you for your letter dated March 10, 2021 (Letter No. (P)21.037) regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project. We acknowledge that the Department of Accounting and General Services (DAGS) does not have any comments as the proposed project does not impact DAGS' projects or existing facilities.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

DAVID Y. IGE
GOVERNOR
STATE OF HAWAII

JOSH GREEN
LT. GOVERNOR
STATE OF HAWAII

WILLIAM J. AILA, JR
CHAIRMAN
HAWAIIAN HOMES COMMISSION

TYLER I. GOMES
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

March 15, 2021

In reply refer to:
PO-21-066

Ms. Jennifer Scheffel, Senior Environmental Planner
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawai'i, 96720
jmscheffel@gmail.com

Subject: Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFNSI) for the Department of Transportation Waimea Roadway Improvements Project

Dear Ms. Scheffel

The Department of Hawaiian Home Lands acknowledges receiving the request for comments on the Waimea Roadway Improvements Project DEA-AFNSI. The Department of Hawaiian Home Lands is governed by the Hawaiian Homes Commission Act of 1920, enacted by the U.S. Congress to protect, and improve the lives of native Hawaiians. The Act was incorporated as a provision in the State Constitution in 1959 when Hawai'i was granted statehood. Responsibility for the Commission and the Hawaiian home lands was transferred to the State at that time. The Hawaiian Homes commission Act provides clear roles and responsibilities to implement the act, while our State administrative rules provide for implementation. DHHL offers the following comments regarding the Department of Transportation's Waimea Roadway Improvements project.

This project is located near several DHHL's Homestead Communities. The DHHL homesteads in Kūhiō Villages are the closest and are located less than one mile from the proposed project location. Due to its proximity, the project is likely to impact our beneficiaries. While the short-term impacts are likely to be negative, it is anticipated that the roadway improvements as described will result in beneficial improvements to traffic safety and congestion.

DHHL has approximately 30,000 acres in the Waimea Nui region and 146 native Hawaiian families with homestead leases in the Waimea region. In response to DHHL's comments on this project, SSFM stated, "The Draft EA will also evaluate the project's the project's consistency with DHHL's General Plan, Hawai'i Island Plan, Waimea Nui Regional Plan," in its letter dated, December 3, 2020 (SSFM2015_157.000) The DEA-AFNSI did not mention any of these plans, nor include an evaluation of the project's consistency with these State-DHHL plans. DHHL would like to see a detailed evaluation the Waimea Roadway Improvements project's consistency with the State-DHHL plans listed above prior to the release of the final

Environmental Assessment. The evaluation should be incorporated into the final Environmental Assessment.

Mahalo for the opportunity to provide comments. If you have any questions, please call Malia Cox, at 620-9485 or contact via email at malia.m.cox@hawaii.gov.

Aloha,

William J. Ailā Jr., Chairman
Hawaiian Homes Commission

Copy: Jim Dupont, DHHL-West Hawaii District Office via email
Waimea Hawaiian Homesteaders Association via email

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May 3, 2021 SSFM 2015_157.000

Mr. William J. Ailā, Jr., Chairman Hawaiian Homes Commission
State of Hawaii
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Mr. Ailā,

Thank you for your comments dated March 15, 2021 (Letter No. PO-21-066) on the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project.

An assessment of the proposed project's consistency with the Department of Hawaiian Home Lands General Plan, Hawaii Island Plan, and Waimea Nui Regional Plan will be included in the Final EA. A copy of consistency determination is attached to this letter for your review prior to publication of the Final EA.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Planner

Attachments: Consistency Determination

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

4.3 Department of Hawaiian Home Lands Planning Documents

4.3.1 Department of Hawaiian Home Lands General Plan

The *Department of Hawaiian Home Lands General Plan* (DHHL, 2002) provides goals and objectives to support the mission of managing Hawaiian Home Lands effectively and to develop and deliver lands to native Hawaiians. There are goals and objectives for the following: land use planning, residential uses, agricultural and pastoral uses, water resources, land and resource management, economic development, and building healthy communities. The goals and objectives related to residential uses, agricultural and pastoral uses, water resources, land and resource management, economic development, and building healthy communities are not applicable to the Proposed Action. The Proposed Action is consistent with the following land use planning goals and objectives:

LAND USE PLANNING

Goals:

Develop livable, sustainable communities that provide space for or access to the amenities that serve the daily needs of its residents.

Objectives:

- Direct urban growth to priority development areas based on infrastructure availability, feasible site conditions, beneficiary preferences, and job opportunities.
- Develop improved relationships with the Counties to ensure reliable and adequate delivery of services to homesteaders.

Discussion: The Proposed Action would provide beneficial impacts to the heart of Waimea Town and adjacent areas due to improved traffic flow, increased pedestrian and bicyclist comfort levels, and improved multimodal safety within Waimea Town. These beneficial impacts would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town. In addition, the Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations thereby allowing faster response times to DHHL properties outside of the project area.

4.3.2 Hawaii Island Plan

The *Department of Hawaiian Home Lands Hawaii Island Plan* (DHHL, 2002b), hereafter referred to as the Hawaii Island Plan, provides a comprehensive assessment of DHHL properties on Hawaii Island, as well as a summary of beneficiary interest in these lands by award type (i.e., residential, agricultural, or pastoral). The goal of the Hawaii Island Plan is to assess and recommend future uses for Hawaiian Home Lands. There are two DHHL tracts adjacent to the Proposed Action: Lalamilo and Puukapu.

The Lalamilo tract is a 232-acre parcel located in the Kamuela area of the South Kohala District and was historically used as pasture land. Northern portions of the parcel front Waimea-Kawaihae Road and the Lalamilo House Lots subdivision. Public services such as schools, fire stations, medical care, and shopping are readily available. The Hawaii Island Plan identifies Lalamilo as a "Priority Tract" recommended for residential use. Extensive lands are available for development on the tract, and beneficiaries support residential use in the area.

The Puukapu tracts 1 and 2 are comprised of two 100-acre lots and one 192-acre lot located in the saddle of the Mauna Kea and Kohala Mountains. Puukapu tract 3 is a 378-acre tract of rolling hills on the upper slopes of Kamuela. Puukapu tracts 1 and 2 are recommended for homestead supplemental agriculture and general agriculture uses, and the Puukapu tract 3 is recommended for homesteading pastoral use. The Hawaii Island Plan identifies the Puukapu tracts as "Non-Priority."

Discussion: The Proposed Action would increase safety by modifying existing intersections, installation of a roundabout, and the installation of dedicated bicycle and pedestrian facilities in the heart of Waimea Town. In addition, the Proposed Action would reduce congestion by improving access, optimizing operations at intersections, and reducing conflict points. Overall, the Proposed Action would provide beneficial impacts due to improved traffic flow, increased pedestrian and bicyclist comfort levels, and improved multimodal safety within Waimea Town. These beneficial impacts would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town. In addition, the Proposed Action would benefit emergency vehicles by improvements at the two major intersections of Lindsey Road with Mamalaoha and Kawaihae (roundabout) allowing faster travel for emergency vehicles in these two locations thereby allowing faster response times to DHHL properties outside of the project area.

4.3.3 Waimea Nui Regional Plan

The *Waimea Nui Regional Plan* (DHHL, 2012) focuses on applying the goals, policies, and land use designations to specific homestead areas. The *Waimea Nui Regional Plan* identifies infrastructure projects, including development, roads, water, utilities, and public facilities. Roadway projects identified include, but are not limited to, the following: Waimea Traffic Circulation Improvements, Mamalahoa Highway – Lindsey Road to Kamamalu Street, Lindsey Road Pedestrian Safety Improvements, and Kawaihae Road Pedestrian Safety Improvements.

Discussion: The Proposed Action would improve pedestrian safety within the heart of Waimea Town along Mamalahoa Highway, Lindsey Road, and Kawaihae Road, which is consistent with the roadway projects identified in the *Waimea Nui Regional Plan*. The Proposed Action would also improve traffic flow through Waimea. The benefits associated with the Proposed Action would extend to the DHHL properties and their tenants through easier access to and within the heart of Waimea Town.

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Jennifer Scheffel

From: Laurie Ainslie <lainslie@hpa.edu>
Sent: Friday, March 12, 2021 8:47 AM
To: ken.tatsuguchi@hawaii.gov
Cc: Patrick Phillips; TJ Kalaniopio; Jennifer Scheffel; Kaky Purdy
Subject: Waimea Roadway Improvements Project

Good morning Ken-

My name is Laurie Ainslie and I am Chair of the Board of Trustees of Hawaii Preparatory Academy. I am contacting you to request that Hawaii Preparatory Academy be formally recognized as a consulted party on the above referenced project.

Please send any and all correspondence/updates on the project to:

Laurie Ainslie, Chair Board of Trustees, HPA - lainslie@hpa.edu
Patrick Phillips, Head of School, HPA - pphillips@hpa.edu
TJ Kalaniopio, Director of Facilities, HPA - tjkalaniopio@hpa.edu

I thank you in advance.

Respectfully yours,

Laurie Ainslie

SSFM International
Innovate | Adapt | Sustain

May 3, 2021 SSFM 2015_157.000

Ms. Laurie Ainslie, Chair Board of Trustees
Hawaii Preparatory Academy
EMAIL: lainslie@hpa.edu

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Ms. Ainslie,

Thank you for your email dated March 12, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project. Formally recognized consulted parties are part of an Environmental Impact Statement (EIS) process and not EA process; however, we have added you, Patrick Phillips, and TH Kalaniopio to the project mailing list.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

Jennifer Scheffel

From: Laurie Heath <la7heath@aol.com>
Sent: Friday, March 19, 2021 2:34 PM
To: Jennifer Scheffel
Subject: Waimea improvements

Follow Up Flag: Follow up
Flag Status: Flagged

Email received from EXTERNAL sender. Confirm the content is safe prior to opening attachments or links.

Hi Jennifer,

It was good talking with you this morning. I'll try again to send this message, and hope it makes it. I will also mail this to your office.

It seems to us that the greatest improvement to Waimea would be completing the bypass road. If the goal is to keep Waimea a charming town, and only having traffic travel our roads if it is destined for the town itself, then the bypass road is the most effective means to achieving that end. And since there seems to be a large, national infrastructure bill in the offing,this seems the ideal time to move forward.

Reducing the speed on Mamalahoa Hwy is also a good idea. People will always drive faster than the posted limit, so reducing the posted speed limit may have an effect.

Thank you for allowing us to comment and participate.

Aloha,
Laurie and Charles Heath
67-1237 Mamalahoa Hwy.
Kamuela, Hi. 96743

Sent from my iPad

SSFM International
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May 3, 2021 SSFM 2015_157.000

Laurie and Charles Heath
67-1237 Mamalahoa Highway
Kamuela, HI 96743

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Mr. and Mrs. Heath,

Thank you for your email dated March 19, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project.

During the Planning and Environment Linkages (PEL) Study, two types of alternatives to address the Purpose and Need were identified: (1) Bypass Alternative and (2) Multimodal Improvements to Existing Roadways. These alternatives are complementary and have independent utility. This EA analyzes the Multimodal Improvements to Existing Roadways alternative. The Bypass Alternative will be documented in a subsequent environmental document as funding becomes available.

Reducing the posted speed limit on Mamalahoa Highway is not currently being considered as an alternative as speed has not been identified as a major problem that needs to be addressed.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

Mitchell D. Roth
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado Jr.
Deputy Police Chief

County of Hawai`i

POLICE DEPARTMENT

349 Kapi`olani Street • Hilo, Hawai`i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

March 24, 2021

SSFM International, Inc.
RECEIVED
3.30.2021

Ms. Jennifer Scheffel
SSFM International, Inc.
99 Aupuni Street, Suite 202
Hilo, Hawaii 96720

SUBJECT: WAIMEA ROADWAY IMPROVEMENTS PROJECT NOTICE OF AVAILABILITY OF DRAFT ENVIRONMENTAL ASSESSMENT

Dear Ms. Scheffel:

This is in response to your correspondence dated March 8, 2021, with regard to the above-referenced notice of availability of draft environmental assessment.

Thank you for allowing the Hawai'i Police Department to make comments regarding this request. At this time, the Hawai'i Police Department has no comments.

Please direct any questions or concerns to Acting Captain Robert Pauole via email at Robert.Pauole@hawaiicounty.gov or at the South Kohala Police Station at (808) 887-3080.

Sincerely,

PAUL K. FERREIRA
POLICE CHIEF

SDB
EMS 20HQ0204

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May 3, 2021

SSFM 2015_157.000

Mr. Paul K. Ferreira, Police Chief
County of Hawaii
Police Department
349 Kapiolani Street
Hilo, HI 96720-3998

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Mr. Ferreira,

Thank you for your letter dated March 24, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project. We acknowledge that the County of Hawaii Police Department does not have any comments regarding the proposed project.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 6, 2021

State of Hawaii
Department of Transportation
Highways Division
Attn: Mr. Ken Tatsuguchi via email: ken.tatsuguchi@hawaii.gov
869 Punchbowl Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Tatsuguchi:

SUBJECT: Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project** located at Waimea, Island of Hawaii; TMKs: (3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; and 6-5-007:001

Thank you for the opportunity to review and comment on the subject matter. The Land Division of the Department of Land and Natural Resources (DLNR) distributed or made available a copy of your request pertaining to the subject matter to DLNR's Divisions for their review and comments.

At this time, enclosed are comments from the (a) Engineering Division and (b) Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: SSFM International (w/copies)
Attn: Ms. Jennifer Scheffel (via email: jscheffel@ssfm.com)
Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 10, 2021

MEMORANDUM

FROM:
~~TO:~~ **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

TO:
~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project**
LOCATION: Waimea, Island of Hawaii; TMK: (3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; and 6-5-007:001
APPLICANT: SSFM International, Inc. on behalf of Hawaii Department of Transportation, Highway Division

Transmitted for your review and comment is information on the above-referenced subject matter. The DEA was published on March 08, 2021 in the Office of Environmental Quality Control's periodic bulletin, The Environmental Notice, at the following link:

http://oeqc2.doh.hawaii.gov/The_Environmental_Notice/2021-03-08-TEN.pdf

Please submit any comments by **April 5, 2021.** If no response is received by this date, we will assume your agency has no comments. Should you have any questions, please contact Darlene Nakamura via email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
(✓) We have no additional comments.
( ) Comments are attached.

Signed: [signature]
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Mar 29, 2021

Attachments
cc: Central Files

3/29/21

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 10, 2021

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment for the Proposed **Waimea Roadway Improvements Project**
LOCATION: Waimea, Island of Hawaii; TMK: (3) 6-5-003:005; 6-5-004:027; 6-5-005:021, 025; and 6-5-007:001
APPLICANT: SSFM International, Inc. on behalf of Hawaii Department of Transportation, Highway Division

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http://oeqc2.doh.hawaii.gov/The_Environmental_Notice/2021-03-08-TEN.pdf

Please submit any comments by **April 5, 2021.** If no response is received by this date, we will assume your agency has no comments. Should you have any questions, please contact Darlene Nakamura via email at darlene.k.nakamura@hawaii.gov. Thank you.

( ) We have no objections.
(✓) We have no comments.
( ) We have no additional comments.
( ) Comments are attached.

Signed: [signature]
Print Name: GORDON C. HEIT
Division: Land Division
Date: 3/30/21

Attachments
cc: Central Files

SSFM International
Innovate | Adapt | Sustain

May 3, 2021

SSFM 2015_157.000

Mr. Russell Tsuji, Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, HI 96809

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Mr. Tsuji,

Thank you for your letter dated April 6, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project. We thank you for distributing the Draft EA to the Divisions within the Department of Land and Natural Resources. We acknowledge that the Engineering Division has no additional comments and the Land Division – Hawaii District has no comments.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways

Jennifer Scheffel
SSFM International
99 Aupuni Street, Suite 202
Hilo, HI 96720
jmscheffel@gmail.com

Graham Paul Knopp, Ph.D.
65-1206 Mamalahoa Highway, 1-206
Kamuela, HI 96743
gpknopp@gkenvllc.com
April 6, 2021

Dear Ms. Scheffel,

Both this EA and the proposed project have serious problems. The EA is not conformant with HAR 200.1, incorrectly evaluates the 13 significance criteria and may inaccurately model traffic. The proposed project itself creates a safety hazard that will likely kill children. As a parent of a Parker School student I insist that this project be dropped and real solutions to Waimea's traffic problems be enacted, including the Lalamilo Connector Road and the Waimea Bypass.

I have the following specific issues with the EA and proposed project:

Issue 1. Alternatives. The DEA does not adequately discuss alternatives. Section 2.1 indentifies the , "(1) Bypass Alternative" but this alternative is not discussed in the EA. As per HRS 343 and HAR 200.1 alternatives are to be evaluated within the document and criteria for selection of the preferred alternative are to be elucidated. ***Why does this DEA not evaluate the first alternative identified?***

Issue 2. Safety. The proposed project would create safety hazards and would kill pedestrians with ***four uncontrolled crosswalks*** along the roundabout. The proposed project would create four uncontrolled crosswalks and would therefore increase safety hazards for pedestrians. ***How are drivers to navigate a roundabout and exit the roundabout while regarding the pedestrian right-of-way law?*** This area accommodates heavy pedestrian traffic and the only way to improve traffic congestion without creating a safety hazard would be to remove traffic from the area with other solutions. ***How would having four uncontrolled crosswalks at the ingress and egress of the roundabout not create safety hazards for pedestrians?***

Therefore, Section 5.1 is not accurate. The EA's evaluation of the projects impact on the social welfare and public health incorrect. The proposed project would have a substantial adverse effect on the social welfare of the community, as it would create a safety hazard for pedestrians. Therefore, the EA incorrectly evaluates the proposed project's consistency with Significance Criterion (4). Also, in producing a safety hazard at the roundabout, the proposed project would have a substantial adverse effect on public health. Therefore, the EA's evaluation of consistency with Significance Criterion (5) is incorrect. ***How is the creation of a safety hazard not an adverse impact?***

Issue 3. Questionable traffic modeling. The proposed solution does not solve the problem. Specifically, at issue is the following question: ***Does the Vissim 12 modeling software account for additional queuing time required by vehicles waiting for pedestrians to exit crosswalks?*** If not, this modeling is invalid, as this intersection frequently accommodates *heavy* pedestrian traffic, as it is located adjacent to schools, parks, a church, and other community facilities. Further, if pedestrians are adequately accommodated in the model, it is likely that the models will show that the roundabout would not reduce congestion.

Waimea's traffic problems are only solvable with other solutions that would remove traffic from the urban core. The EA is inadequate as it does not recognize that this one element of the proposed project, the proposed Linsdsey Road/Kawaihae Road intersection improvements. This can be done partially through construction of a Lalamilo Road/Kawaihae Road connector, which would remove a large fraction of traffic from the portion of Kawaihae Road between Lindsey Road and the connector. The ultimate solution is to return to the Waimea Bypass which, along with the Lalamilo connector road, would route most through traffic around Waimea altogether. The Waimea Bypass, which would route traffic through a new road transiting from near the Mealani Agricultural Station to near the Kamuela Airport, is clearly the best solution to Waimea's traffic woes, and would produce a pedestrian and bicycle friendly community. It would also, with the Lalamilo Connector Road, allow trucks to safely navigate the area, without requiring a Waika Bridge realignment. ***Why are these alternatives not discussed in the EA?***

Mahalo,

Graham Paul Knopp, Ph.D.

SSFM International
Innovate | Adapt | Sustain

May 3, 2021 SSFM 2015_157.000

Mr. Graham Paul Knopp, Ph.D.
65-1206 Mamalahoa Highway, 1-206
Kamuela, HI 96743

SUBJECT: **Draft Environmental Assessment Comment Response Letter**
Waimea Roadway Improvements Project
Tax Map Keys (TMKs): (3) 6-5-003:005; 6-5-007:001; 6-5-005:021, 025; 6-5-004:027

Dear Dr. Knopp,

Thank you for your letter dated April 6, 2021 regarding the Draft Environmental Assessment (EA) for the Waimea Roadway Improvements Project. We provide the following responses to your comments:

Issue 1. Alternatives
As stated in Section 2.1, the bypass alternative and the multimodal improvements alternative have independent utility (i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made). The bypass alternative will be addressed in a subsequent environmental document as funding becomes available.

Issue 2. Safety
The proposed roundabout would include sidewalks, bikeways, and crosswalks. The sidewalk and bikeway would be combined into a single raised sidewalk in addition to differentiating between existing and proposed sidewalks. The north leg of Lindsey Road would handle the transition into the existing travelway with Parker School's drop-off lane. The roundabout would include marked crosswalks across all legs with splitter island refuges across the west and southern legs. These are design techniques that have been proven to improve safety at crosswalks.

Roundabouts are a proven safety countermeasure. By reducing the number and severity of conflict points, and because of the lower speeds of vehicles moving through intersection, roundabouts are a significantly safer type of intersection. The Federal Highway Administration Office of Safety has prepared several documents regarding the safety of roundabouts (https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/).

Issue 3. Questionable traffic modeling
The Vissim microsimulation does include pedestrian volumes at crosswalks and accounts for additional delay as vehicles yield for pedestrians. While it is acknowledged that there are community facilities at this location, several of these uses (parks, churches) typically have the highest trip generation outside of the weekday peak commute periods for roadway traffic such

that the pedestrian demand is not expected to substantially exacerbate peak hour congestion. One of the benefits of the roundabout configuration is the provision of designated pedestrian crosswalks that do not exist at the intersection today. In addition, the roundabout will manage traffic speeds at this location where pedestrians will cross the road. The roundabout will allow traffic volumes to continue to move through the area and minimize delays, while improving safety for pedestrians and cyclists.

Additional Alternatives
The additional alternatives you mention, including the bypass alternative and the Lalamilo Connector Road alternative, are separate projects with independent utility and will be addressed in subsequent environmental documents as funding becomes available.

Your letter, along with this response letter, will be included in the forthcoming Final EA. Should you have additional questions regarding the proposed project, please contact me at (808) 356-1273 or via email at jscheffel@ssfm.com.

SSFM INTERNATIONAL, INC.

Jennifer M. Scheffel

Jennifer M. Scheffel
Sr. Planner

cc: Brian Tyau, HDOT-Highways
Ken Tatsuguchi, HDOT-Highways