LĀLĀMILO WIND FARM REPOWERING PROJECT

Draft Environmental Assessment

Prepared for

Lālāmilo Wind Company LLC

and

Department of Water Supply of the County of Hawaiʻi and its Governing Water Board

Prepared by

TETRA TECH

Tetra Tech, Inc.

June 2014

EXECUTIVE SUMMARY

Project Name:	Lālāmilo Wind Farm Repowering Project
Location:	Lālāmilo, South Kohala, Island and County of Hawaiʻi
Judicial District:	South Kohala
Tax Map Key (TMK):	(3) 6-8-001:001 (portion) (3) 6-6-001:002 (portions) (3) 6-6-001:071 (3) 6-6-001:076
Land Area:	Approximately 126 acres
Proposing Agency:	Department of Water Supply of the County of Hawaiʻi by and through its governing Water Board
Accepting Authority:	Department of Water Supply of the County of Hawaiʻi by and through its governing Water Board
Landowner:	State of Hawaiʻi Department of Land and Natural Resources
Exiting Use:	Site of old Lālāmilo Wind Farm
Proposed Action:	The previous Lālāmilo Wind Farm constructed in the mid-1980s with 120 wind turbines for a generating capacity of 2.7 megawatts (MW) was decommissioned in 2010 in anticipation of re-powering the site. The proposed new Lālāmilo Wind Farm consists of installation of five Vestas V47-660 kilowatt wind turbine generators as well as related facilities to re-power the eight Department of Water Supply's water wells in the Lālāmilo -Parker well system. The total generating capacity is anticipated to be 3.3 MW.
Current Land Use Designations:	State Land Use: Agricultural County General Plan LUPAG: Extensive Agriculture, Urban Expansion and Open Area County Zoning: A-5a (Agricultural) and Open Space Special Management Area (SMA): Not in SMA
Alternatives Considered:	The following alternatives were considered: • No Action: The Project would not be constructed, and wind-generated power would not be supplied to power the wells in the Lālāmilo-Parker well system. • Alternative Type of Renewable Energy: Alternative types of renewable energy technology were considered for powering the Lālāmilo-Parker well system including geothermal, pump-hydro, or solar. Repowering the wind farm was determined to be the most feasible renewable energy resource; therefore this alternative was not carried forward for analysis. • Larger or Smaller Wind Project: Smaller and larger wind projects were considered. A 3.3 MW wind facility was determined to be the optimal size for the Project; therefore this alternative was not carried forward for

analysis.

Potential Impacts and Mitigation Measures:

The Project provides beneficial impacts through reducing energy cost by replacing a large portion of its pumping energy demands with renewable wind energy and saving up to 50 percent of the Department of Water Supply annual pumping cost for the next twenty years in the Lālāmilo-Parker well system. Additionally, the Project would contribute to the State's Clean Energy Initiative goal that at least 40 percent of the State's energy be supplied by renewable resources by year 2030. The following potential adverse impacts would be mitigated:

- Temporary construction impacts to soils, noise, air quality, and water resources would be mitigated through the use of Best Management Practices.
- To reduce risk associated with natural hazards, the Project would implement design features to reduce the risk of damage and comply with the 2006 International Building Code.
- To reduce risk of wildfires, grass and other flammable materials would be kept well away from the base of the towers.
- There are no plant or animal species on the site currently listed as endangered, threatened, or proposed for listing. Down-shielded lighting on buildings, strategic curtailment of turbines, and avoiding nighttime construction would minimize potential impacts to listed species that could transit the Project Area (seabirds, waterbirds, and bats).
- A construction traffic management plan would be implemented for the oversize loads to help mitigate construction traffic impacts.
- Impacts to visual resources are considered low due to the distance, screening vegetation and terrain of the surrounding area.

Anticipated Determination:

Finding of No Significant Impact

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
A.D.	after death
AIS	Archaeological Inventory Survey
ALISH	Agricultural Lands of Importance to the State of Hawaiʻi
amsl	above mean sea level
BMP	Best Management Practice
CDP	Community Development Plan
CO_2	carbon dioxide
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dB	decibel
dBA	A-weighted decibel
DLNR	State of Hawaiʻi Department of Land and Natural Resources
DOE	U.S. Department of Energy
Department of Water Supply	County of Hawaiʻi Department of Water Supply
EA	Environmental Assessment
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
HAR	Hawaiʻi Administrative Rules
HCC	Hawaiʻi County Code
HDOH	State of Hawaiʻi Department of Health
HDOT	State of Hawaiʻi Department of Transportation
HELCO	Hawaiʻi Electric Light Company
HRS	Hawaiʻi Revised Statutes
IBC	International Building Code
ISO	International Organization for Standardization
kV	kilovolt
KVA	key viewing area
kW	kilowatts
kWh	kilowatts hour

L_{dn}	day-night sound level
L_{eq}	equivalent sound level
LUPAG	Land Use Pattern Allocation Guide
LSB	University of Hawai'i Land Study Bureau
MBTA	Migratory Bird Treaty Act
MGD	million gallons per day
mph	miles per hour
MW	megawatt
MWh	megawatt hour
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NREL	National Renewable Energy Laboratory
PPA	Purchase Power Agreement
Project	Lālāmilo Wind Farm Repowering Project
RA	Removal Action
SCADA	supervisory control and data acquisition
TMK	Tax Map Key
Tetra Tech	Tetra Tech, Inc.
UBC	Uniform Building Code
USGS	U.S. Geological Survey
UXO	unexploded ordnance

1.0 INTRODUCTION

This Environmental Assessment (EA) is prepared in accordance with Chapter 343, Hawaiʻi Revised Statutes (HRS) and Hawaiʻi Administrative Rules (HAR) Chapter 11-200 for the proposed Lālāmilo Wind Farm Repowering Project (Project) in Lālāmilo, South Kohala District, Island and County of Hawaiʻi, State of Hawaiʻi.

1.1 PROJECT SUMMARY INFORMATION

1.1.1 Landowner

The landowner for the wind farm site, access road, interconnect, and collection line (Tax Map Keys [TMKs] (3) 6-6-001:002 (portions), 071, and 076) is the State of Hawaiʻi Department of Land and Natural Resources (DLNR). The Department of Water Supply of the County of Hawaiʻi by and through its governing Water Board (Department of Water Supply) has a lease approval-in-concept from the DLNR to repower the Lālāmilo Wind Farm with a condition that the Department of Water Supply publish an EA with the Office of Environmental Quality Control and obtain a Finding of No Significant Impact (FONSI) for the Project.

The landowner for the transmission line (TMK (3) 6-8-001:001 (portion)) from the existing Hawaiʻi Electric Light Company (HELCO) interconnect to the Parker Well No. 4 is Parker Ranch. The transmission line would be located within the Department of Water Supply's current, paved access road right-of-way and utility easement.

1.1.2 Proposing Agency and Accepting Authority

The Department of Water Supply is the proposing agency and the accepting authority.

Contact: Department of Water Supply of the County of Hawaiʻi
ATTN: Quirino Antonio, Jr. P.E., Manager-Chief Engineer
345 Kekūanaōʻa St., Suite 20
Hilo, Hawaiʻi 96720
Telephone: (808) 961-8050
Fax: (808) 961-8657

1.1.3 Environmental Consultant

Tetra Tech, Inc. (Tetra Tech) is the environmental planning consultant.

Contact: Tetra Tech, Inc.
ATTN: Leilani Pulmano
737 Bishop Street, Suite 2340
Honolulu, Hawaiʻi 96813
Telephone: (808) 441-6652
Fax (808) 836-1689

1.1.4 Compliance with State of Hawai'i Environmental Laws

The Project will involve the use of State and County lands, which is a trigger for the preparation of an EA. Preparation of this EA is in accordance with the provisions of HRS Chapter 343 and HAR

Title 11 Chapter 200 pertaining to Environmental Impact Statements Rules. Consistency with other land use plans and policies is provided in Chapter 3 of this EA.

1.1.5 Location, Property Description, and Surrounding Land Uses

The Project is located near the town of Kamuela, Lālāmilo ahupuaʻa, South Kohala District, Island and County of Hawaiʻi (Figure 1-1). The approximately 126-acre Project Area is identified as TMKs (3) 6-8-001:001 (portions), (3) 6-6-001:002 (portions), 071, and 076 (Figure 1-1, Figure 1-2), on lands which have been used to graze livestock since the 1850s and are still currently being grazed. The original Lālāmilo Wind Farm, which began operation in 1985, consisted of 120 Jacobs wind turbines each with a generating capacity ranging from 17.5 to 20 kilowatts (kW) for a total generating capacity of 2.7 megawatts (MW). In 2010, the original Lālāmilo Wind Farm was decommissioned.

The Project Area is surrounded on all sides by agricultural pastoral lands principally used for cattle grazing. Surrounding landowners include the State of Hawaiʻi, Parker Ranch, and Waikoloa Village Association. Access to the Project Area is from an existing, paved unnamed road, commonly called the Department of Water Supply Lālāmilo-Parker Well Site access road, off of Queen Ka ʻahumanu Highway (State Highway 19) near the Puakō Beach Drive intersection. The Project Area is dominated by heavily disturbed, dry grassland vegetative community. Fountain grass (*Pennisetum setaceum*) and buffelgrass (*Cenchrus ciliaris*) are the dominant species, both of which are non-native, aggressive, introduced grasses.

Topography of the Project Area consists of relatively flat plateau falling off to the west and north. Elevations range from 1,401 feet (427 meters) above mean sea level (amsl) to 1,145 feet (349 meters) amsl with on average a slope of 5 percent. Several small dry gulches score the landscape around the western and northern portions of the Project Area.

1.1.6 Existing Land Use Designations

The Project Area is within the State Land Use Agricultural District, designated for Extensive Agricultural and Urban Expansion by the County General Plan Land Use Pattern Allocation Guide (LUPAG), and zoned by the County of Hawaiʻi as Agricultural (see Table 1-1).

Table 1-1. Current Land Use Designations for the Project Area

Category	Designation
State Land Use	Agricultural (See Figure 1-3)
County General Plan LUPAG	Extensive Agriculture, Urban Expansion and Open Area (See Figure 1-4)
County Zoning	A-5a, Agricultural and Open Space (See Figure 1-5)
Special Management Area (SMA)	Not in SMA
Note: These land use designations apply to the wind farm lease area and existing Department of Water Supply access road rights-of-way and utility easements.	

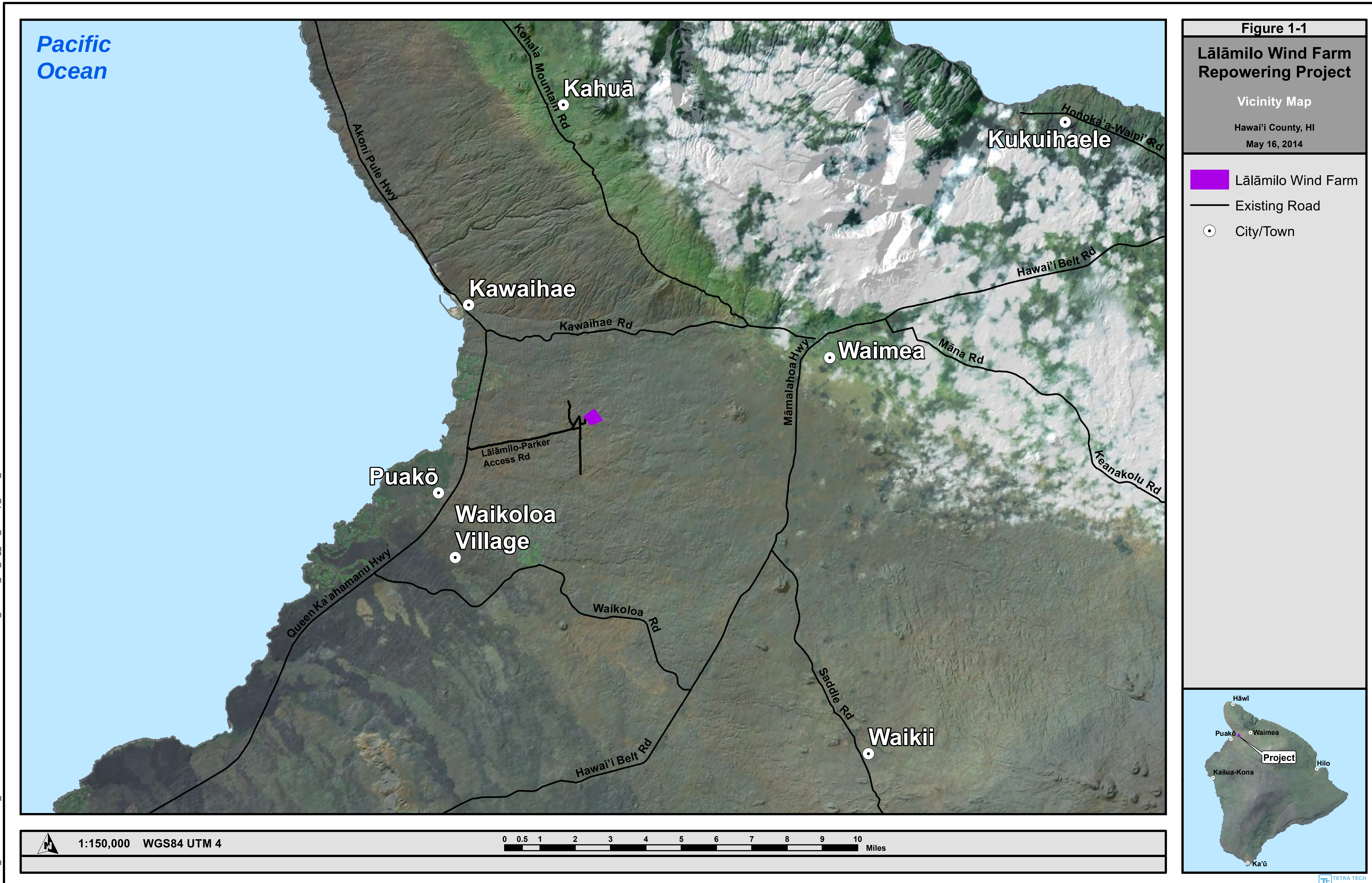

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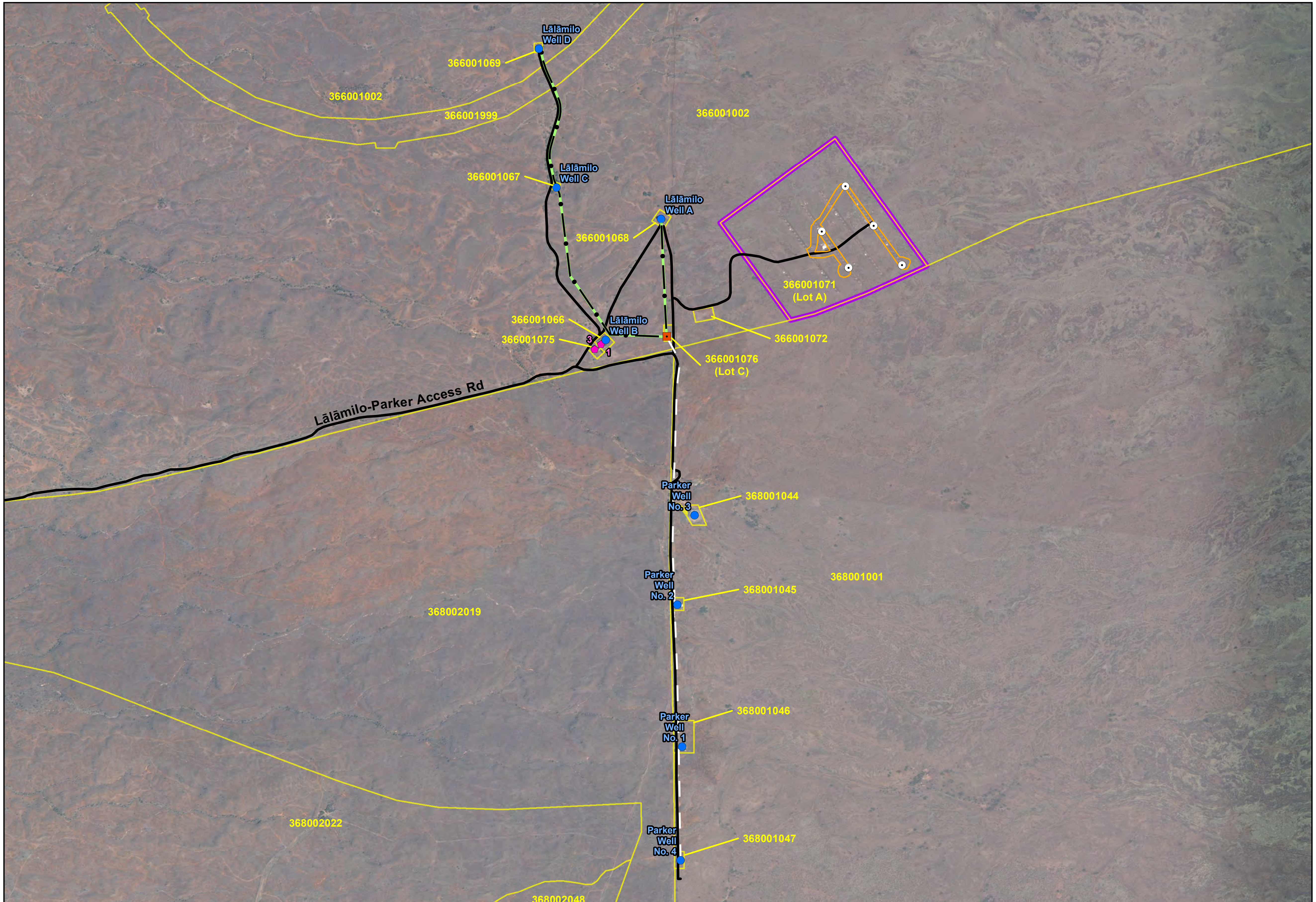
Figure 1-2

Lālāmilo Wind Farm Repowering Project

Project Facilities

Hawai'i County, HI

May 16, 2014



- Wind Farm Site
- Internal Access Road
- TMK Parcel
- Proposed 13kV Transmission Line
- Existing Project Transmission Line
- Existing Road
- Proposed Turbine
- HELCO Interconnect
- Well
- Reservoir

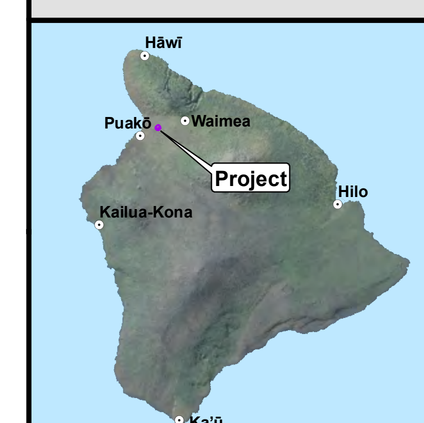


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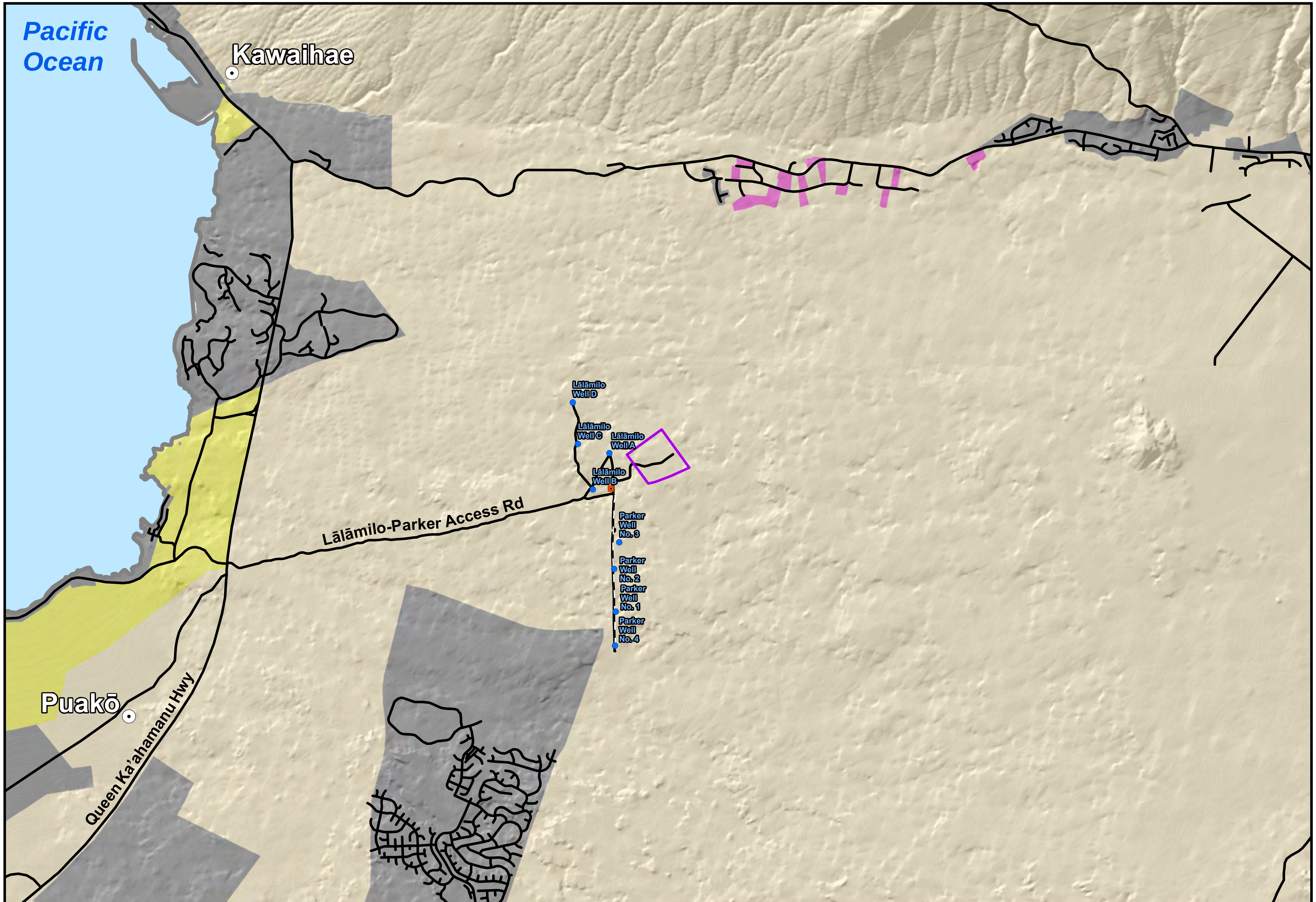
Figure 1-3

Lālāmilo Wind Farm Repowering Project

State Land Use Districts

Hawai'i County, HI

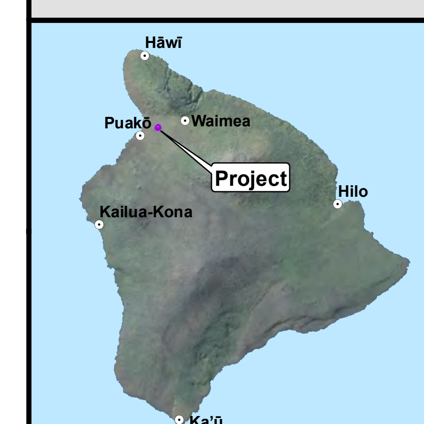
May 16, 2014



- Wind Farm Site
- Proposed 13kV Transmission Line
- Existing Road
- HELCO Interconnect
- Well
- City/Town

Land Use District

- Agricultural
- Conservation
- Rural
- Urban



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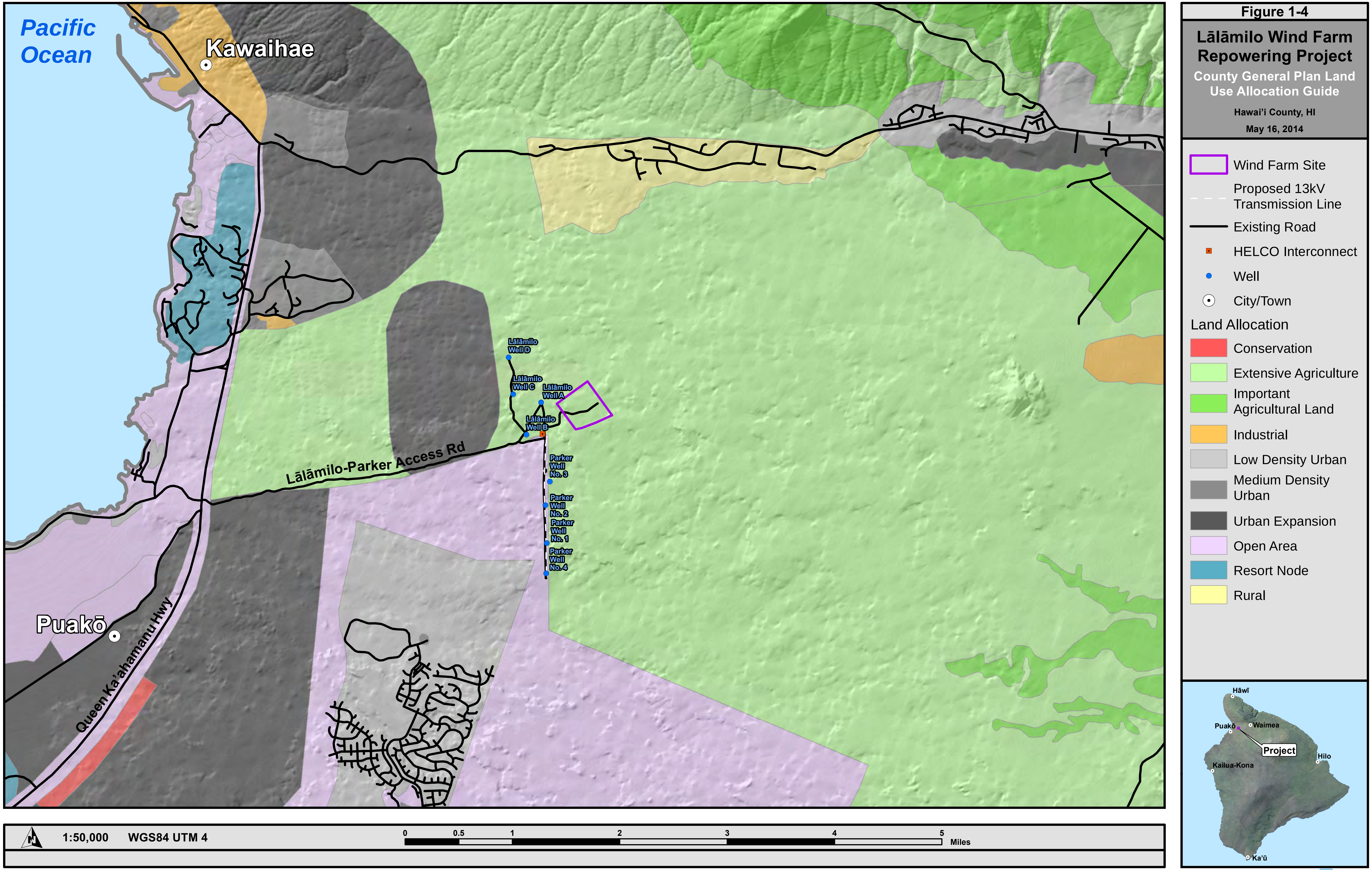

Figure 1-4

Lālāmilo Wind Farm Repowering Project

County General Plan Land Use Allocation Guide

Hawai'i County, HI

May 16, 2014

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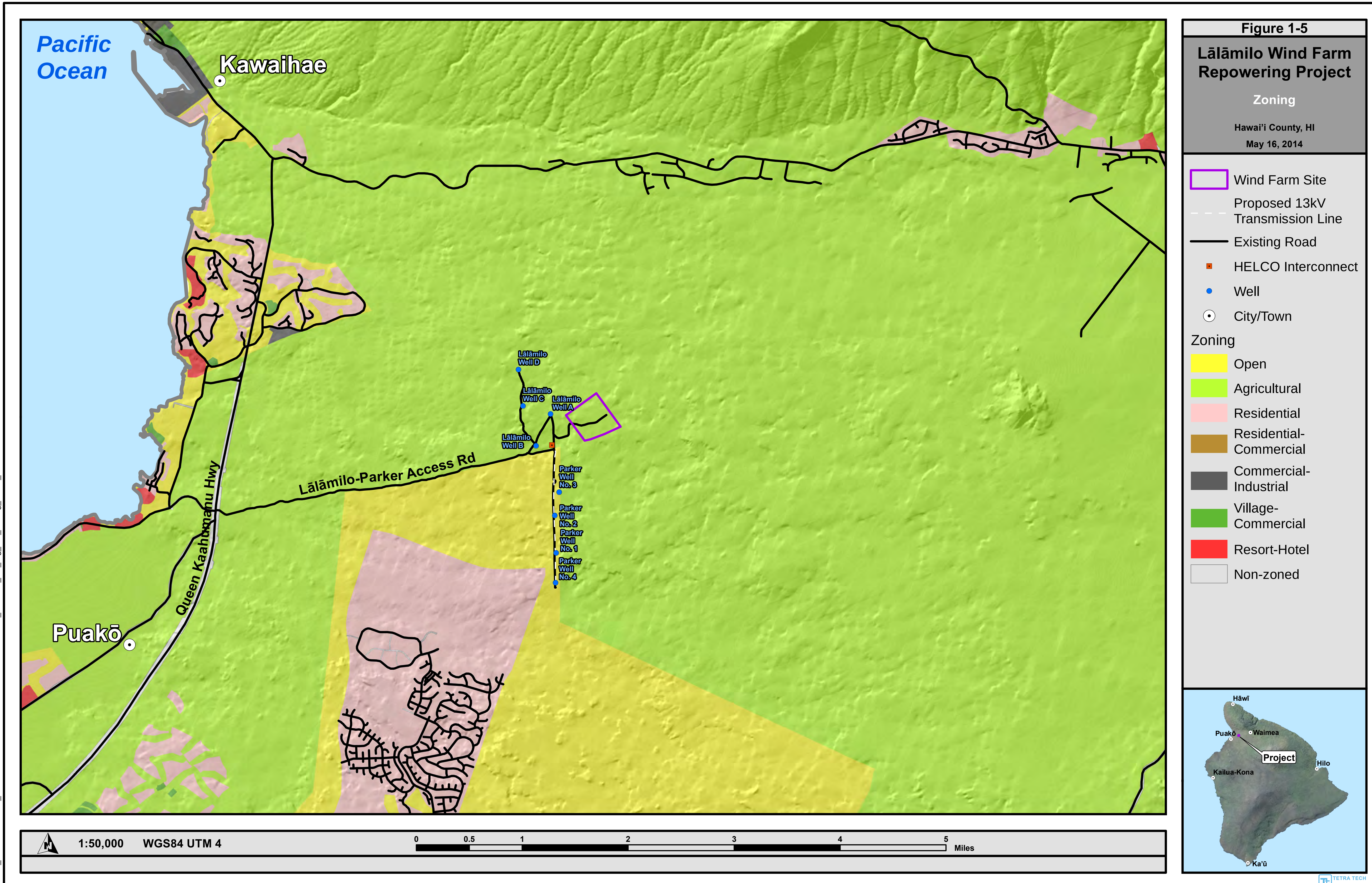

Figure 1-5
Lālāmilo Wind Farm Repowering Project
Zoning
Hawai'i County, HI
May 16, 2014
Wind Farm Site
Proposed 13kV Transmission Line
Existing Road
HELCO Interconnect
Well
City/Town
Zoning
Open
Agricultural
Residential
Residential-Commercial
Commercial-Industrial
Village-Commercial
Resort-Hotel
Non-zoned
Pacific Ocean
Kawaihae
Puakō
Lālāmilo-Parker Access Rd
Queen Kaahumanu Hwy
Lālāmilo Well D
Lālāmilo Well C
Lālāmilo Well A
Lālāmilo Well B
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Parker Well No. 2
Parker Well No. 1
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1.1.7 Regional Land Use History

Permanent settlement in the South Kohala region has been reported as early as the 13th century when small coastal settlements subsisted primarily on marine resources, likely supplemented by small-scale agriculture (Tomonari-Tuggle 1988). The next several centuries were characterized by population growth and expanded efforts to increase upland agriculture, developing strong links between permanent coastal and upland communities. Through the reign of Kamehameha I and his son Liholiho in the nineteenth century, large portions of Island of Hawaiʻi were controlled by a few powerful aliʻi (chiefs). The arrival of foreigners in Hawaiʻi in the eighteenth century, the introduction of a western economy, and the rise of the sugar and cattle industries resulted in major social and socioeconomic changes and land modification and ownership in the South Kohala region. Cattle ranching became a major industry in the South Kohala region toward the mid-nineteenth century and into the twentieth century, with the lands of the Project Area eventually being owned by Parker Ranch.

In 1943, nearly 123,000 acres of land in the Waimea-Waikoloa area were leased by the U.S. War Department for use as a troop training area (Escott 2008). With this lease the Project Area became part of the U.S. Navy's 91,000-acre Waikoloa Maneuver Area, which included the 9,141-acre Lālāmilo Firing Range. The Waikoloa Maneuver Area was returned to Parker Ranch in 1946. The Lālāmilo Firing Range, through a permit granted by the Territory of Hawaiʻi, was retained by the U.S. Marines as a training area and camp site until 1953 when the lands once again reverted to leased cattle pasture administered by the Territory of Hawaiʻi. Cleanup of unexploded ordnance (UXO) within the Waikoloa Maneuver Area is still ongoing. Following World War II, the lands in the vicinity of the Project Area were again used as cattle pasture.

Since the 1950s, modern development has concentrated along the coastal land of Lālāmilo around the Villages of Waimea and Waikoloa. During the 1980s, large resort properties were developed along the coast. The resort developments required water, which necessitated the drilling of wells and the development of a modern water distribution system. Several wells were drilled in the vicinity of the current Project Area around this time, and in 1985 the original Lālāmilo Wind Farm with 120 turbines was erected as a power source for some of those wells. The wind farm, which was acquired by HELCO in 1987, continued to operate until being decommissioned in 2010.

1.2 PURPOSE AND NEED FOR ACTION

The mission of the Department of Water Supply is to "provide customers with an adequate and continuous supply of drinking water in a financially responsible manner, comply with all relevant standards, and assist and facilitate development of water systems in areas not currently served." In keeping with this mission, the Department of Water Supply established an energy policy in 2011 to reduce energy use and its associated costs and environmental impacts. The Project is consistent with this policy and its mission of reducing energy costs by replacing a large portion of its pumping energy demands with renewable wind energy and saving up to 50 percent of its annual pumping cost for the next 20 years. The Project would also contribute to the State's Clean Energy Initiative goal that at least 40 percent of the State's energy be supplied by renewable resources by the year 2030.

The Department of Water Supply operates eight existing water wells for a combined available water capacity of 5 million gallons per day (MGD) in the Lālāmilo-Parker well system. In an average year, the energy required to meet the pumping demands of Lālāmilo-Parker well system exceeds 10,000,000 kilowatt hour (kWh) at the current HELCO rate of 40 cents per kWh. It is anticipated that with the installed generation capacity of 3.3 MW, the repowering of the Lālāmilo Wind Farm will provide up to 75 to 80 percent of the pumping energy demands, thereby saving the water customers approximately $1 million per year at today's electrical rates.

1.3 PROPOSED ACTION

The Department of Water Supply awarded Lālāmilo Wind Company, LLC (Lālāmilo Wind Company) a contract to design, build, and operate the wind farm and associated facilities for the Project. The Project would consist of five Vestas V47-660 kW wind turbines, for a nameplate generation capacity of 3.3 MW for the Lālāmilo wind farm, to power the eight existing water wells in the Lālāmilo-Parker well system, as well as an updated monitoring and control system to optimize the operations of the pumping system. Associated infrastructure would include on-site access road improvement, electrical collection system, operations and maintenance building, new 13-kilovolt (kV) overhead electrical transmission line, and updated switchgear and electrical interconnection equipment. These components are described in more detail below. The anticipated useful lifespan of this Project is 40 plus years.

1.3.1 Wind Farm

Turbines – The Vestas V47-660 turbine has a hub height of 121 feet (37 meters) and a rotor diameter of 154 feet (47 meters), resulting in a maximum height at the top of the blade of 198.5 feet (60.5 meters) above ground level. The blades and rotor hub are attached to the nacelle, which houses mechanical and electrical components including the gear box, generator, and controller. Table 1-2 describes the dimensions of the turbines.

Table 1-2. Dimensions and Specifications of the Vestas V47-660 Turbine

Description	Measurement
Power generation	660 kW
Hub height	121 feet (37 meters)
Rotor type	3-bladed, horizontal axis
Rotor diameter	154 feet (47 meters)
Blade length	77 feet (23.5 meters)
Number of blades	3
Total height above ground	198.5 feet (60.5 meters)
Rotor swept area	18,626 square feet (1,735 square meters)
Cut -in wind speed	16 feet/second (5 meters/second)
Cut-out wind speed	82 feet/second (25 meters/second)

The turbines would be arranged in two southeast to northwest oriented strings, consisting of two and three turbines, respectively (Figure 1-2). The turbines would be marked and/or lighted in accordance with Federal Aviation Administration Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting to improve nighttime visibility for aviation.

Turbine Pads and Foundations – An approximately 30,000 square foot (2,540 square meter) work area would be required at each turbine location to provide space for delivery and laydown of turbine components, crane access, and foundations, as well as turbine construction. This area would be cleared and graded as necessary (Table 1-3). Turbines would be erected with a combination of forklifts and cranes; additional construction equipment would include both wheeled and tracked vehicles.

Each turbine foundation would be approximately 35 feet (10.5 meters) square by 7 feet (2 meters) deep and would consist of approximately 110 cubic yards (3 cubic meters) of concrete. Approximately 11 concrete trucks would be required per foundation. An area of approximately 200 feet (61 meters) radius around the permanent turbine pads would be maintained clear of vegetation during operation (although as discussed below, existing vegetation onsite consists of sparse, non-native grasses).

During operation, technicians would perform routine preventative maintenance on each turbine and troubleshoot problems as needed. Routine maintenance and repairs would require service vehicle access. Should there be a need for major component replacement (e.g., blades, generator, supporting tower), heavy equipment similar to that used during construction would be required. In that case, the access road, crane pad, and staging area would be used in a manner similar to their use during the original tower assembly and construction process.

Meteorological Tower and Radio Towers – There is an existing meteorological (met) tower and two existing radio towers on-site. These would be re-utilized for the Project. No modifications to these structures are included as part of the Proposed Action.

Operations and Maintenance Building – An operations and maintenance building would be located within the wind farm site at the location of an existing building. The existing building remaining from the old wind farm has a building footprint and concrete slab that is approximately 40 feet by 37 feet (12 meters by 11 meters). A minimal gravel area, immediately adjacent to this existing building and used for the original wind farm, would be maintained for parking and outdoor storage.

Internal Access Road –Existing roads remaining from the original Lālāmilo Wind Farm would be used to access the turbines (Figure 1-2). Where necessary the internal access road would be improved and widened to facilitate construction. The internal access road would be approximately 20 feet (6 meters) wide and approximately 1.3 miles (1.5 kilometers) in total length. Up to 3.0 acres (1.2 hectares) would be disturbed in association with the internal access road (Table 1-3). The internal access road would have a gravel surface and storm water collection and erosion control features, and would be maintained as such throughout construction and operation of the Project.

The wind farm site would be accessed via an existing paved Department of Water Supply right-of-way that extends approximately 500 feet (152 meters) north from the interconnect to the entrance to the wind farm site (Figure 1-2). This road may be widened to 25 feet (7.5 meters), remaining within the existing road right-of-way, and would be maintained during construction of the Project as the access road.

Electrical Collection System – Power generated by each of the turbines would be collected by a 13-kV underground electrical collection system. Cables would pass from the generator in each nacelle through the foundation to a pad-mounted step-up transformer and would connect the individual wind turbines in a daisy chain configuration to the interconnect. The cables would pass through the existing buried and encased conduits on the wind farm site and would connect with both the existing and new 13-kV overhead transmission lines at the existing HELCO interconnect located adjacent to the wind farm site (Figure 1-2). A new supervisory control and data acquisition (SCADA) system for the pumping system would transmit data from the turbine controllers to the interconnect and the operations and maintenance building. The SCADA system would optimize the pumping demand and maximize the usage of wind generated electricity. Using small trucks, qualified personnel would routinely monitor, inspect, and maintain the communication and electrical collector cables throughout the Project operation.

1.3.2 Interconnect

Power from the wind farm would be transmitted via the underground electrical collection system to the existing HELCO interconnect, where power would be transmitted to the wells through the existing and new 13-kV overhead transmission lines. Improvements to the existing interconnect would be required to accept the power from the wind farm. All work would be conducted within the existing interconnect footprint.

1.3.3 Transmission Line

A new, overhead 13-kV transmission line would be constructed from the existing HELCO interconnect to deliver power to Parker Wells No. 1 to 4 (Figure 1-2). The transmission line would be approximately 1.3 miles (2.1 kilometers) long and would be installed adjacent to an existing road and within the existing Department of Water Supply 40-foot-wide right-of-way and easement. Poles would be spaced approximately every 300 feet (91 meters), resulting in the installation of up to 25 poles. If any pull-boxes or underground cabling is required it would be within existing disturbed right-of-way. The poles are anticipated to be approximately 30 feet (9 meters) tall wood poles, similar to the existing wood poles supporting HELCO's transmission line. Therefore, the transmission line would have a height at or below 30 feet (9 meters) above ground (the height of the poles with the line sagging between poles).

Conductors will be arranged in the same arrangement as the existing transmission line. The transmission line would be designed to minimize the potential for collision by birds by fitting it with bird flight diverters. Construction of the transmission line would utilize standard industry procedures including surveying, corridor preparation, materials hauling, pull sites, staging areas, structure assembly and erection, ground wire, conductor stringing, cleanup, and revegetation. The transmission line would be accessed via the existing Department of Water Supply Lālāmilo – Parker Wells Access Road. During operations, qualified personnel would routinely monitor, inspect, and maintain the transmission line using light trucks. Heavy construction equipment would only be required if overhead components need to be repaired or replaced.

There is an existing 13-kV transmission line running between the interconnect and Lālāmilo Wells A to D. No Project-related activities are proposed for these wells, other than the provision of power.

1.3.4 External Construction Access Route

An approximately 8-mile (9.5-kilometer) construction access route would be required for the transportation of equipment from Kawaihae Harbor to the wind farm site. The construction access route would primarily follow existing state and county roadways as well as approximately 3.25 miles (4 kilometers) of the Department of Water Supply Lālāmilo – Parker Wells Access Road between Queen Ka ʻahumanu Highway and the wind farm. The major turbine components that are considered oversized loads would require the use of special transportation equipment (e.g., multi-axle transport trailers, stretch trailers, etc.). Where necessary to facilitate crossing steeper portions of the access road, prefabricated ramps may be temporarily placed within the existing road bed to minimize grade break. No modifications (road widening, regrading, or intersection modifications) would be required along the highway.

The existing Lālāmilo – Parker Wells Access Road off of Queen Ka ʻahumanu Highway would be used as the access route for the Project by personnel during construction and operation of the Project. The majority of the existing access road is paved either with concrete or asphalt. Small areas are lined with pressed gravel. No modifications (road widening or regrading) or use of areas outside of the existing road bed would be required along the Lālāmilo – Parker Wells Access Road between the highway and the interconnect. Gravel improvement of the access road between the turn off at the HELCO interconnect and the entrance to the wind farm (within the existing Department of Water Supply right-of-way and easement), described above under Internal Access Road, would be maintained for continued access to the wind farm site, as well as repair of any asphalt damaged by construction traffic.

Each turbine would require up to five (5) deliveries, including three (3) permitted oversized loads, of equipment and materials to its pad. Deliveries would be made using transport vehicles that conform to road weight limits. Timing for the transportation of special loads requiring escort vehicles would be coordinated with Hawaiʻi Department of Transportation (HDOT) to minimize the impacts to commuter traffic. Other construction traffic would primarily occur between the hours of 7:30 a.m. and 3:30 p.m.

Table 1-3. Disturbance Associated with Project Construction and Operation

Project Component	Permanent (Clearing/Grading; Project Facilities)(Acres)	Temporary (Acres)
Turbines	3.45	0.00
Internal Access Road 1/	3.00	0.00
Access Road into Wind Farm 1/	0.17	0.00
Transmission Line	0.06	6.00 2/
Operations and Maintenance Building	0.00	0.00
Met Tower	0.00	0.00
Total	6.68	6.00

1/ Existing road; would be widened as necessary. Acreages are overestimated assuming widening of the entire road length.
2/ Existing 40-ft Department of Water Supply utility easement; includes all areas potentially used for equipment/ materials storage, off-road vehicle driving, and other temporary activities.

1.3.5 Site Clean-Up

All portions of the Project would be maintained in an orderly and clean manner throughout construction. At the completion of the construction phase, a final cleanup of all construction areas would be done, and all construction-related waste would be properly handled in accordance with county, state, and federal policies and permit requirements, and removed from the area for disposal or recycling as appropriate. Areas with disturbed soil that would not be used during operations would be stabilized and returned to preconstruction conditions.

1.3.6 Decommissioning

The Project has an estimated 40-year life based on the projected useful life of the turbines. After the 20 year term of the Power Purchase Agreement (PPA) between the Department of Water Supply and Lālāmilo Wind Company, the Department of Water Supply would evaluate whether to continue operation of the Project or decommission it. If the Project was decommissioned, the power generation equipment would be removed and the site would be returned to a condition as close to its pre-construction (post-2010 decommissioned) state as possible, as contractually required in both the lease with DLNR and the PPA with the Department of Water Supply.

1.4 PROJECT TIMEFRAME AND PRELIMINARY COSTS

The Department of Water Supply anticipates starting construction after the EA and construction permits applications are approved. Construction of the Project is anticipated to take 18 months. It is expected the commercial operation of the Project to occur in the first quarter of 2015. The total anticipated cost to construct the Project would be approximately $13 million.

2.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This section describes the existing physical, biological, and socioeconomic conditions of the Project Area.

2.1 CLIMATE

2.1.1 Existing Conditions

The climate of the Hawaiian Islands is characterized by two seasons, summer (May through September) and winter (October through April). Climate, including temperature, humidity, rainfall and wind patterns, in the islands is influenced by latitude, elevation, proximity to the ocean, and geological features. Summer is typically warmer and drier while winters are cooler and wetter with the majority of storm events occurring during the winter months (WRCC 2014).

The Project Area, ranging in elevation between approximately 1,145 feet (349 meters) and 1,401 feet (427 meters) amsl, is located on the leeward side of the Island of Hawaiʻi and is in the rain shadow of Mauna Kea and Kohala Mountains. Average temperatures in the vicinity of the Project Area range from approximately 54 degrees Fahrenheit (°F) to 74 °F (County of Hawaiʻi Data Book 2012a).

Average annual precipitation recorded at the Waikoloa Station southwest of the Project Area is approximately 13.2 inches and at the Parker Ranch Range 1 Station northeast of the Project Area is approximately 15.7 inches (Giambelluca et al. 2013). The majority of this rainfall occurs between October and March.

Relatively persistent northeasterly trade winds also influence the climate of the Hawaiian Islands. Trade winds affect cloud formation and precipitation, particularly on the windward slopes (WRCC 2014). Leeward areas of the islands tend to be less cloudy, with cloudier conditions occurring during the winter months. Trade winds are more prevalent, occurring 80 to 95 percent of the time, and typically exhibit the highest wind speeds during the summer months. During the winter months trade winds are prevalent about 50 to 80 percent of the time (WRCC 2014).

In December 2009, the National Renewable Energy Lab, a National Laboratory of the U.S. Department of Energy, conducted a preliminary analysis for repowering the old Lālāmilo Wind Farm. They classified the wind resource in the area as a Class 7 wind source, where 1 is minimal and 7 being optimal (NREL 2009).

2.1.2 Potential Impacts

Construction and operation of the Project would not result in direct or indirect effects to local climate conditions including temperature, rainfall, humidity, or atmospheric mixing patterns. Operation of wind turbines can potentially alter atmospheric mixing patterns as the wind passes over a site; however, these effects are unlikely to occur from a project with as few turbines as the Project.

The Project, on a regional level, is expected to have beneficial effects on climate through the reduction of fossil fuel consumption and greenhouse gas emissions. Renewable energy generated by the Project would replace energy currently generated by combustion of fossil fuels, thereby resulting in a long-term reduction in greenhouse gas emissions that contribute to global warming. Additionally, the Project would contribute to the State's Clean Energy Initiative goal of 40 percent of energy from renewable sources by 2030.

Greenhouse gas emissions from construction and operation of the Project (e.g., exhaust from construction vehicles) would be more than offset by the reduction of emissions resulting from operation of the Project. The emissions reductions associated with the new equipment will depend upon the extent to which different types of other generating resources on the island are reduced as a result of the wind turbines. The wind turbines have a nameplate, or peak, generating capacity of 3.3 MW; however they would not run at this load 24 hours per day, 365 days per year. If the capacity factor is 40 percent (as has been assumed for other wind projects), and the power generated displaced an equivalent quantity of power generated from Keāhole Power Plant, the associated carbon dioxide (CO_2) emission reductions would be approximately 11,000 metric tons per year. If instead an equivalent quantity of power were displaced from Hāmākua Power Plant, CO_2 emissions reductions would be approximately 6,000 metric tons per year. However, actual CO_2 emissions reductions may be less, depending on the specific resources and amount of generation displaced. These amounts far exceed those which would be produced by construction and operation of the

Project. Therefore, over the long term, operation of the Project is expected to result in beneficial effects on climate through reduction in levels of greenhouse gas emissions.

2.1.3 Best Management Practices and Mitigation Measures

Impacts to climate would be less than significant; therefore, no mitigation is required.

2.2 GEOLOGY AND TOPOGRAPHY

2.2.1 Existing Conditions

The Project is located on the lower (western) flank of Mauna Kea volcano and is within the U.S. Geological Survey (USGS) mapped stratigraphic formation "hm," Hāmākua Volcanics (Pleistocene) (Wolfe and Morris 1996, Sherrod et al. 2007). This unit consists of lava flows discontinuously mantled by unmapped windblown, tephra-fall, and colluvial deposits. Elevations across the Project range from 1,401 feet (427 meters) amsl to 1,145 feet (349 meters) amsl with on average a slope of 5 percent. Topography of the site consists of a relatively flat plateau, descending to the west and north of the Project Area. Several small dry gulches traverse the landscape in the western and northern portions of the Project Area.

2.2.2 Potential Impacts

Construction activities would involve excavation and drilling for turbine foundations and minimal grading for turbine pads and internal access road improvements. Up to approximately 6.7 acres would be cleared and graded. The Project footprint where surface impacts would occur would be limited in extent, and will not adversely impact the topographic nature of the Project Area relative to the surrounding lands. Due to the previously disturbed/developed nature of the site (e.g., there is currently an internal access road from the original wind farm) and generally flat surface, it is likely that minimal grading will be required. Any grading will be in conformance with the Chapter 10, Erosion and Sediment Control per the Hawai'i County Code (HCC). As such, the Project would not result in significant adverse impacts to geology or topography.

2.2.3 Best Management Practices and Mitigation Measures

Impacts to geology and topography would be less than significant; therefore, no mitigation is required.

2.3 SOILS

2.3.1 Existing Conditions

Soils on the Island of Hawai'i have been classified and mapped by the U.S. Department of Agriculture Soil Conservation Service and Natural Resource Conservation Service (NRCS) (NRCS 2014), the University of Hawai'i Land Study Bureau (LSB) Detailed Land Classification (State of Hawai'i 2014), and the State Department of Agriculture's Agricultural Lands of Importance to the State of Hawai'i (ALISH) system (State of Hawai'i 2014).

The entire Project Area is mapped by the NRCS as Hāpuna-Waikui-Lālāmilo complex, 0 to 20 percent slopes (Figure 2-1). This soil series consists of approximately 35 percent Hāpuna and Waikui and similar soils, and 20 percent Lālāmilo and similar soils, with `a`ā lava flows making up 10

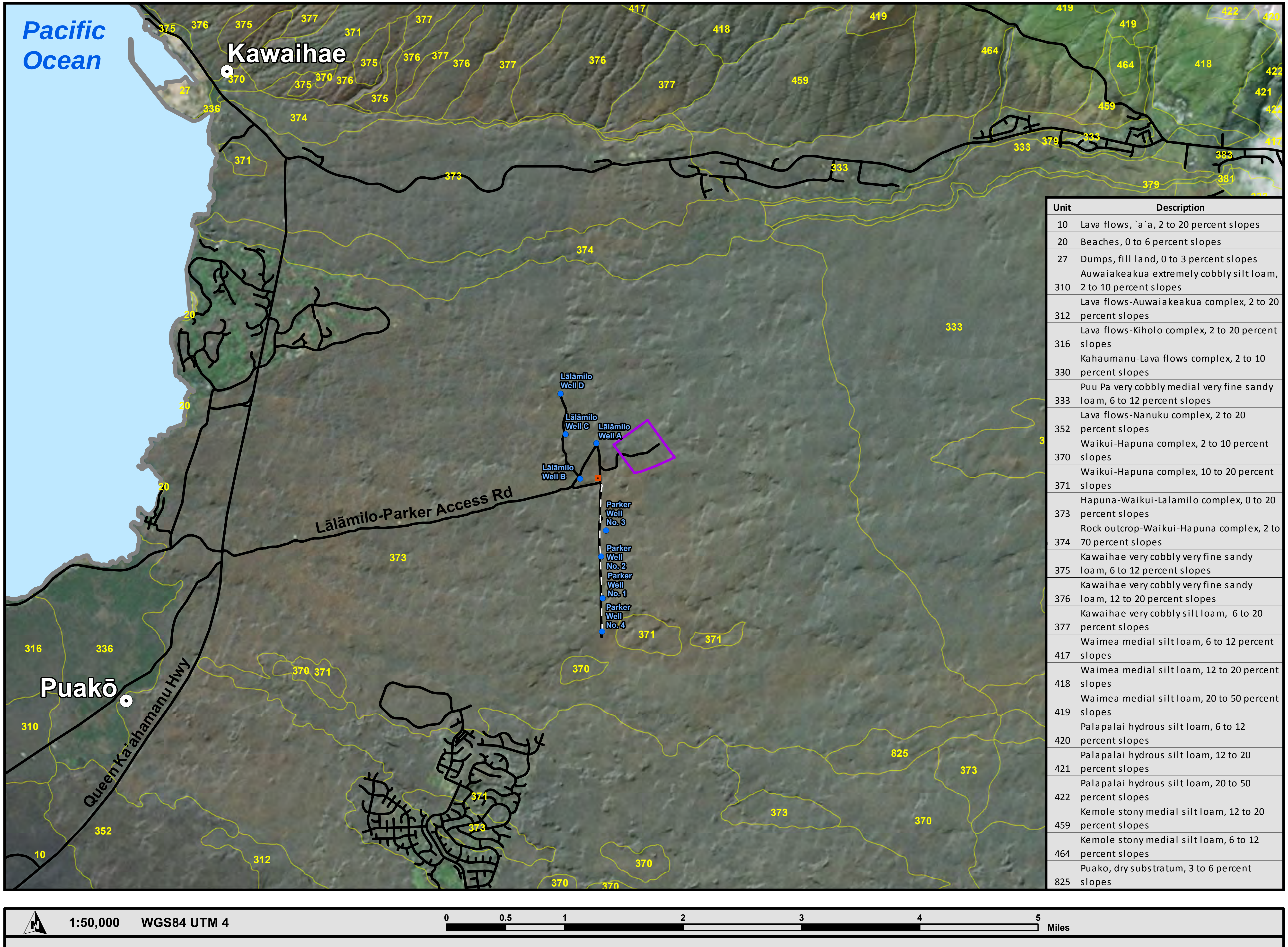
Figure 2-1

Lālāmilo Wind Farm Repowering Project

Soils

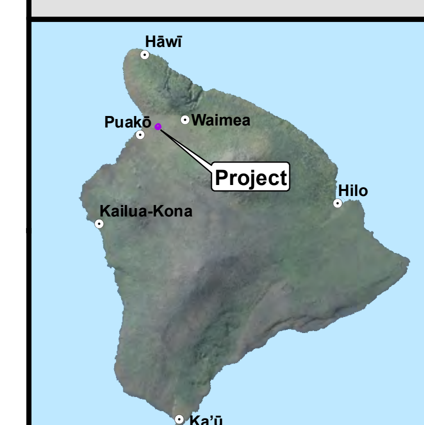
Hawai'i County, HI

May 16, 2014



Unit	Description
10	Lava flows, `a`a, 2 to 20 percent slopes
20	Beaches, 0 to 6 percent slopes
27	Dumps, fill land, 0 to 3 percent slopes
310	Auwaiakeakua extremely cobbly silt loam, 2 to 10 percent slopes
312	Lava flows-Auwaiakeakua complex, 2 to 20 percent slopes
316	Lava flows-Kiholo complex, 2 to 20 percent slopes
330	Kahaumanu-Lava flows complex, 2 to 10 percent slopes
333	Puu Pa very cobbly medial very fine sandy loam, 6 to 12 percent slopes
352	Lava flows-Nanuku complex, 2 to 20 percent slopes
370	Waikui-Hapuna complex, 2 to 10 percent slopes
371	Waikui-Hapuna complex, 10 to 20 percent slopes
373	Hapuna-Waikui-Lalamilo complex, 0 to 20 percent slopes
374	Rock outcrop-Waikui-Hapuna complex, 2 to 70 percent slopes
375	Kawaihae very cobbly very fine sandy loam, 6 to 12 percent slopes
376	Kawaihae very cobbly very fine sandy loam, 12 to 20 percent slopes
377	Kawaihae very cobbly silt loam, 6 to 20 percent slopes
417	Waimea medial silt loam, 6 to 12 percent slopes
418	Waimea medial silt loam, 12 to 20 percent slopes
419	Waimea medial silt loam, 20 to 50 percent slopes
420	Palapalai hydrous silt loam, 6 to 12 percent slopes
421	Palapalai hydrous silt loam, 12 to 20 percent slopes
422	Palapalai hydrous silt loam, 20 to 50 percent slopes
459	Kemole stony medial silt loam, 12 to 20 percent slopes
464	Kemole stony medial silt loam, 6 to 12 percent slopes
825	Puako, dry substratum, 3 to 6 percent slopes

Wind Farm Site
Soil Unit Boundary
Proposed 13kV Transmission Line
Existing Road
HELCO Interconnect
Well
City/Town



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P:\GIS_PROJECTS\Site_Constructors\Lalamilo\MXDs\EA\SiteConstructors_Lalamilo_EA_Fig_2-1_SoilUnits_11i17i_20140516.mxd - Last Saved 5/16/2014 percent of the soil series. These soils, typically found on mountain flanks, side slopes and footslopes, are found on ash fields on `a`ā lava flows. They are well drained, extremely stony soils that formed from basic volcanic ash over `a`ā lava and alluvium over basic volcanic ash (NRCS 2014). The available water capacity for Hāpuna soils is very low (approximately 2.4 inches per foot of soil), Waikui soils is moderate (approximately 8.3 inches per foot of soil), and Lālāmilo soils is high (approximately 11.9 inches per foot of soil).

The LSB's Detailed Land Classification classifies soils based on productivity rating, with "A" rated soils being the most productive and "E" rated soils being the lowest. The soils in the Project Area are classified as "E" (Figure 2-2), which signifies land that is not suitable for agriculture.

The ALISH system classifies agricultural lands based primarily on soil characteristics. This system classifies land as Prime, Unique, or Other Important Agricultural Lands. The Project Area has not been categorized as agricultural land by ALISH (Figure 2-3).

2.3.2 Potential Impacts

Construction of the Project would include ground-disturbing activities, such as clearing and grading. These ground disturbing activities increase the potential for soil erosion and generation of dust. Ground disturbing activities would occur during construction of the Project such as road improvement of the internal access road, the transmission line, and during installation of the wind turbines.

Insomuch as the Project is repowering the original Lālāmilo Wind Farm, the Project would not remove any active agricultural land out of production and would not impact the availability of agricultural land for cultivation. No impacts to prime, unique, or other agricultural land would occur.

Grading and other earthwork associated with construction and operation of the Project would disturb up to approximately 6.7 acres (2.7 hectares). Erosion and dust would be minimized during construction, by implementing common dust suppression techniques, such as regularly watering exposed soils, stockpiling soils, and stabilizing soils. These measures would reduce erosion by holding soil in place and protecting soil from wind, rain, and other soil removing processes. Upon completion of construction, temporarily disturbed areas would be returned to pre-construction conditions. With the implementation of Best Management Practices (BMPs) described below in Section 2.3.3, the Project is not anticipated to result in significant adverse impacts to soils.

2.3.3 Best Management Practices and Mitigation Measures

The BMPs that would be implemented to control and minimize dust and erosion include:

- Sequencing construction activities to minimize the exposure time of cleared areas.
- Minimizing the extent of disturbed areas, where possible.
- To avoid fugitive dust emissions, covering soil stockpile areas containing more than 100 cubic yards of material, or keeping continuously wet.
- Stabilizing all disturbed soil that is not subject to graveling or development, using approved chemical soil binders, jute netting, or other methods.

- Installing erosion and sediment control measures (for example, silt fences) before initiating earth moving activities, and making sure they are properly maintained throughout the construction period.
- During dry periods, inspecting BMP features once weekly and repair as necessary.
- Inspecting and repairing features as needed within 24 hours after a rainfall event of 0.5 inches or greater in a 24-hour period. During periods of prolonged rainfall, inspections would occur daily.
- Apply permanent soil stabilization (that is, graveling or re-planting of vegetation) as soon as practical after final grading.

With the implementation of the BMPs described above, impacts associated with dust and soil erosion resulting from Project construction and operation would be minimized. Therefore, impacts to soils would be less than significant.

2.4 NATURAL HAZARDS

A natural hazard is a naturally occurring event that could negatively affect people, infrastructure, and/or the environment. Many natural hazards can be triggered by another event, though they may occur in different geographical locations, for example, an earthquake can trigger a tsunami in an entirely different geographic area. Natural hazards that can affect Hawai‘i include flooding, tsunamis, hurricanes and tropical storms, earthquakes, volcanic eruptions, and wildfire.

2.4.1 Existing Conditions

2.4.1.1 Flood

Potential flood hazards are identified by the Federal Emergency Management Agency (FEMA) National Flood Insurance Program and are mapped on Flood Insurance Rate Maps (FIRM). The maps classify land into zones depending on the potential for damage and inundation during flood events. The Project Area is mapped by FIRM as being located entirely within Zone X (FEMA 2013). Zone X includes areas determined to be outside the 0.2-percent-annual-chance (or 500-year) floodplain. No base flood elevations or depths are shown within this zone.

2.4.1.2 Tsunami

Tsunamis are large, rapidly moving ocean waves triggered both by disturbances around the Pacific Rim (i.e., teletsunamis) and by earthquakes and landslides near Hawai‘i (i.e., local tsunamis) (USGS 2014). Twenty-six tsunamis with flood elevations greater than 3.3 feet (1 m) have made landfall in the Hawaiian Islands during recorded history and 25 of these had an adverse impact on the Island of Hawai‘i. (Fletcher et al. 2002). Approximately 221 people in Hawai‘i were killed by tsunamis in the twentieth century (USGS 2014). No portion of the Project Area is in the Civil Defense Tsunami Evacuation Zone (NOAA 2014a).

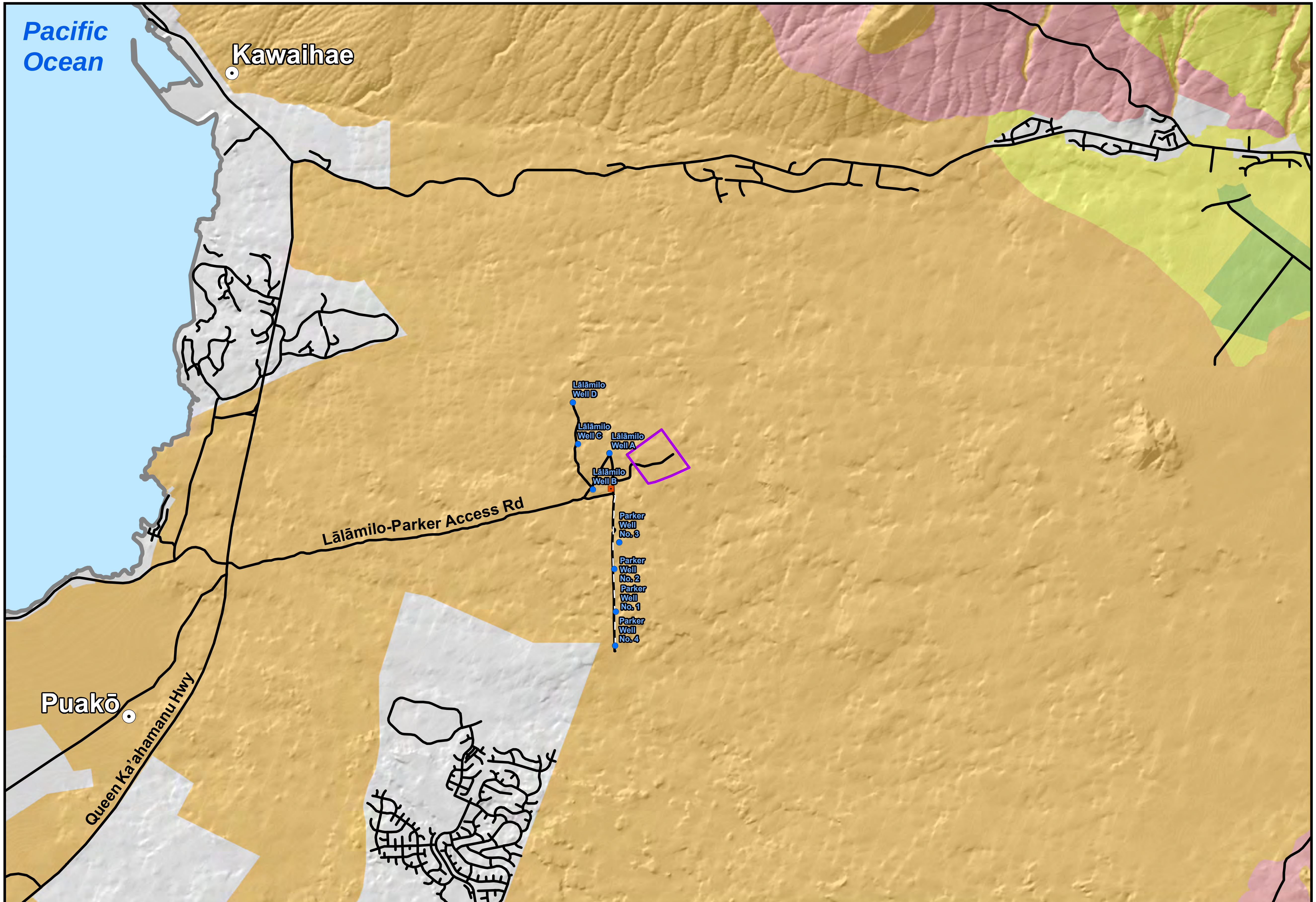
Figure 2-2

Lālamilo Wind Farm Repowering Project

Land Study Bureau Detailed Land Classification

Hawai'i County, HI

May 16, 2014

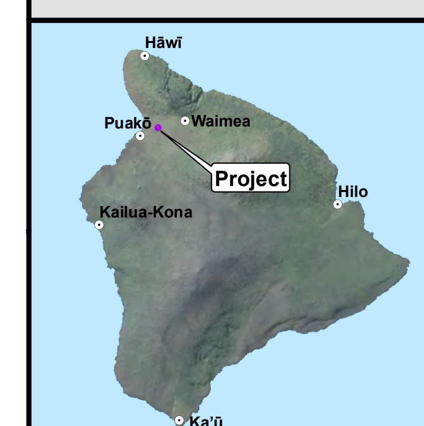


Wind Farm Site
Proposed 13kV Transmission Line
Existing Road
HELCO Interconnect
Well
City/Town

Agricultural Productivity *

- B
- C
- D
- E
- Unclassified

* The agricultural productivity rating ranges from A to E, with A having the highest productivity.



1:50,000 WGS84 UTM 4

0 0.5 1 2 3 4 5 Miles

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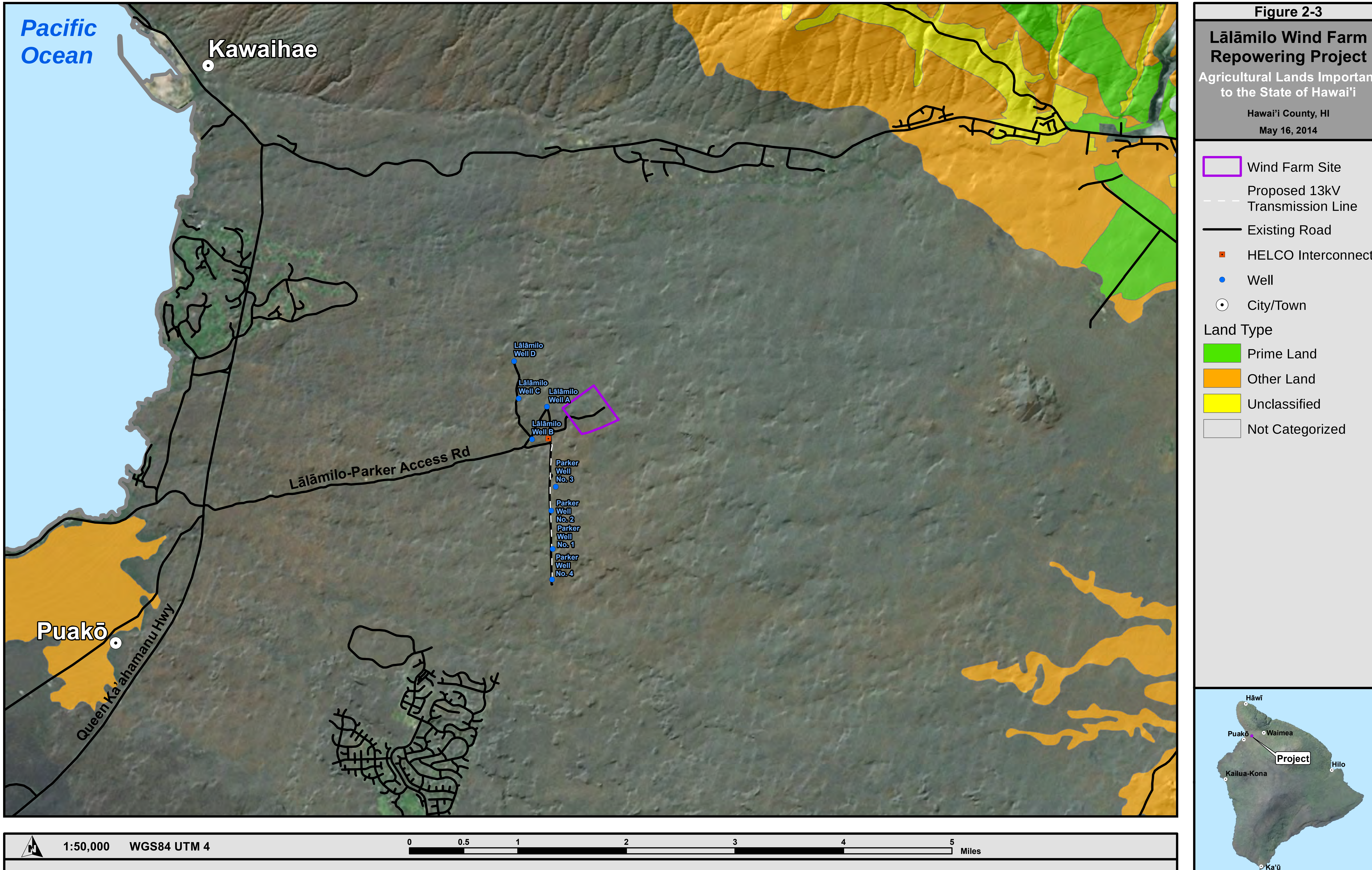

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2.4.1.3 Hurricanes and Tropical Storms

Hurricanes develop over warm tropical oceans, and have sustained winds that exceed 74 miles per hour (mph). Based on the Saffir-Simpson Hurricane Wind Scale (NOAA 2014b), there are five categories of hurricanes:

- Category 1 has sustained winds between 74 and 95 mph
- Category 2 has sustained winds between 96 and 110 mph
- Category 3 has sustained winds between 111 and 129 mph
- Category 4 has sustained winds between 130 and 156 mph
- Category 5 is sustained winds greater than 157 mph

The Central Pacific Hurricane season runs from June 1 to November 30. Hurricanes are relatively rare in Hawai‘i; only five hurricanes have caused serious damage to the islands since 1950 (Businger 1998). No recorded hurricane has made landfall on the Island of Hawai‘i, although Hurricane Estelle (in 1986) affected the Island of Hawai‘i through high winds and surf (Businger 1998; Fletcher et al. 2002).

Tropical storms are similar to hurricanes, except that the sustained winds are below 74 mph. These events can also produce torrential rains. Tropical storms occur more frequently in Hawai‘i than hurricanes and typically pass sufficiently close to Hawai‘i every 1 to 2 years to affect the weather in some part of the Islands (WRCC 2013). Although the Island of Hawai‘i has not directly been hit by a hurricane, several strong tropical storms have brought about considerable damage (Fletcher et al. 2002). Fifty-six tropical storms, or high wind events, have affected the Island of Hawai‘i since 1871 (Fletcher et al. 2002).

2.4.1.4 Earthquakes

Earthquakes in Hawai‘i are often linked with volcanic activity (USGS 2001). Numerous small volcanic earthquakes are triggered by eruptions and magma movement within the presently active volcanoes of Kīlauea, Hualālai, and Mauna Loa on the Island of Hawai‘i, and Lō`ihi off the coast of the island. Tectonic earthquakes tend to produce larger earthquakes and occur in areas of structural weakness at the base of these active volcanoes or deep within the Earth's crust beneath the Island of Hawai‘i (USGS 2001). Several strong tectonic earthquakes have caused extensive damage to roads, buildings, and homes, have triggered local tsunamis and have resulted in loss of life on the Island of Hawai‘i in the past 150 years (USGS 2001). Most recently, in 2006, a series of earthquakes with magnitudes of 6.0 and 6.7 occurred near Kīholo Bay resulting in more than $100 million in damages (USGS 2013). Forty-four earthquakes with a magnitude of 5.0 or greater occurred in Hawai‘i County between 1974 and 2011 (County of Hawai‘i Data Book 2012b)

The Uniform Building Code (UBC) was developed to regulate building codes in specific areas to account for seismic hazards. The UBC‘s seismic hazard classification system is based on expected ground shaking strength and probability of shaking occurring within a specified time (USGS 2001). Hawai‘i has four UBC seismic hazard zones. According to the USGS, Zone 0 means that there is “no chance of severe ground shaking” and a seismic hazard rating of 4 means that there is a “10 percent chance of severe shaking in a 50-year interval" (USGS 2001). The County of Hawai'i has a UBC seismic risk zone ranking of 4 (USGS 2001).

2.4.1.5 Volcanic Hazards

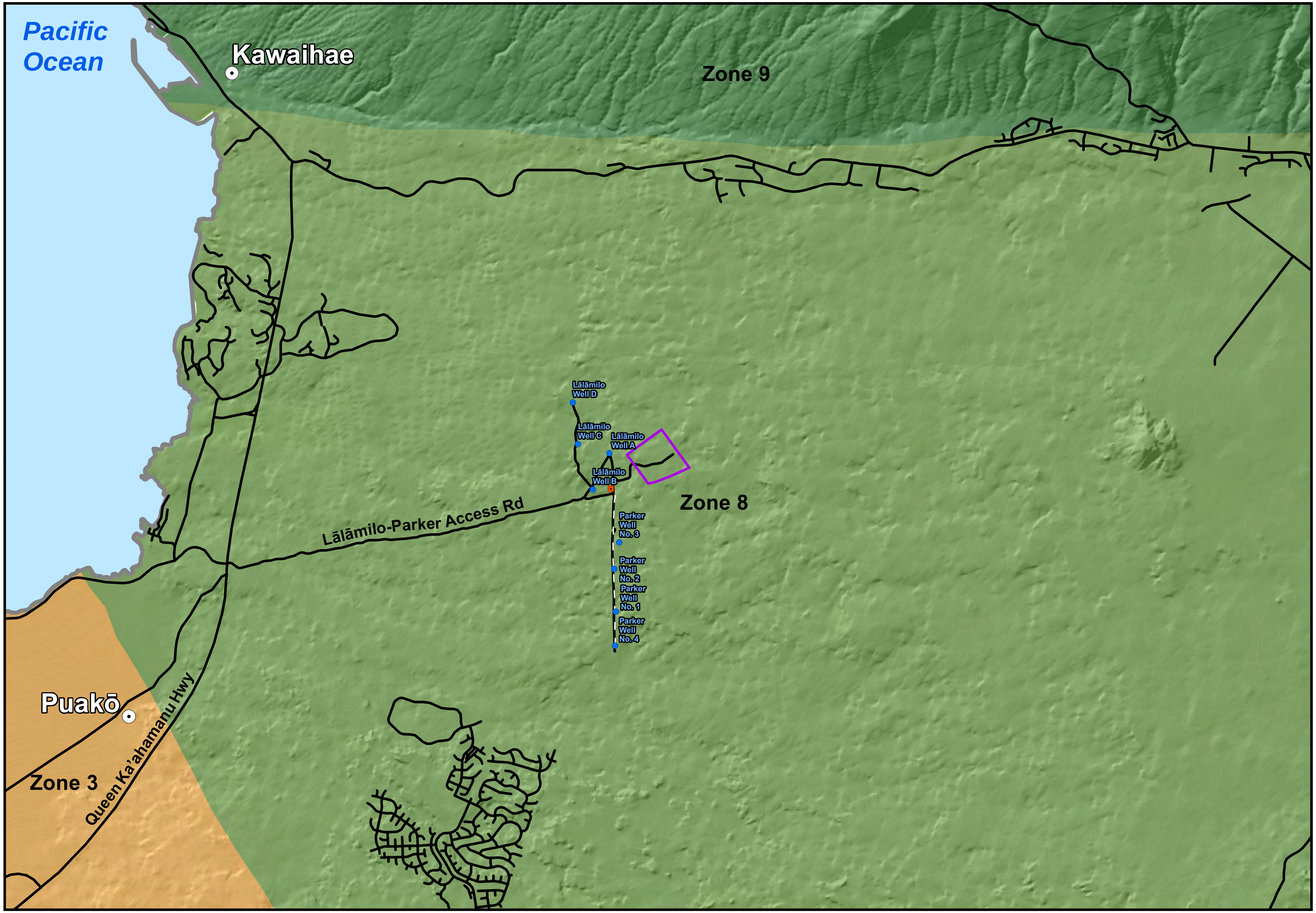
There are five volcanoes on the Island of Hawai'i: Kīlauea, Mauna Loa, Hualālai, Mauna Kea, and Kohala, and one, Lō`ihi, located just offshore of the island. All of these volcanoes, except Mauna Kea and Kohala are considered active volcanoes (USGS 2001). Volcanic hazards include lava flows, tephra (airborne lava fragments), emission of volcanic gases, explosive eruptions, and ground cracks and settling (USGS 1997). While they seldom endanger people's lives, lava flows on Hawai'i are the most common of the volcanic hazards and pose the greatest threat to property (USGS 1997). Lava flows may burn and/or bury structures in their path.

The USGS has published a volcanic hazard zone map for the Island of Hawai'i. The map divides the island into zones ranked from one to nine, with one being the area of greatest hazard, based primarily on the probability of coverage by lava flows (USGS 1997). The Project Area is located within Zone 8, which indicates that only a small percent of the area has been covered in lava in the past 10,000 years (USGS 1997; Figure 2-4).

Emissions of volcanic gases, such as sulfur dioxide, can react with oxygen and atmospheric moisture to produce volcanic smog (also known as vog) and acid rain (USGS 2000). Volcanic gases are emitted not only during all types of eruptions, but can also be released by inactive eruptive vents and fumaroles (USGS 1997). Volcanic smog can increase air pollution, decrease visibility and pose a health hazard by aggravating pre-existing respiratory conditions. Emissions of volcanic sulfur dioxide can also combine with water to form sulfuric acid which poses hazards to human health and can harm structures made of metal and other materials (USGS 1997). Hazards from volcanic gas emissions are greatest immediately downwind from active vents and typically vog from Kīlauea is blown over the southwest area of the island (USGS 2000), south of the Project Area.

2.4.1.6 Wildfires

Fire is believed to have been infrequent in the lowlands of the Hawaiian Islands prior to human settlement. Wildfires have increased in frequency with Polynesian and European colonization, the introduction and spread of invasive species, and the cessation of feral and domestic ungulate grazing (La Rosa et al. 2008). Fires of volcanic origin occurred in Hawai'i prior to human colonization and continue today; however, these fires are intermittent and geographically localized (La Rosa et al. 2008). Currently, wildfires in the Hawaiian Islands occur most commonly in lowland communities, with human activity as the primary cause. Between 2009 and 2013, 168 wildfires (fires occurring outside and/or in association with natural vegetation/brush) occurred within the South Kohala region (approximately 33 wildfires occur per year; Hawaii County Fire Department 2014.



1:50,000 WGS84 UTM 4

0 0.5 1 2 3 4 5 Miles

Figure 2-4

Lālāmilo Wind Farm Repowering Project

Lava Hazard

Hawai'i County, HI

May 16, 2014

Wind Farm Site

Proposed 13kV Transmission Line

Existing Road

HELCO Interconnect

Well

City/Town

Lava Flow Hazard Zones

1

2

3

4

5

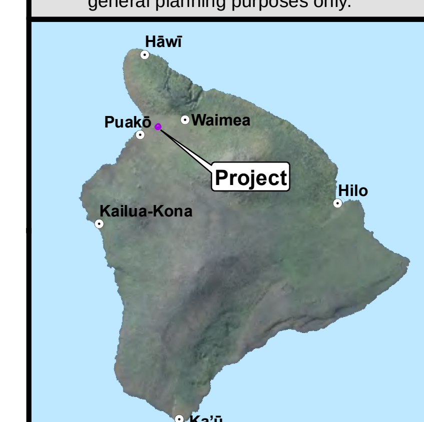
6

7

8

9

* Lava hazard zones are ranked from 1 (Highest) to 9 (Lowest) based on the location of past eruptive events, past lava coverage, and topography. The zone boundaries are approximate and gradual and should be used for general planning purposes only.



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Wildfires have resulted in extensive damage to life and property and pose an ecological threat to endemic flora and fauna in the Hawaiian Islands (Chu et al. 2002). Wildfires can also result in impacts to native species and can facilitate the proliferation of non-native invasive species (La Rosa et al. 2008) as well and increase soil erosion and runoff and decreasing water quality in the area. Fountain grass (*Pennisetum setaceum*) and buffelgrass (*Pennisetum ciliare* [*Cenchrus ciliaris*]), two non-native grasses, are the most dominant species in the Project Area (Tetra Tech 2014). These two species are highly flammable and can increase the spread of wildfire.

2.4.2 Potential Impacts

Neither construction nor operation of the Project is expected to affect the occurrence rate of natural hazards or the level of risk to the public, with the exception of a very minor increased potential for wildfires. Construction of the Project has the potential to increase fire risk associated with the use of vehicles and the presence of electrical equipment in the Project Area. Fire risk associated with operation of wind turbines is generally low and will be minimized by the design features of the turbines. Additionally, grass and other flammable materials will be kept well away from the base of the towers as a matter of regular maintenance. Implementation of fire prevention measures and routine monitoring and maintenance of Project structures and surrounding vegetation, albeit very sparse, would reduce the fire risk even further.

The Project Area lies outside the 500-year floodplain and the designated tsunami evacuation zone, therefore, no flood or tsunami hazards are anticipated during the life of the Project. Construction and operation could be adversely affected by a natural hazard, such as a hurricane, earthquake, or volcanic eruption; however, the occurrence rate of such a natural hazard in the area is expected to be very low. To reduce any risk associated with natural hazards, the Project will implement design features to reduce risk of damage, will include industry standard BMPs and will comply with the 2006 International Building Code (IBC). The 2006 IBC provides minimum design criteria to address the potential for damage due to seismic disturbances. For these reasons, the Project is not anticipated to result in significant adverse impacts related to natural hazards.

2.4.3 Best Management Practices and Mitigation Measures

Impacts associated with natural hazards would be less than significant; therefore, no mitigation is required.

2.5 HYDROLOGY AND FRESH WATER RESOURCES

2.5.1 Existing Conditions

The Project Area is within the boundaries of the Island of Hawaiʻi Waimea aquifer (Aquifer Code 8030; State Commission on Water Resource Management 2008). The State-identified sustainable yield for the Waimea aquifer is 24 MGD. There are eight existing large-capacity deep groundwater wells in the Lālāmilo-Parker well system operated by the Department of Water Supply. The wells provide potable water for the system serving Puakō to Kawaihae in the region of South Kohala. The wells are ideally located adjacent, within a distance of approximately 0.15 miles to 1.3 miles (0.24 kilometers to 2.1 kilometers), to the Project in order to efficiently supply a portion of the power needs. The combined capacity of the eight wells is 5 MGD, which range in depth from 1,106 feet to

1,250 feet (337 meters to 381 meters). During construction, the wells would be used temporarily as a source of water to irrigate exposed soils for the purpose of fugitive dust control.

There are no perennial streams, intermittent streams or wetlands within the Project Area, based on a review of mapping from the National Wetlands Inventory (USFWS 2014) and National Hydrography Dataset (NHD 2014), and based on site observations. Additionally, the U.S. Army Corps of Engineers confirmed that there are no waters of the U.S. within the Project Area (see letter included in Appendix A).

2.5.2 Potential Impacts

There are no bodies of water in the Project Area; therefore, the Project would have no direct effects to hydrology or freshwater resources. Stormwater would be managed during construction in order to meet all applicable federal, state and county water quality requirements associated with construction sites. Appropriate BMPs would be implemented during construction to minimize soil erosion (see Section 2.3) and prevent stormwater from transporting pollutants offsite, including the use of swales and berms during construction to manage stormwater runoff. Additionally, transmission line poles would be placed such as to avoid installing the poles within the bed or banks of any gulches or drainage ways, thereby avoiding any impacts to waters of the U.S. With the implementation of BMPs described below in Section 2.5.3, the Project is not anticipated to have significant adverse impacts to groundwater or surface water resources.

2.5.3 Best Management Practices and Mitigation Measures

Standard BMPs that would be implemented to minimize potential impacts to hydrology and freshwaters associated with erosion are listed in Section 2.3.3. Stormwater collection and erosion control features such as swales and berms would also be implemented during construction to manage stormwater runoff. With the implementation of these measures, impacts associated with erosion and stormwater runoff resulting from Project construction and operation would be minimized. Therefore, impacts to hydrology and water resources would be less than significant.

2.6 MARINE WATERS

2.6.1 Existing Conditions

The Project is located approximately 4 miles (6.4 kilometers) inland from the nearest coastline at Hāpuna Beach State Recreation Area. Near shore marine waters off the coast of Hāpuna Beach are classified as class "AA" by the State of Hawai'i Department of Health (HDOH) (HDOH 2013a). According to DOH Water Quality Standards, Class "AA" waters are described as "waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or action" (HAR 11-54-03).

2.6.2 Potential Impacts

Development of the Project would result in a negligible increase in the amount of impermeable surface area of the Project Area (less than 1 acre) associated with the five wind turbines and the transmission line poles. Because the original operations and maintenance building would be reused for the Project, no additional impervious surface would result. With the implementation of the

BMPs described below in Section 2.6.3, the Project is not anticipated to have significant adverse impacts to marine waters.

2.6.3 Best Management Practices and Mitigation Measures

Standard BMPs that would be implemented to minimize potential impacts to marine waters associated with soil erosion are listed in Section 2.3.3. In addition, swales and berms would be installed during construction to manage stormwater runoff to protect downstream properties including marine waters. With the implementation these measures, impacts associated with soil erosion and stormwater runoff resulting from Project construction and operation would be minimized. Therefore, impacts to marine waters would be less than significant.

2.7 BOTANICAL RESOURCES

2.7.1 Existing Conditions

2.7.1.1 Vegetation Communities

A biological reconnaissance survey of the wind farm site and access road from the wind farm site to the HELCO interconnect was conducted in December 2013 to document vegetation communities and the presence of rare plants. The Biological Reconnaissance Survey report is included in Appendix B. A follow up survey along the proposed transmission line corridor was conducted in March 2014. Based on results of a biological reconnaissance survey, the Project Area consists of a single heavily disturbed, dry grassland (Appendix B). Fountain grass (*Pennisetum setaceum*) and buffelgrass (*Cenchrus ciliaris*) were the dominant species, both of which are non-native, aggressive, introduced grasses. Isolated or small groups of introduced kiawe (*Prosopis pallida*), klu (*Acacia farnesiana*), and koa haole (*Leucaena leucocephala*) were broadly distributed along the access road and gulches, and a mixture of introduced and native herbaceous and shrub species were widely scattered among the dominant grasses.

Twenty-three plant species including four indigenous species were observed during the biological reconnaissance survey of the Project Area (Tetra Tech 2014; Appendix B). The four indigenous species observed are: ‘uhaloa (*Waltheria indica*), ‘ilima (*Sida fallax*), ‘a‘ali‘i (*Dodonaea viscosa*), and koali awahia (*Ipomoea indica*). All native plants observed within the Project Area are widespread in appropriate habitat on the Island of Hawai‘i and elsewhere in the Hawaiian Islands. ‘Uhaloa was scattered throughout the Project Area, whereas ‘a‘ali‘i, ‘ilima, and the single observed koali ‘awahia plant were concentrated in the vicinity of a topographical ridgeline in the northeastern portion of the Project Area. Despite the presence of scattered native species, there was no intact native dryland plant community.

2.7.1.2 Special Status and Rare Plant Species

No federal or state listed threatened or endangered plant species or other special status or rare plant species were observed during the biological reconnaissance survey (Tetra Tech 2014; Appendix B). Although the reconnaissance survey was conducted during a significant and prolonged drought, the disturbed nature of the site and its past land use, including a long history of cattle (*Bos taurus*) grazing and the former use of the Project Area as a wind farm, support that there is a very low likelihood of the occurrence of rare or special status plant species in the Project Area. This assessment is further bolstered by the absence of threatened or endangered plant species during a botanical survey at the Waikoloa Highlands subdivision 3 miles (4.8 kilometers) away in 2006 (David and Guinther 2006).

2.7.2 Potential Impacts

Project development would not impact any special status or rare plant species, including federal or state listed threatened, endangered, or candidate plant species, as none were detected during the biological reconnaissance survey, and none are expected to occur in the Project Area. Existing plants within the Project Area have little value as native botanical resources because the scattered individuals of the few native species observed are common and widespread in the area and across the Hawaiian Islands. With the implementation of measures described below in Section 2.7.3, development of the Project is not anticipated to result in significant adverse impacts to botanical resources.

2.7.3 Best Management Practices and Mitigation Measures

To avoid and minimize potential impacts to vegetation the following measures would be implemented:

- Standard stormwater BMPs such as using stormwater collection and erosion control features such as swales and berms will be implemented to capture and convey stormwater in areas of temporary disturbance.
- With the exception of areas where permanent surface recontouring is required, disturbed areas will be restored to preconstruction conditions.
- To minimize the introduction and spread of invasive plant species, potential off-site sources of materials (gravel, fill, etc.) will be inspected, and the import of materials from sites that are known or likely to contain seeds or propagules of invasive species will be prohibited.
- Vehicle operators transporting materials to the Project Area from off-site will be required to follow protocols for removing soils and plant material from vehicles and equipment prior to entry onto the site.

Given the low diversity of vegetation within the Project Area, and with the implementation of these measures, the impacts of development of the Project to botanical resources would be less than signfiicant.

2.8 WILDLIFE RESOURCES

This section describes wildlife resources in two groups: non-listed wildlife and Endangered Species Act (ESA) listed species. Non-listed wildlife includes Hawai‘i State Species of Greatest Conservation Need, Migratory Bird Treaty Act (MBTA)-protected species, and species that do not have a special status. Each of the special status categorizations has some overlap with others, and to avoid duplication, species were grouped hierarchically by special status as Hawai‘i State Species of Greatest Conservation Need, MBA-protected species, and ESA-listed species. Areas of overlap are identified parenthetically for species having more than one category.

2.8.1 Existing Conditions

2.8.1.1 Non-Listed Wildlife

Based on results from a biological reconnaissance survey, fauna within the Project Area are scarce and dominated by non-native species (Tetra Tech 2014; Appendix B). Species detected during the biological reconnaissance survey included five introduced birds, an introduced mammal, and two insects, one introduced and one indigenous (Table 2-1).

Table 2-1. Fauna Observed during General Biological Surveys of the Lālāmilo Wind Farm

Species	Scientific Name	Status	Protected Status1/
Birds			
chestnut-bellied sandgrouse	*Pterocles exustus*	Introduced	
zebra dove	*Geopelia striata*	Introduced	
sky lark	*Alauda arvensis*	Introduced	MBTA
house finch	*Carpodacus mexicanus*	Introduced	MBTA
African silverbill	*Lonchura cantans*	Introduced	
Mammals			
domestic cow	*Bos taurus*	Domesticated	
Invertebrates			
globe skimmer	*Pantala flavescens*	Indigenous	
house fly	*Musca domestica*	Introduced	
1/ MBTA= Migratory Bird Treaty Act			

Five introduced bird species were detected during the biological reconnaissance survey and one additional species, the Pacific golden-plover (*Pluvialis fulva*), an indigenous migrant, was detected during avian radar surveys (ABR 2013; Tetra Tech 2014 [Appendix B]). Of these, three introduced species—sky lark (*Alauda arvensis*), African silverbill (*Lonchura cantans*), and chestnut-bellied sandgrouse (*Pterocles exustus*)—could nest in the Project Area. Other non-listed species could occur within the Project Area. However, due to the presence of few live plants, use of the area by other bird species is expected to be very infrequent and consist of occasional overflights of the area by other introduced species.

Domestic cattle were the only mammals observed in the Project Area. However, it is likely that other introduced species such as feral goat (*Capra hirca*), small Indian mongoose (*Herpestes auropunctatus*), cat (*Felis catus*), house mouse (*Mus musculus*), and rats (*Rattus spp.*) also occur within the Project Area. Populations of each of these species are likely to be very low due to the low availability of live plants in the Project Area which would act as food, or food for supporting prey, for each of these species.

No reptiles or amphibians were observed during the surveys. None of the terrestrial reptiles or amphibians that occur in Hawaiʻi is native to the Hawaiian Islands and therefore none is a species of concern. Populations of each of these species are likely to be low due to the low availability of live plants in the Project Area which would act as food or food for supporting prey for any of these species.

Two insect species were recorded in the Project Area, the globe skimmer (*Pantala flavescens*), an indigenous dragonfly, and the introduced house fly (*Musca domestica*). These are both common and widespread species in the Hawaiian Islands and across the planet. Given the presence of domesticated cattle in the vicinity, other common, non-native insect species are also likely to occur within the Project Area.

Hawai'i State Species of Greatest Conservation Need

Hawaiian Short-eared Owl (MBTA)

The Hawaiian short-eared owl was not detected during the biological reconnaissance survey (Tetra Tech 2014; Appendix B). The Hawaiian short-eared owl is a widespread resident species on the island of Hawai'i where it is most common in open habitats such as grasslands, shrublands, and montane parklands (Mitchell et al. 2005, Pyle and Pyle 2009). The species preys on a wide variety of animals, including introduced small mammals, birds, and insects. As there is little vegetative cover to support prey populations or the owl's ground nests, which are typically somewhat hidden in low-growing vegetation, the species is likely to only occur in the Project Area in transit.

Pacific Golden-Plover (MBTA)

During fall nocturnal radar surveys, biologists observed daily patterns of approximately 10 Pacific golden-plovers flying toward the ocean through the vicinity of the Project Area in the evening around sunset and similar numbers flying inland in the morning around sunrise (ABR 2013). During both evening and morning observations, peak movements occurred during daylight hours. Pacific golden-plovers occur in Hawai'i July through May, utilizing a wide variety of habitats for foraging, including pastures on mountain slopes up to over 8,000 feet (2,440 meters) elevation (Mitchell et al. 2005, Pyle and Pyle 2009). Preferred foraging areas include open habitat with plentiful insects. The absence of vegetative cover for insects and the abundance of similar habitat throughout the region suggest that the Pacific golden-plover is only likely to use the Project Area by flying through it in transit between areas that provide food.

Migratory Bird Treaty Act-protected Species

The MBTA-protected species with the potential to occur in the Project Area include indigenous species and resident bird species introduced from the mainland U.S., where they are considered migratory and are hence protected under the MBTA—this protection carries over to populations in Hawai'i, despite a species being introduced to the islands. Three MBTA-protected species are known to use the Project Area, Pacific golden-plover (see Hawai'i State Species of Greatest Conservation Need above), sky lark, and house finch (*Carpodacus mexicanus*). The sky lark (a resident and introduced species) frequents open ranchland habitats throughout the main Hawaiian Islands (Pyle and Pyle 2009), and is expected to be a permanent resident in the Project Area and vicinity. The house finch (a resident and introduced species) is a widespread species in the main Hawaiian Islands that frequents a variety of habitats, including ranchlands and grassland habitats. It may occasionally use the Project Area, but is unlikely to nest there due to the absence of trees (Pyle and Pyle 2009).

2.8.1.2 Endangered Species Act-Listed Species

Hawaiian Hoary Bat—Endangered (Species of Greatest Conservation Need)

The Hawaiian hoary bat (*Lasiurus cinereus semotus*), or ʻōpeʻapeʻa, is the only fully terrestrial native mammal in the Hawaiian Islands. It has been observed in a variety of habitats that include open pastures and more heavily forested areas in both native and non-native habitats (Mitchell et al. 2005, Gorressen et al. 2013). Typically, this species feeds over streams, bays, along the coast, over lava flows, or at forest edges where it forages on native and non-native night-flying insects (Whitaker and Tomich 1983). Hawaiian hoary bats are known to roost solitarily in tree foliage (using native and non-native vegetation) and have only rarely been seen exiting lava tubes, leaving cracks in rock walls, or hanging from human-made structures. Hawaiian hoary bats are found in both wet and dry areas from sea level to 13,000 feet (2,962 meters) amsl, with most observations occurring below 7,500 feet (2,286 meters) amsl (USFWS 2012a). Research indicates that Hawaiian hoary bats on the Island of Hawaiʻi use coastal lowlands during the breeding season (April – August) and migrate to interior highlands during the winter (Gorressen et al. 2013). However, Hawaiian hoary bats can also range between habitats and elevations within a single night to target optimal local foraging opportunities (Gorressen et al. 2013).

The Hawaiian hoary bat is known to occasionally use the Project Area based on results from a 1-year acoustic monitoring study conducted for this Project (Insight Environmental 2013). Results of this study suggest bat presence varies seasonally, with one or more bats detected during 45 percent of the nights May–November, while one or more bats were detected during only 5 percent of the surveys December–April. On average, 0.13 bat passes per recorder-night were identified. Recent research on Hawaiian hoary bats suggests that bats can use a wide variety of introduced and native trees for roosting, but trees are typically at least 15 feet (5 meters) tall and have dense foliage cover (Mitchell et al. 2005; USFWS and DOFAW pers. comm. 2013). Large trees are sparsely distributed in the Project Area and none have the dense foliage cover preferred by Hawaiian hoary bats. Therefore, the Project Area is only used by bats for foraging or in transit between foraging and roosting locations.

Hawaiian Petrel—Endangered (Species of Greatest Conservation Need, MBTA)

The Hawaiian petrel (*Pterodroma sandwichensis*), or ʻuaʻu, is a highly pelagic, migratory seabird that only breeds in remote mountain habitats in the southeastern Hawaiian Islands and forages at sea. Nesting colonies are typically on steep slopes in high elevation xeric habitats, but they also nest in wet, dense forests at mid- to high-elevations. On the Island of Hawaiʻi, small numbers breed in lava beds between Mauna Loa and Mauna Kea, near Kīlauea Crater, on the southeast slopes of Mauna Loa, and on Hualālai (Pyle and Pyle 2009). However, the lava beds between Mauna Kea and Mauna Loa are the only known breeding area that would result in Hawaiian petrels flying through the Project Area when moving between breeding colonies and their ocean foraging grounds.

Hawaiian petrels return to their breeding colonies each year between March and April, and nesting colonies are left vacant following the departure of fledglings in October and November (Simons and

Hodges 1998). The frequency of passage between the nesting colonies and the ocean varies throughout the breeding season with the developmental stage of nestlings and the nesting period. Passage rates typically peak in summer when non-breeders continue to attend the colony and young are being fed at successful nests (Simons and Hodges 1998). Hawaiian petrels feed their young mostly at night with flights between the ocean and breeding ground occurring throughout the night but concentrated during crepuscular periods (Day and Cooper 1995, Deringer 2009).

A fall nocturnal radar survey was conducted to evaluate the frequency with which listed seabirds including Hawaiian petrel could fly through the Project Area (ABR 2013). Results included the detection of radar images consistent with petrels or shearwaters (petrel/shearwater target), but no target was identified to species. During 5 days of surveys, this effort identified daily passage of 1 to 5 landward bound petrel/shearwater targets and 0 to 3 seaward bound petrel/shearwater targets. The timing of the detections, flight direction, and flight characteristics were consistent with Hawaiian petrel as well as the Newell's shearwater (*Puffinus auricularis newelli*), but it is also possible that some or all of these detections were non-listed species exhibiting behavior consistent with listed seabirds. As the Hawaiian petrel forages for food over the open ocean and typically nests in burrows in high elevation xeric habitats or on steep forested slopes, neither of which occur in the Project Area, it would only occur within the Project Area in transit between the ocean and nesting grounds.

Newell's Shearwater—Threatened (Species of Greatest Conservation Need, MBTA)

The Newell's shearwater, or ʻaʻo, is a highly pelagic migratory seabird endemic to the southeastern Hawaiian Islands that typically breeds in isolated locations on steep slopes at middle to high elevations (Ainley et al. 1997). On the Island of Hawaiʻi, nesting colonies have only been confirmed in the Puna District on the eastern side of the island and distant from the Project (Ainley et al. 1997, Reynolds and Ritchotte 1997). However, suitable habitat for this species occurs on the slopes of Hualālai and the Kohala Mountains. While the Project Area is not situated along a flight path likely to be used by Newell's shearwaters attending potential colonies in these areas, the potential for the species to occasionally fly through the area cannot be ruled out.

The breeding season begins in April when adults arrive at the nesting colony to prospect for nest sites, and the colony is left vacant upon the departure of fledglings in October, November, and rarely, December. The frequency of passage between the nesting colonies and the ocean varies throughout the breeding season with the developmental stage of nestlings and the nesting period. Passage rates typically peak in summer when non-breeders continue to attend the colony and young are being fed at successful nests (Ainley et al. 1997). Newell's shearwaters feed their young mostly at night with flights between the ocean and breeding ground occurring throughout the night but concentrated during immediately after dusk and before dawn (Day and Cooper 1995; Deringer 2009).

Detections from fall nocturnal radar survey could have included detections of the Newell's shearwater or ʻaʻo, but some or all of these detections could have been non-listed species exhibiting behavior consistent with listed seabirds (See Hawaiian Petrel, above; ABR 2013). As the Newell's shearwater forages for food over the open ocean and typically nests in burrows at middle to high elevations on steep and densely vegetated mountain slopes (Ainley et al. 1997), which do not occur within the Project Area, it would only occur within the Project Area in transit between the ocean and nesting grounds.

Hawaiian Goose—Endangered (Species of Greatest Conservation Need, MBTA)

The Hawaiian goose (*Branta sandvicensis*), or nēnē, is a year-round resident endemic to the southeastern Hawaiian Islands where populations currently occur on several islands. The Hawaiian goose nests from sea level to high elevations across a variety of habitats including beach strand, shrubland, grassland, and ancient lava flows (Banko et al. 1999; Mitchell et al. 2005; Pyle and Pyle 2009). As the Hawaiian goose is relatively sedentary, translocation of individuals and management of populations has had a significant effect on the current distribution of the species (Banko et al. 1999). On the Island of Hawaiʻi the species occurs at highest densities in dry subalpine scrub (Stone et al. 1983; Scott et al. 1986). In the vicinity of the Project, a small population of the Hawaiian goose breeds at Puʻuanahulu, approximately 10 miles (16 kilometers) from the Project (Pyle and Pyle 2009).

The Hawaiian goose typically nests between October and March, and during this period nesting adults defend nests and young (Banko et al. 1999). Adults molt and lose the ability to fly after the young hatch, regaining this ability about the same time the young fledge. Thus, when nesting, adults do not stray far from the nest location.

The Hawaiian goose was not detected during the biological reconnaissance survey and is rare in this area of the island, but the Hawaiian goose is known to breed within approximately 10 miles (16 kilometers) of the Project (Pyle and Pyle 2009). The Hawaiian goose sometimes utilizes non-native grassland communities such as those found in the Project Area (Mitchell et al. 2005; Pyle and Pyle 2009). However, due to lack of food availability within the Project Area, this would not be considered high quality habitat. A review of aerial imagery in the vicinity of the Project Area indicates that there is an abundance of similar habitat in the surrounding area, and the abundance of similar habitat throughout the region suggests that there is a low probability of the species using the specific Project Area. The species has the potential to occur in transit of the Project Area.

Hawaiian Hawk—Endangered (Species of Greatest Conservation Need, MBTA)

The Hawaiian hawk (*Buteo solitarius*), or ʻio, is a year-round resident endemic to the Island of Hawaiʻi, where it is most common in forested areas on the flanks of Mauna Kea, Mauna Loa, Kīlauea, and Hualālai, as well as the Kohala Mountains (Clarkson and Laniawe 2000). The Hawaiian hawk is largely absent from the northwestern part of the island as well as other locations that are dominated by large non-forested areas (e.g., the Kaʻū Desert), but it has been detected above tree line (Pyle and Pyle 2009). This indicates the potential for birds to fly over or through habitats not typically used for breeding or foraging.

The Hawaiian hawk was not observed during the biological reconnaissance survey (Tetra Tech 2014; Appendix B). The dry grassland vegetative community in the Project Area is not suitable nesting or foraging habitat for the Hawaiian hawk, but suitable nesting and foraging habitat does occur in the

Kohala Mountains to the north and on the forested slopes of Hualālai to the south (Clarkson and Laniawe 2000; Pyle and Pyle 2009). Therefore, the Hawaiian hawk could transit the Project Area when flying between such areas of suitable habitat.

Blackburn's Sphinx Moth—Endangered (Species of Greatest Conservation Need)

The Blackburn's sphinx moth (*Manduca blackburnii*) is endemic to Hawai'i, and populations currently persist on only three islands including the Island of Hawai'i. The Blackburn's sphinx moth occurs in dry to mesic forests between sea level and 5,000 feet (1,525 meters) amsl that include suitable host and food plants (Mitchell et al. 2005). Adults can be found year-round, but are most active January to April and September to November, while larvae have been documented October to May (USFWS 2005). Populations may vary in response to environmental or climactic factors that affect the abundance and quality of larvae host and adult food plants. Larvae of the Blackburn's sphinx moth feed on plants in the nightshade family, and many of the host plants recorded for this species are not native to the Hawaiian Islands (Riotte 1986; Mitchell et al. 2005). A variety of flowering plants are thought to be food plants of adults (Mitchell et al. 2005).

No Blackburn's sphinx moths or their larvae were observed during the biological reconnaissance survey (Tetra Tech 2014; Appendix B). No larvae host plants and a single nectar plant were observed during the survey (Tetra Tech 2014; Appendix B). The apparent absence of larvae host plants and rarity of nectar plants suggests a low likelihood of occurrence for this species. The similarity of the habitat surrounding the Project Area, suggests plants used by this species are similarly sparse across the broader area. Therefore, this species has a very low likelihood of occurring in the Project Area.

2.8.2 Potential Impacts and Mitigation Measures

2.8.2.1 Non-Listed Wildlife

Project development will not have a significant adverse impact on non-listed wildlife species that are likely to occur within the Project Area, as most species are non-native and invasive species. Habitat throughout the vicinity of the Project Area is similar to that within the Project Area, and therefore any species temporarily displaced during construction should find suitable habitat in the immediate vicinity of the Project. As the Project Area is already disturbed and the existing vegetation is very sparse, no impacts to habitats used by non-listed wildlife are anticipated. Although the likelihood is low, some non-listed wildlife could be killed or injured as a result of collision with the Project components, primarily wind turbines or electrical transmission lines. Non-listed species at the greatest risk for collision based on species biology and likelihood of occurrence include: Pacific golden-plover (Species of Greatest Conservation Need, MBTA), sky lark (MBTA), and chestnut-bellied sandgrouse. Each of these is most likely to be flying within the Project Area during day light hours when turbines and the transmission line would be visible and provide the best opportunity for the species to avoid them. Furthermore, the small size and small number of Project turbines minimizes the risk of collision. With the implementation of measures described below in Section 2.8.3, the Project is not anticipated to have significant adverse impacts to non-listed wildlife species.

2.8.2.2 ESA-Listed Species

Construction and operation of the Project is not anticipated to have a significant adverse impact to any federal or state listed threatened, endangered, or candidate avian or mammalian species, as all listed species have a low potential to occur in the Project Area. There is no suitable habitat for any listed species within the Project Area (Tetra Tech 2014; Appendix B), and the species with the potential to occur within the Project Area would do so as transient individuals. Project design considerations and BMPs for construction and operation of the Project would minimize the potential for any impacts to listed species. Potential impacts to individual species are described below.

Hawaiian Petrels and/or Newell's Shearwaters may fly through portions of the Project Area at night between the months of April and November, and could collide with Project infrastructure including turbines and transmission lines. They could also become attracted to and disoriented by outdoor lighting, especially fledglings during the months of October and November. Based on the results of the radar surveys, passage rates of seabirds through the Project Area are low, and therefore, there is a very low likelihood of effects to these species. With the implementation of measures described below in Section 2.8.3, the Project is not anticipated to have significant adverse impacts the Hawaiian petrel or Newell's shearwater.

Hawaiian hoary bats are detected at low rates within the Project Area throughout the year, but detection rates are higher during the months of May to November, and bats could collide with turbines particularly during this period. However, wind turbine low-wind speed curtailment (increasing turbine cut-in speed to 16 feet per second (5 meters per second) and feathering blades into the wind at wind speeds below this level) has been shown to reduce bat mortality by more than 70 percent (Arnett et al. 2009, 2010). The Vestas V47 turbines proposed for this Project already have a cut-in speed of 16 feet per second (5 meters per second), which would reduce potential impacts to bats. In addition, while trees within the Project Area did not appear to be suitable roosting sites for the Hawaiian hoary bat (greater than 15 feet [4.5 meters] tall and greater than 50 percent canopy cover) during the biological reconnaissance survey, tree canopy can vary in response to rainfall, and pups can be killed or injured during the pup rearing season, if roosting areas are impacted. With the implementation of measures described below in Section 2.8.3, development of the Project is not anticipated to result in significant adverse impacts to the Hawaiian hoary bat.

Impacts to the Hawaiian goose, Hawaiian hawk, and Blackburn's sphinx moth as a result of Project development would be negligible. The Hawaiian goose and Hawaiian hawk may transit the Project Area during daylight hours, but the expected low frequency of such incidents and the high probability that these species would detect and avoid turbines and other Project components support the conclusion that impacts to these species are highly unlikely. The observation of a single plant that could serve as a nectar source for the Blackburn's sphinx moth suggests that there is not sufficient habitat to support this listed species. Therefore, the Project would not have a significant impact to the Blackburn's sphinx moth. As the Project Area is already disturbed, restoration to pre-construction conditions would not create habitats that attract these species.

2.8.3 Best Management Practices and Mitigation Measures

The following avoidance and minimization measures would be implemented to reduce the likelihood of potential impacts to non-listed birds (including MBTA-protected species), listed seabirds and bats:

- On-site lighting at the operations and maintenance building will use fixtures that will be shielded and/or directed downward to the extent practicable to avoid attraction and disorientation of night-flying seabirds.
- The electrical collection line will be placed below ground, thereby reducing the risk of collision for birds and bats.
- Lālāmilo Wind Company will maximize the amount of construction activity that can occur in daylight during the seabird breeding season to minimize the use of nighttime lighting that could be an attraction to night-flying seabirds. To the extent practicable, Lālāmilo Wind Company will avoid nighttime construction during the peak fledging period (approximately October 15-November 23)
- Should nighttime construction be required, Lālāmilo Wind Company will have a biological monitor in the construction area to watch for the presence of night-flying seabirds or bats. Should a seabird or bat be observed, the monitor will stop construction activities and shut down construction lighting until the individual(s) move out of the area.
- Low wind speed curtailment (feathering of blades into the wind) would be implemented strategically (implemented on a seasonal or daily basis taking into account bat activity patterns) during periods of low wind (below 5 meters per second) to minimize impacts to bats. The Vestas V47 turbines already have a cut in speed of 16 feet per second (5 meters per second), which is typically the standard for low-wind speed curtailment to reduce impacts to bats.
- Trees greater than 15 feet (4.5 meters) tall will not be removed or trimmed during the pup rearing season (June 1–September 15) to avoid impacts to Hawaiian hoary bats..

With the implementation of these measures, impacts of the Project to the migratory birds, the Hawaiian petrel, the Newell's shearwater, the Hawaiian goose, the Hawaiian hawk, and the Hawaiian hoary bat would be less than significant.

To monitor for any potential impacts to birds and bats, a post-construction mortality monitoring program will be implemented during Project operation. The monitoring plan will be developed in collaboration with the USFWS and DOFAW to incorporate industry standard procedures.

2.9 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

ASM Affiliates, Inc. conducted an archaeological inventory survey (AIS) for the Project. The results of the AIS are presented in the technical report entitled *An Archaeological Inventory Survey of the Lālāmilo Wind Farm Repowering Project* (ASM 2014) included in Appendix C.

2.9.1 Existing Conditions

2.9.1.1 Cultural and Historical Background

The first settlers of the District of Kohala likely established a few small communities near sheltered bays with access to fresh water primarily in the windward valleys and gulches potentially as early as 461 A.D. (Dunn and Rosendahl 1989). Permanent settlement in Kohala likely occurred as early as 1300 A.D. at Koaiʻe, a coastal settlement area, due to subsistence marine resources supplemented with small-scale agriculture (Tomanari-Tuggle 1988). The Expansion Period (1350 to 1650 A.D.) experience population growth and increase growth of upland agriculture. Rosendahl (1972) suggested that settlement during this time was seasonal where coastal areas were occupied during the summer for marine resources and upland areas were occupied during the winter for agricultural resources. The Expansion Period witnessed the start of the ahupuaʻa system of resource land management and bartering for coastal and upland resources resulting in shifts to the settlement patterns from seasonal to permanent occupation of coastal and upland areas.

The Proto-Historic Period (1650 to 1795 A.D.) experienced continual war conquest by the reigning aliʻi. Wars occurred regularly for control of lands, both intra-island and inter-island. These wars lead to Kamehameha I uniting the islands under one rule.

Post Contact Period (after 1778 A.D.) saw a reduction of population due to disease and famine. Trade flourished in the area for sandalwood. Livestock ranching and sugarcane production became the dominate agriculture in the 1800s. A ranching wall exists within the Project Area from this period.

Shortly after World War II, the U.S. War Department occupied large areas of the Kohala District for training facilities including the Project Area. After the war, the Project Area was once again used for ranching. Subsequently, in 1985, the original Lālāmilo Wind Farm was constructed.

2.9.1.2 Identified Sites

Hawaiʻi Administrative Rules Section §13-284-6 establishes criteria to evaluate the significance of historic sites. 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:

Criterion A Be associated with events that have made a significant contribution to the broad patterns of our history;

Criterion B Be associated with the lives of persons significant in our past;

Criterion C Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

Criterion D Have yielded, or may be likely to yield, information important in prehistory or history.

Criterion 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.

During the AIS, three sites were identified within the Project Area. Of the three sites, Site 9012 was previously recorded.

Site 9012 is an early nineteenth century dry-stack rock wall called Kaukiokamoa's wall that was purportedly built during the reign of Kamehameha I, at his direction, to keep the growing population of "kapu" cattle out of the fertile agricultural areas of Lālāmilo. As such, this site is associated with both significant events and person important in Hawaiian history, and is evaluated as significant under Criterion A and B. This site is also considered significant under Criterion D for its research value.

Site 30109 is a World War II–era military encampment associated with training activities conducted within the greater Camp Tarawa Waikoloa Maneuver Area. This site reflects activities associated with significant events important in Hawaiian history as well as U.S. history, and is evaluated as significant under Criterion A. It is also considered significant under Criterion D for its historical research value.

Site 30110 is a series of Historic/Modern boundary markers (a complex of five cairns) marking the boundary between Lālāmilo and Waikōloa ahupuaʻa. They are considered significant under Criterion D. This historic value of this site has been fully and comprehensively documented as a result of the current study.

2.9.2 Potential Impacts

The AIS recommends the following treatment for the identified sites:

- Site 9012 - The Project will have no effect on this site as the wall has an existing gated breach for an access road crossing, and the continued preservation of this site is recommended.
- Site 30109 - Although this site will not likely be directly impacted by the Project, it may be indirectly impacted by increased use of the area. However, the recordation of this site has mitigated such potential impacts and no further work is recommended.
- Site 30110 - This site has been recorded and no further work is recommended.

Based on the findings in the AIS, with the implementation of the measures described below in Section 2.9.3, construction and operation of the Project is not anticipated to have a significant adverse impact on archaeological or historic resources.

2.9.3 Best Management Practices and Mitigation Measures

Table 2-2 provides a summary of the significance and recommended treatments for the identified sites.

Table 2-2. Site Significance and Treatment Recommendations

SHIP Site No.	Site Type	Temporal Affiliation	Significance	Recommended Treatment
9012	Kaukiokamoa's Wall	Historic	A, B, D	Preservation
30109	World War II Military Encampment	Historic	A, D	No Further Work
30110	Boundary Marker	Historic/Modern	D	No Further Work

With the implementation of these treatments, impacts to archaeological and historic resources would be less than significant.

2.10 CULTURAL RESOURCES

ASM Affiliates, Inc. conducted a cultural impact assessment (CIA) for the Project. The results of the CIA are presented in the technical report entitled Cultural Impact Assessment for the Proposed Lālāmilo Wind Farm Repowering Project included in Appendix D.

2.10.1 Existing Conditions

Hawaiʻi Island was divided into six moku (districts), Hāmākua, Hilo, Puna, Kaʻū, Kona, and Kohala, representing six chiefdoms. The Project is located in the moku of Kohala. After the Mahele of 1848, Kohala was further separated into a North and South District (PBR 2013). The Project is located within the South Kohala District. Within the moku districts are smaller land divisions called ahupuaʻa. The Project crosses the ahupuaʻa of Lālāmilo and Waikōloa.

According to the CIA, the name of an ahupuaʻa sometimes indicates its importance, records its history, or reveals something about its resources or population. Waikōloa may have been named for a cold northwest wind that sometimes blows across the Hawaiian Islands. Waikōloa literally translates as "duck water" while Lālāmilo literally translates as "milo tree branch" (Pukui et al. 1974). The Hawaiian language newspaper Ka Hoku o Hawai'i contained the following traditional moʻolelo of the naming of the ahupuaʻa of the region in a two part article published on July 5 and 19, 1917:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert lawaiʻa hī-ʻahi (deep sea tuna lure fisherman) and Pili-a-moʻo, a powerful priestess and ʻōlohe. Kanakanaka and Piliamoʻo were the parents of Nēʻula (a fishing goddess), and she married Puʻu Hīnai a chief of the inlands. Nēʻula and Puʻu-hīnai were the parents of Lālāmilo. Kanakanaka's sister was the wind goddess, Waikōloa, for whom the lands are now named.
>
> Lālāmilo gained fame as an expert ʻōlohe and fisherman. And through his wife Puakō, he came to possess the supernatural leho (cowry 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 . . .
>
> Puakō was the daughter of Waʻawaʻa (kāne) and Anahulu (wahine), and the sister of ʻAnaehoʻomalu (wahine); Pūʻāla'a (kane); and Maui-loa (kāne). Puakō's great desire was to eat he'e (octopus), and Puʻāla'a was kept continually busy acquiring heʻe for Puakō, and getting

> paʻouʻou fish for ʻAnaehoʻomalu. When he could no longer provide sufficient numbers of fish for his sisters they left Puna and set out in search of suitable husbands who could provide for their needs.
>
> Because of their great love for ʻAnaehoʻomalu and Puakō, Anahulu, Waʻawaʻa, their relatives and attendants also moved to the Kona - Kohala region and dwelt at sites which now bear their names; only Pūʻālaʻa remained in Puna. This is how Puʻu- Huluhulu, Puʻu-Iki, and Mauiloa came to be named; and Puʻu Anahulu (Ten day hill [ceremonial period]) was named for Anahulu, the chiefess wife of Waʻawaʻa (Puʻu Waʻawaʻa).
>
> Arriving at Kapalaoa in the Kekaha lands of Kona, ʻAnaehoʻomalu married Nāipuakalaulani, son of the chiefess Kuaīwa of Kapalaoa. Puakō went on to Waimea where she met with natives of that area, and was introduced to the chiefess Nēʻula, mother of Lālāmilo. When Nēʻula learned that Puakō greatly coveted heʻe, she told Puakō that her son was the foremost lawaiʻa ʻōkilo heʻe (octopus fisherman) of the region. And because Puakō was so beautiful, Nēʻula introduced her to Lālāmilo. Lālāmilo saw Puakō, and compared her to the foremost "heʻe" which he could catch.
>
> (translated in Maly and Maly 2002: 22-23)

During the Māhele, all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of all the ahupuaʻa that had been awarded as a part of the Māhele. The Lālāmilo ahupuaʻa was awarded to William C. Lunalilo, who became the first popularly elected Hawaiian King in 1874.

Waikōloa (Nui) ahupuaʻa was awarded to George Davis Hūʻeu. Kamehameha I had originally given the land to George's father Isaac Davis. This award didn't include coastal areas and primarily included non-agricultural pili lands south of the productive Lālāmilo area.

There have been several CIA studies conducted in the ahupuaʻa of Lālāmilo and Waikōloa. The Project's CIA listed seven previous CIA studies. The conclusions for the previous studies did not identify any on-going cultural practices occurring in each of the study areas.

Approximately 4.5 miles (7.2 kilometers) away from the Project is the Puʻukohalā Heiau. This heiau is an ancient place of worship that was dedicated by Kamehameha I in 1791 prior to his unification conquest. Puʻukohalā continues to be a significant cultural site for present day cultural practitioners. In an effort to assess visual impacts of the Project may have on the view from Puʻukohalā, a visual simulation was prepared, see Appendix D, Section 2.13 for further discussion on visual impacts.

2.10.2 Potential Impacts

The visual simulation of the Project from Puʻukohalā Heiau was shared with the National Park Service Superintendent at the Puʻukohalā Heiau National Historical Site as well as two cultural practitioners of Na Ao Koa o Puʻukohalā and Na Papa Kanaka o Puʻukohalā Heiau (at the time of writing the EA, no response have been received). The visual simulation revealed that the turbines are partially screened by intervening terrain and approximately 4.5 miles away from the viewer lowers overall visibility of the Project. See Section 2.13 for further discussion.

As part of the CIA, community members that may have knowledge of traditional cultural practices and beliefs within and nearby the Project area were contacted. Barbara Robertson, representing the Philips family, who resides in the Lālāmilo Subdivision and has knowledge of the area, was not aware of any on-going cultural places and practices occurring within or nearby the Project Area. She felt that the Project would not have any significant impacts on cultural properties or practices.

The result of the CIA concluded that there are no specific traditional cultural properties, valued resources, or any traditional and customary practices identified that would be impacted by the Project.

2.10.3 Best Management Practices and Mitigation Measures

Impacts to cultural resources would be less than significant; therefore, no mitigation is required.

2.11 UNEXPLODED ORDNANCE

2.11.1 Existing Conditions

The Project Area is within the former Waikoloa Maneuver Area, a U.S. military training area. The U.S. Navy acquired, through a license agreement, approximately 123,000 acres of land from Parker Ranch in 1943. Portions of that acquired land were used as an artillery firing range on which live ammunition and other explosives were employed, with the remaining areas utilized for troop maneuvers. In 1946, the land was returned to Parker Ranch. As part of the Department of Defense Formerly Used Defense Site funding, investigations for UXO within the former Waikoloa Maneuver Area were conducted in 1946, 1954, 1993, 1997 to 1999, and 1999 to 2002 (U.S. Army Corps of Engineers accessed on March 11, 2014).

The first Removal Action (RA) or cleanup of the munitions and explosives of concern were conducted from 2002 to 2007 and the second RA was conducted in 2008 and 2009. The current RA started in 2010 continues today. In addition to the RA that the U.S. Army Corps of Engineers completed and is completing, HELCO conducted its own UXO survey on the Project Area in 1998 and did not find any UXO.

2.11.2 Potential Impacts

According to the UXO survey data, no UXO were found on the Project Area. With the implementation of measures described below in Section 2.11.3, the construction and operation of the Project is not anticipated to have a significant adverse impact on UXO.

2.11.3 Best Management Practices and Mitigation Measures

The operators of the Project will receive unexploded ordnance safety training and briefs conducted by the U.S. Army Corps of Engineers. Personnel will be trained to recognize, retreat, and immediately report any UXO if encountered. Therefore impacts associated with UXO would be less than significant.

2.12 TRANSPORTATION AND TRAFFIC

2.12.1 Existing Conditions

The Project access road is off of Queen Kaʻahumanu Highway on an unnamed road, commonly called the "Department of Water Supply Lālāmilo-Parker Well Site access road", near the intersection of Puakō Beach Road. Existing traffic on the access road is limited to the Department of Water Supply employees, Parker Ranch employees, and HELCO employees. Crews completing UXO work in the surrounding areas are also allowed to use the access road. With the controlled access, approximately one to two trips per day use the access road. A left-turn south-bound storage lane is provided on Queen Kaʻahumanu Highway to allow the highway to flow freely as well as providing a queuing lane to turn onto the access road safely. From the access road turning toward north-bound traffic on Queen Kaʻahumanu Highway to Kawaihae, a queuing lane is provided to safely merge onto the highway.

2.12.2 Potential Impacts

Each turbine would require up to five deliveries, including three permitted oversized loads, or equipment and materials to its pad. Deliveries would be made using transport vehicles that conform to road weight limits. With the implementation of the measures described below in Section 2.12.3, the Project is not anticipated to have a significant adverse impact to traffic along Queen Kaʻahumanu Highway during construction.

The access road will continue to be controlled during Project operations. Over the long-term, three employees would manage the Project's operations. Vehicle traffic for the three employees would generate approximately three trips per day. At this low level of traffic, it is anticipated that the Project would not have a significant adverse impact to the traffic along Queen Kaʻahumanu Highway during operations.

2.12.3 Best Management Practices and Mitigation Measures

Timing of the transportation of oversized loads requiring escort vehicles would be coordinated with HDOT to minimize the impacts to commuter traffic. Other construction traffic would primarily occur between the hours of 7:30 a.m. to 3:30 p.m. A construction traffic management plan will be implemented for construction traffic, namely the oversized loads. With these measures in place, impacts to traffic and transportation would be less than significant.

2.13 VISUAL RESOURCES

The areas surrounding the communities of Waimea, Waikoloa Village, and Kawaihae are known for their pastoral, natural character and scenic vistas. This portion of the Island of Hawaiʻi is located within the Tropical and subtropical grasslands, savannas, and shrubland ecoregion, which is dominated by grass species and some scattered trees. It should be noted that this area of the Island of Hawaiʻi is within an anthropogenic area, meaning the vegetation in these areas are the result of human change and are not considered the natural vegetation of the surrounding area. Kohala Mountain provides a backdrop of rolling hills covered with lush pastures. Mauna Kea provides a distant but dramatic mass as it rises steeply above the plateau to the southeast. Views to the west feature Kawaihae Bay and open ocean views.

2.13.1 Existing Conditions

The existing environment of the Project Area is relatively uniform low lying grasses with a few trees spotted throughout the area. Most soils have reddish burnt or raw sienna hue with vegetation color changing seasonally from browns and tans to deep and bright green hues. The topography is flat to undulating with more dramatic distant mountain silhouettes. The only man-made structures apparent are fence posts, a meteorological tower, operations and maintenance building from the original wind farm, and radio towers. Most structures have a metallic or dark finish with the exception of the tan operations and maintenance building.

2.13.2 Potential Impacts

The Project would be partially noticeable from key viewing areas (KVAs) throughout the tropical and subtropical grasslands, savannas, and shrubland ecoregion. Two KVAs were chosen for the visual analyses which represent typical viewing conditions within the surrounding region. These views include the Waikoloa Village neighborhood and the Puʻukoholā Heiau, a National Historic Site administered by the National Park Service (Figure 2-5).

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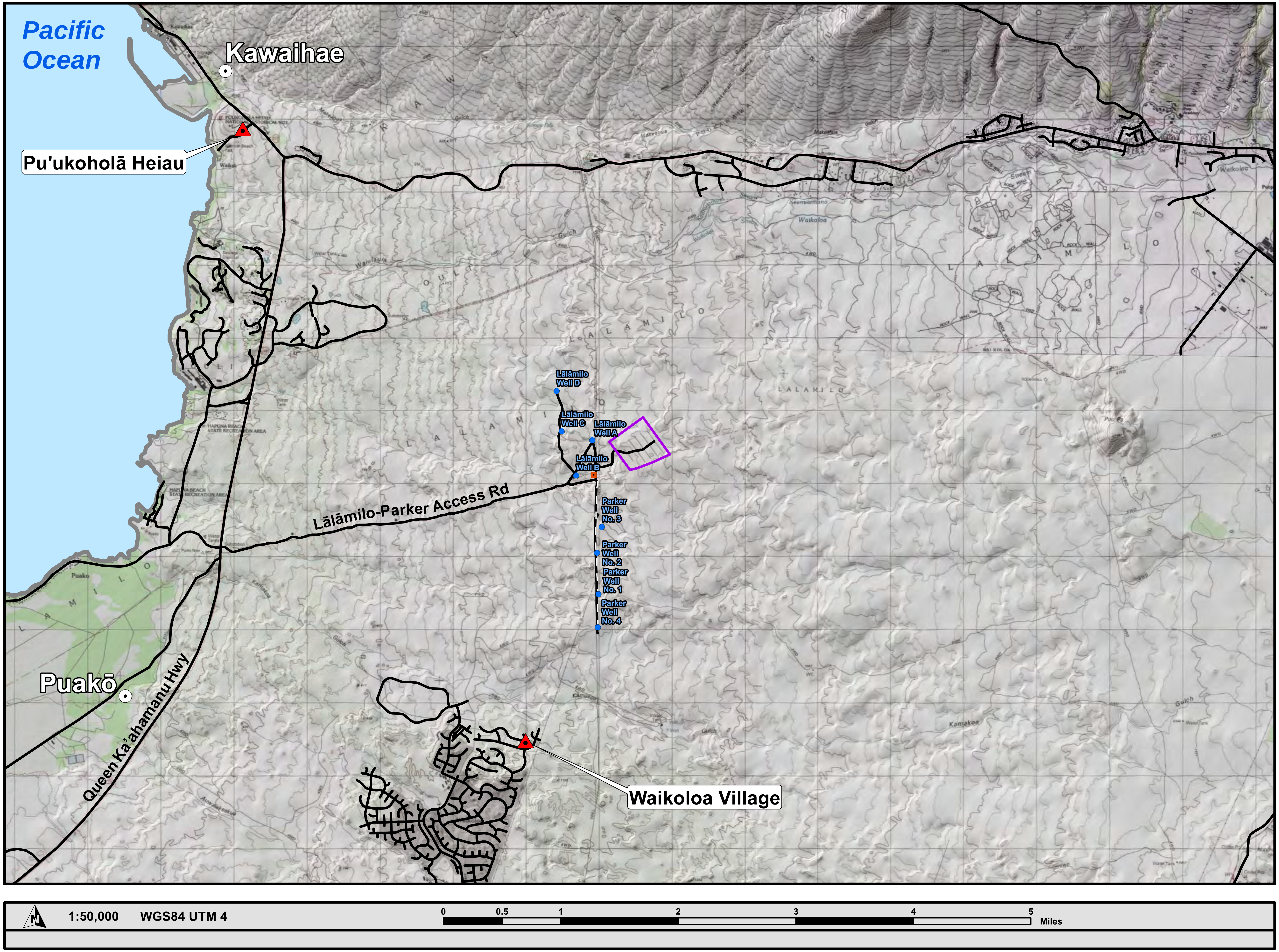
Figure 2-5

Lālāmilo Wind Farm Repowering Project

Visual Analysis
Key Viewing Areas

Hawai'i County, HI

May 16, 2014



Wind Farm Site

Proposed 13kV Transmission Line

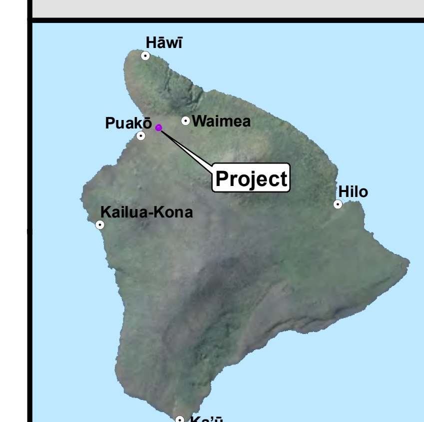
Existing Road

Key Observation Point

HELCO Interconnect

Well

City/Town



TETRA TECH

P:\GIS_PROJECTS\Site_Constructors\Lalamilo\MXDs\EA\SiteConstructors_Lalamilo_EA_Fig_2-5_KeyViewingAreas_11i17i_20140516.mxd - Last Saved 5/16/2014

KVA 1: Waikoloa Village (Figure 2-6) – The Waikoloa Village neighborhood, a census designated place located on the west side of Island of Hawaiʻi, is approximately 19.0 square miles with a population of 4,800 people. KVA 1 is located approximately 2.5 miles (4.0 kilometers) south of the Project. Views from KVA 1 are open and panoramic with undulating terrain in the foreground and background mountainous silhouettes forming a backdrop in the background of the view. Vegetation is predominately low grasses with a few scattered shrubs and palm trees. Man-made structures are predominately ranch roads and power pole structures. The Project, which is over 2.5 miles (4.0 kilometers) from the viewpoint, would introduce five visible turbines within this view. The wind turbines would likely draw the attention of the casual observer due to the white color of the turbines as well as the oscillating motion of the blades, which add movement to a landscape of static visual elements. The turbines are partially screened by intervening terrain. Though the color and motion of the wind turbines would likely result in high visibility and high contrast, their distance from the viewpoint would likely lower impacts to a moderate overall level of visual impacts.

KVA 2: Puʻukoholā Heiau (Figure 2-7) – The Puʻukoholā Heiau, a National Historic Site administered by the National Park Service, is located approximately 4.5 miles (7.2 kilometers) northwest of the Project. Views from KVA 2 are open and panoramic with undulating terrain in the foreground and background mountainous silhouettes which are screened by atmospheric conditions. Vegetation is predominately low grasses with a few scattered shrubs and clusters of more dominant vegetation. Man-made structures are predominately power pole and rural residential structures. The Project, which is 4.5 miles (7.2 kilometers) from the viewpoint, would introduce five visible turbines within this view. The wind turbines would likely draw the attention of the casual observer due to the white color of the turbines as well as the oscillating motion of the blades, which add movement to a landscape of static visual elements. The turbines are partially screened by intervening terrain and approximately 4.5 miles (7.2 kilometers) from the observer which lowers overall visibility. Though the color and motion of the wind turbines would likely result in moderate visibility and moderate contrast the distance of the Project would likely lower impacts to a low overall level of contrast and visual impacts. It should be noted that only the upper portion of the turbine blades would be visible from this distance with intervening screening vegetation and terrain.

In conclusion it can be assumed that the Project would likely result in the introduction of moderate and low visual impacts due to the visibility of wind turbines. Therefore, the Project is not anticipated to result in significant adverse impacts to visual resources.

2.13.3 Best Management Practices and Mitigation Measures

The Applicant's contractor will keep construction time to a minimum, implement active dust suppression measures, remove construction debris, restore temporarily disturbed areas, and comply with all required setbacks from roads and residences to minimize visibility. Therefore, impacts to visual resources would be less than significant.

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Figure 2-6

Lālāmilo Wind Farm Repowering Project

Visual Simulation
Waikoloa Village

Hawai'i County, HI

May 16, 2014

TETRA TECH

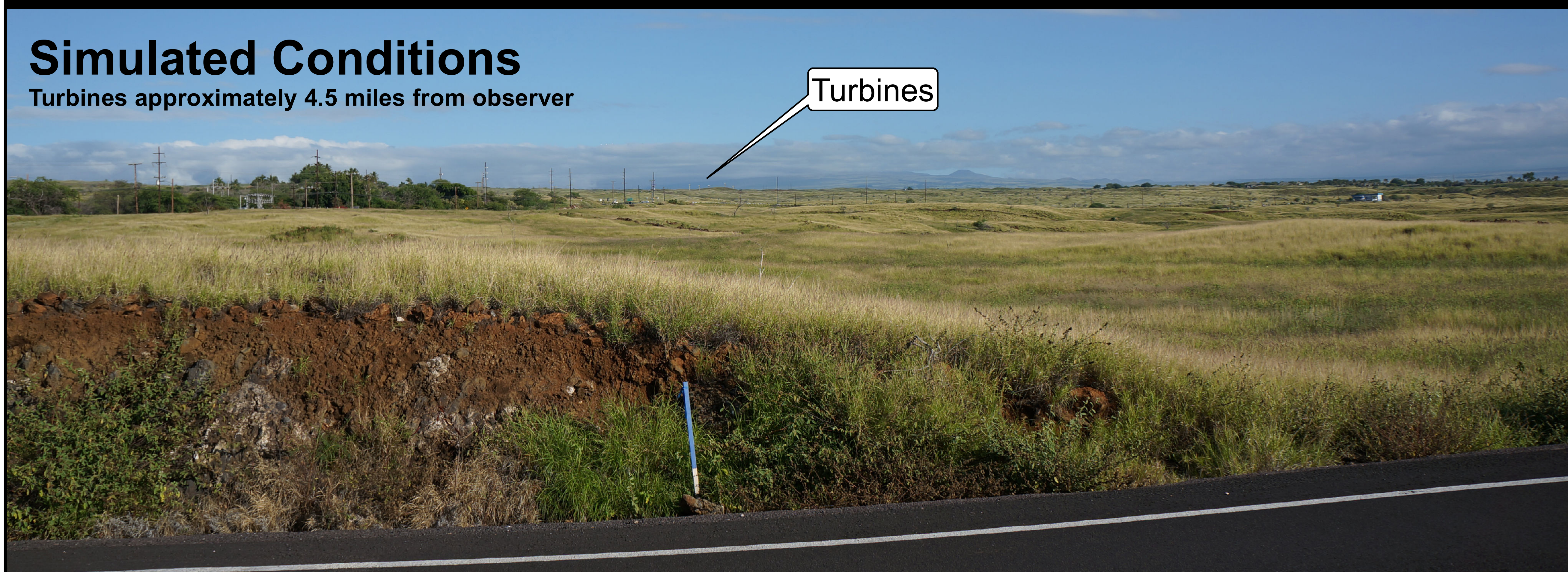
Figure 2-7

Lālāmilo Wind Farm Repowering Project

Visual Simulation
Pu'ukoholā Heiau

Hawai'i County, HI

May 16, 2014



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2.14 AIR QUALITY

2.14.1 Existing Conditions

The existing air quality in the vicinity of the Project is generally very good year-round. The typical climatic pattern in Hawaiʻi with prevailing northeasterly winds can provide turbulence of the atmosphere to disperse human-caused and natural pollutants (B.D. Neal & Associates 2002). Kīlauea volcano is the main source of air pollutants (vog – sulfur dioxide and particulate matter less than 2.5 micrometers in diameter) on Island of Hawaiʻi (Longo 2013). Air quality is monitored at a network of Special Purpose Monitoring stations around the island mainly focused on volcanic emissions. Federal and state ambient air quality standards are periodically exceeded at stations located near or downwind of the volcano. Excluding when standards are exceeded due to the volcano, the state of Hawaiʻi typically meets the National Ambient Air Quality Standards (HDOH 2013b).

2.14.2 Potential Impacts

State and Federal air quality standards are not likely to be exceeded due to construction of the Project. Project activities that could contribute to air quality issues, such emissions from construction vehicles and generation of airborne dust (fugitive dust), would be limited in extent and duration.

The primary potential short-term air quality impact from the Project would be fugitive dust resulting from construction of turbine foundations, grading access roads, and vehicle movement. All construction activities will comply with HAR Section 11-60.1-33 Fugitive Dust. With the implementation of measures described below in Section 2.14.3, the project is not anticipated to result in significant adverse impacts to air quality.

2.14.3 Best Management Practices and Mitigation Measures

The following BMPs will be implemented during construction to address controlling airborne dust.

- Design, development and implementation of a dust control plan for both during and after construction hours.
- Pre-apply and re-apply water as necessary to maintain damp conditions of soils in the construction site and access roads.
- Stabilize disturbed surface areas or stockpiled soils.
- Cover open-bodied trucks used to transport excavated soil.
- Install wind barriers as needed to deter disturbed soils from becoming airborne.

With the implementation of these measures, impacts to air quality would be less than significant.

2.15 NOISE

2.15.1 Existing Conditions

The State of Hawaiʻi Community Noise Control Rule (HDOH 1996), enforced by the State DOH, identifies three classes of zoning districts and corresponding maximum permissible noise levels due to stationary noise (as measured from the property boundary). The daytime and nighttime maximum permissible noise limits are provided in A-weighted decibels (dBA) according to zoning districts in Table 2-3. The A-weighted sound level metric measures sound in a similar fashion to how a person perceives or hears sound, thus achieving a good correlation in terms of how to evaluate acceptable and unacceptable sound levels. As wind energy generation projects may operate at any time during the day or night, the more stringent nighttime permissible sound level will become the controlling limit. For additional information on noise regulations see Appendix E.

The TMKs located within 1.2 miles (2 kilometers; see Appendix E) of the Project are zoned agricultural (HAR 11-46 Class C, 70 dBA). There are no sensitive receptors within this area. Existing sound levels within these TMKs, estimated using the Federal Transit Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment guidance for ambient sound levels by population density (FRA 2012; see Appendix E), range from approximately 35 dBA L_{eq} during the day to 25 dBA L_{eq}[1] at night (see Appendix E for additional discussion).

Table 2-3. Hawaiʻi Maximum Permissible Sound Levels by Zoning District

Receiving Zoning Class District	Maximum Permissible Sound Level (dBA) 1/	
	Daytime	Nighttime
Class A zoning districts include all areas equivalent to land zoned residential, conservation, preservation, public space, or similar type.	55	45
Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C zoning districts include all areas equivalent to lands zoned agriculture, county, industrial, or similar type.	70	70

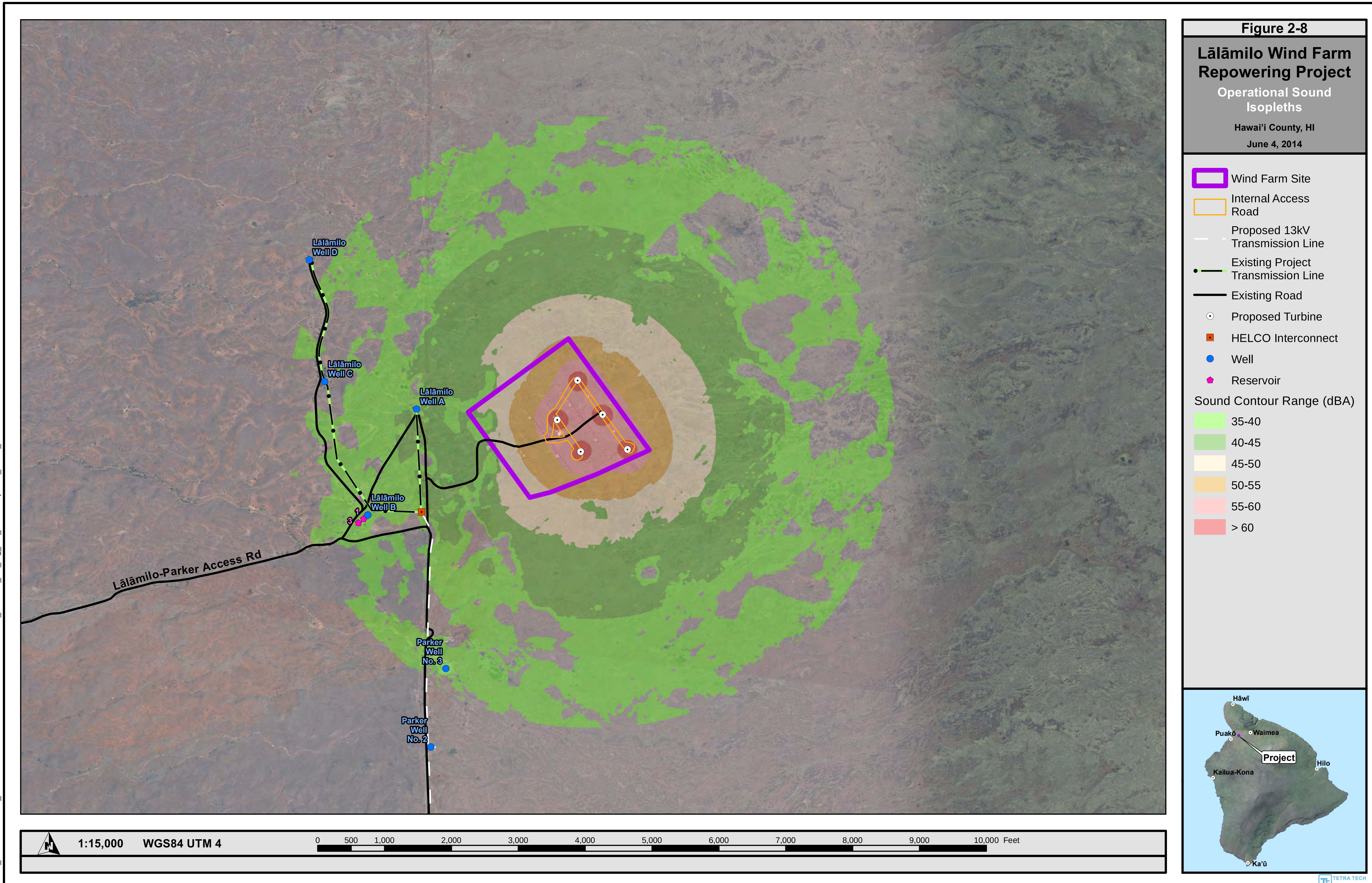
1/ daytime: 7:00 a.m.to 10:00 pm; nighttime: 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
Source: HDOH 1996

2.15.2 Potential Impacts

Noise generated during construction would occur in association with the operation of heavy equipment and construction vehicles for various activities, including construction of the access roads, excavation and pouring of foundations, installation of buried and aboveground electrical collection and transmission lines, and erection of turbine components. Impacts would be short term and because the Project would be constructed primarily during daytime hours, and because of the rural location, are expected to be minimal.

To evaluate operational noise, a modeling analysis was conducted based on the turbine maximum sound power level (as provided by the turbine manufacturer). The modeling methodology, inputs, and results are described in detail in Appendix E. The analysis took into account various factors that influence the sound attenuation including site topography and meteorological conditions (temperature, humidity, wind). Modeled sound propagation and attenuation from the Project is shown on the sound contour map in Figure 2-8. Described sound levels were found to be at or

[1] A-weighted sound levels are typically presented as equivalent sound pressure level (L_{eq}), which is defined as the average noise level, on an equal energy basis for a stated period of time and is commonly used to measure steady state sound or noise that is usually dominant.



P:\GIS_PROJECTS\Site_Constructors\Lalamilo\MXDs\EA\SiteConstructors_Lalamilo_EA_Fig_2-8_SoundIsopleths_11i17i_20140604.mxd - Last Saved 6/4/2014 below the assumed daytime sound levels (35 dBA L_{eq}) at approximately 1.0 mile (1.5 kilometers) from the project and at approximately 1.25 miles (2 kilometers) for assumed nighttime sound levels (25 dBA L_{eq}). There would be no noise impacts to sensitive receptors, as there are none within 1.2 miles (2 kilometers) of the Project. Therefore, no significant adverse impact associated with Project noise is anticipated.

2.15.3 Best Management Practices and Mitigation Measures

Impacts to noise would be less than significant; therefore, no mitigation is required.

2.16 INFRASTRUCTURE AND UTILITIES

2.16.1 Wastewater System

2.16.1.1 Existing Conditions

There are no County wastewater water systems that service the Project Area. The Department of Water Supply employees currently utilize port-a-potties that are serviced on average weekly.

2.16.1.2 Potential Impacts

During construction, port-a-potties would be dispersed within the Project Area to handle wastewater. As for long-term operations, the current quantity and weekly service of the port-a-potties will likely be sufficient. Therefore, the Project would not impact wastewater systems.

2.16.1.3 Best Management Practices and Mitigation Measures

There would be no impact to wastewater systems; therefore, no mitigation will be required.

2.16.2 Drainage System

2.16.2.1 Existing Conditions

The Project Area and surrounding area do not currently have a master drainage system in place. The existing Department of Water Supply facilities have a negligible effect on stormwater impacts.

2.16.2.2 Potential Impacts

As noted previously, the Project would result in minimal new impervious surfaces (less than 1 acre). Stormwater will be managed during construction in order to meet all applicable federal, state and stormwater runoff requirements associated with construction sites. With the implementation of measures described below in Section 2.16.2.3, the Project is not anticipated to result in significant adverse impacts to drainage.

2.16.2.3 Best Management Practices and Mitigation Measures

Standard BMPs that would be implemented to minimize potential impacts to drainage systems associated with erosion are listed in Section 2.3.3. Stormwater collection and erosion control features such as swales and berms would also be implemented during construction to manage stormwater runoff. With the implementation of these measures, impacts to drainage systems would be less than significant.

2.16.3 Solid Waste

2.16.3.1 Existing Conditions

The County of Hawaiʻi Solid Waste Division does not provide waste collection services. Private companies haul away waste that is generated in some residential and commercial areas to County landfills. In other areas, waste is self-hauled directly to transfer stations or the landfill. The County operates and maintains all solid waste collection and transfer stations on the island. The Solid Waste Division manages two landfills, one that services east Hawaiʻi and the other that services west Hawaiʻi, and 21 transfer stations.

Currently, the Department of Water Supply employees that utilize the Project Area pack in and pack out their solid wastes. No solid wastes are currently being generated on-site.

2.16.3.2 Potential Impacts

Solid waste generated during construction would be disposed of in accordance with state and county regulations. Waste that would be generated during construction would primarily consist of soils and rocks displaced during grading and clearing. To the extent possible, this displaced cut would be utilized as fill material and the remainder will be spread on-site.

During operations, a dumpster would onsite for general waste (e.g., office waste, packaging materials, etc.), which would be taken offsite on an approximately weekly basis. There would also be containers for waste lubrication oils, greases, and their packaging that is generated as part of the regular schedule maintenance of the generation equipment and support vehicles and equipment. These waste products would either be recycled or properly disposed of according to all pertinent regulations. As such, the Project would not impact solid waste.

2.16.3.3 Best Management Practices and Mitigation Measures

Impacts associated with solid waste would be less than significant; therefore, no mitigation is required.

2.16.4 Electrical and Communications System

2.16.4.1 Existing Conditions

The Department of Water Supply Lālāmilo-Parker well pumps use approximately 10,000 MW hours of electricity annually at an annual cost of $3 Million to $4 Million. Currently, all electrical needs to power the Lālāmilo-Parker wells are provided by HELCO via a 13-kV overhead transmission line and interconnect located within the Project Area.

There is currently no telecommunication infrastructure within or immediately adjacent to the Project Area and immediately adjacent to the Project Area. Communications for the water system are handled by the existing SCADA system and a radio transceiver/repeater system that would be updated and expanded to manage the water system and maximize the usage of energy generated by the wind farm.

2.16.4.2 Potential Impacts

The Project would provide renewable wind generated electricity to offset the fossil-fuel generated energy provided by HELCO to power the well pumps. It is estimated that the Project would produce up to 80 percent of the Lālāmilo-Parker wells' electrical needs, with the remaining electrical needs being met by HELCO. The Project has been planned and would be developed in collaboration with HELCO in order to ensure that electric needs of the Lālāmilo-Parker well system are met, and the system can continue to reliably provide drinking water to its customers. The Project is intended to reduce the cost of electricity through the use of the renewable wind energy, purchased at a discounted rate, thereby reducing the need for the Department of Water Supply to utilize, and pay for, HELCO fossil-fuel generated energy delivered to the Lālāmilo-Parker well system. The reduced cost of energy produced by the wind farm would save the Department of Water Supply customers approximately $1 million dollars per year at today's rates. The Project would be designed in accordance with HELCO interconnection requirements, with HELCO approval of the final system design, in order to ensure that the Project would not adversely impact HELCO's generation or transmission systems, and would benefit the Department of Water Supply's consumers through reduced rates for water deliveries.

Communications infrastructure would not be adversely affected by the Project because a new dedicated communications system would be installed and maintained within the Project Area for operation of the Project. Upgrades to the SCADA system would also be implemented as part of the Project in order to efficiently manage the water system's energy needs and the wind farms generation output.

2.16.4.3 Best Management Practices and Mitigation Measures

Impacts to electrical and communications systems would be less than significant; therefore, no mitigation is required.

2.17 SOCIOECONOMIC RESOURCES

2.17.1 Existing Conditions

2.17.1.1 Population Growth

The U.S. Census Bureau reported that the population of Hawai'i County was 185,079 people in 2010, a 24.5 percent increase from the 2000 population of 148,677 people. Nine districts encompass Hawai'i County. The population in the South Kohala, the district that the Project is within, was 17,627 people in 2010, a 34.8 percent increase from the 2000 population of 13,079 people (U.S. Census Bureau 2010).

2.17.1.2 Economy

The South Kohala District includes a wide variety of economic activities predominantly tourism. The Hawai'i State Department of Labor & Industrial Relations reported that the seasonally adjusted unemployment rate for the State was 4.5 percent in December 2013, up slightly from 4.4 percent in November 2013. The seasonally adjusted unemployment rate for Hawai'i County was 5.9 percent, lower than the 6.1 percent in November 2013 (Hawai'i State Department of Labor and Industrial Relations 2014).

2.17.2 Potential Impacts

2.17.2.1 Population Growth

The Project is not a population generator and would not affect population growth.

2.17.2.2 Economy

The Project would generate up to approximately 50 construction-related jobs during the development of the Project over an 18-month period. As a result, the Project would have a beneficial effect on the economy during construction.

In the long term, the Project would employ two to three permanent persons to manage and maintain the wind farm and related facilities. In addition, the Project would reduce the cost of electricity to power the Department of Water Supply wells, thereby reducing cost to the Department of Water Supply customers. Overall, the Project will have a beneficial effect on the economy.

2.17.3 Best Management Practices and Mitigation Measures

Impacts to socioeconomic resources would be less than significant; therefore, no mitigation is required.

2.18 PUBLIC SERVICES AND FACILITIES

2.18.1 Existing Conditions

2.18.1.1 Schools

Public schools in the South Kohala region include Waikoloa Elementary School (K–5), Waimea Elementary School (K–5), Waimea Middle Public Charter School (6–8), and Kealakehe High School (9–12). Kanu o Ka ʻĀina School is a new Century Public Charter School offering Hawaiian based education for students K–12. Private schools in the South Kohala region include Kamehameha Schools Waimea Pre-School, Pūnana Leo O Waimea, Hawaiʻi Preparatory Academy (K–12), Parker School (K–12), and Waimea Country School (K–6).

2.18.1.2 Police, Fire, and Medical Services

Police

The Hawaiʻi County Police Department Area II Patrol, South Kohala District (Waimea Station) provides law enforcement and patrol services from the North Kohala District at Kiowa to the Kona District at Kauaʻi Point.

Fire

The Hawaiʻi County Fire Department, West Battalion, Station No. 14 provides fire protection services for Mahukona to the Hualalai Resort. The Project Area is serviced by Engine Company No. 14 in South Kohala located in Mauna Lani (68-4550 Queen Kaʻahumanu Highway, Kamuela, HI 96743). It has one engineer, one ladder truck, one tanker, a medic unit, a helicopter, and fuel truck. At any one time, there are five to six firefighters on duty.

Medical Services

The North Hawaiʻi Community Hospital is a full service acute care hospital located in downtown Waimea. The hospital has 39 beds offering 24 hour emergency services for the regions of South Kohala, North Kohala, parts of Hāmākua, and North Kona. The hospital is a non-profit entity that is community owned.

2.18.1.3 Recreation

South Kohala recreational facilities include golf courses, tennis courts, beaches, riding stables, historic sites, small boat harbors, and other facilities. One of these facilities is the Puʻukoholā Heiau National Historic Site located near the intersection of Queen Kaʻahumanu Highway and Kawaihae Road (Highway 19). The Heiau built in the late 1700s by Kamehameha I includes several heiau and the remains of the John Young homestead.

Another one of these facilities in the coastal area near the Project is Hāpuna Beach State Park. Hāpuna Beach is a popular white sand beach adjacent to the Hāpuna Prince Hotel. Hāpuna Beach is popular for swimming, picnicking, and camping. Hāpuna Beach is only one of several beaches in the area.

2.18.2 Potential Impacts

2.18.2.1 Schools

The Project is not a population generator and would not place additional demands for education facilities.

2.18.2.2 Police, Fire, and Medical Services

On occasion, there may be an unavoidable need for police, fire, and medical services. It is anticipated that the existing services would be adequate to service the Project and would not be significantly adversely affected by the Project.

The incidence of wildfire in the South Kohala region is relatively low (on average 33 fires per year; Hawaiʻi County Fire Department 2014). Ignition sources for accidental fires include errant sparks from a variety of vehicles, equipment and tools, and discarded matches and cigarette butts. These are of limited intensity, and under most conditions are unlikely to spark a grass or other fire given that there is very little vegetation in the Project Area.

2.18.2.3 Recreation

The Project is not a population generator and would not affect recreational facilities in the area.

2.18.3 Best Management Practices and Mitigation Measures

Impacts to public infrastructure and services would be less than significant; therefore, no mitigation is required.

2.19 CUMULATIVE AND SECONDARY IMPACTS

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency or person undertakes such actions." Cumulative impacts can result from additive or interactive effects that would collectively create significant impacts over time. Secondary impacts is defined as impacts that "may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density of growth rate, and related effects on air and water and other natural systems, including ecosystems." The geographic extent from which projects and activities were identified for the assessment of cumulative effects was defined as the area within approximately 2.0 miles (3.2 kilometers) of the Project for most resources; a larger scale (Island of Hawaiʻi) was considered for resources which act regionally (e.g., climate, air quality, and wide-ranging wildlife species such as birds and bats).

The Project repowers the old Lālāmilo Wind Farm by replacing older wind turbine technology to provide electrical energy to the Department of Water Supply Lālāmilo-Parker well system using renewable wind energy. There are no foreseeable actions such as adding more turbines that would result in additional incremental impacts of the Project. There are also no foreseeable development projects and/or large renewable energy projects known in the Project Area or immediate vicinity. Therefore, the direct and indirect effects of the Project would not contribute to cumulative effects to geology and topography, soils, natural hazards, hydrology and freshwater resources, marine waters, botanical resources, archaeological and historic resources, cultural resources, unexploded ordinance, noise, infrastructure and utilities, socioeconomic resources, or public services and facilities.

Existing uses of the Project Area for cattle grazing and cultural purposes would continue during Project operation. Thus the Project would make minor, short-term contributions to cumulative effects associated with traffic and dust (air quality) associated with vehicle travel along the Project Area roads. There is one existing wind turbine located west of the Project Area which is visible from the highway and surrounding agricultural lands. The Project would make a minor contribution to the cumulative effects to visual resources.

The Project would create beneficial secondary impacts to the climate due to reduced green-house gas emissions, as well as reductions in the cost of energy for to the Department of Water Supply, which will be passed on to its consumers. Thus it would contribute to the impacts of the two operating wind farms on the Island of Hawaiʻi (South Point and Hawi) associated with reduced greenhouse gas emissions, and resulting beneficial impacts to climate and air quality. Like all Hawaiʻi wind farms, there is the potential for impacts to ESA-listed birds and bat species. It is assumed that the existing projects will take measures to avoid and minimize impacts to ESA-listed wildlife to the extent possible. The Project would make a minor contribution to these effects. Given that the Project would have less than significant effects to all resources, cumulative effects of this Project in combination with ongoing and foreseeable projects would also be less than significant.

3.0 LAND USE CONFORMANCE

State of Hawaiʻi and Hawaiʻi County land use plans, policies, and ordinances relevant to the Project are described below.

3.1 STATE OF HAWAI'I

3.1.1 Environmental Impact Statement Law, Chapter 343, Hawai'i Revised Statutes

This EA has been prepared in compliance with Chapter 343, HRS. The use of State lands is a trigger for the preparation of the EA. As part of the EA process, a pre-consultation process was conducted with various agencies and organizations. Pre-consultation comment letters and responses are included in Appendix A of this EA. In addition, a 30-day comment period upon publication of the Draft EA in the Office of Environmental Quality Control's *The Environmental Notice* is a component of the EA process. Comment letters received on the Draft EA will be included in the Final EA.

3.1.2 State Land Use Law, Chapter 205, Hawai'i Revised Statutes

The State Land Use Law (Chapter 205, HRS) establishes the State Land Use Commission and authorizes the Commission to designate all lands in the State into one of four Land Use Districts: Urban, Rural, Agricultural, or Conservation.

The Project Area is within lands designated as Agricultural (Figure 1-4). Wind farms are permitted in the Agricultural district.

3.1.3 State Environmental Policy, Chapter 344, Hawai'i Revised Statues

The State Environmental Policy (Chapter 344 HRS) establishes a State policy to:

> *Encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawai'i.*

The following is a discussion of the applicable policy guidelines.

Energy

> *(A) Encourage the efficient use of energy resources.*

The Project will utilize the abundant natural wind resources of the area to provide electrical energy for the existing Department of Water Supply wells. The use of the renewable wind energy will help to offset reliance on fossil-fuel generation assets and reduce energy costs for the Department of Water Supply, and ultimately, its customers. For this reason, the Project is consistent with the State Environmental Policy, as well as the state PUC's Integrated Resource Plan to incorporate more renewable energy generation capabilities in the State's energy portfolio.

3.1.4 Coastal Zone Management Act, Chapter 205A, Hawai'i Revised Statutes

Hawai'i Coastal Zone Management (CZM) Program (HRS § 205A-2) complies with the federal Coastal Zone Management Act of 1972 (16 United States Code §§ 1451-1456). It is designed to protect valuable and vulnerable coastal resources. The CZM area includes all of the lands in the State. As a result, the Project lies within the CZM area.

The following is a discussion of the Project's consistency with the objectives and policies of the CZM Program.

Recreational Resources

Objective:

Provide coastal recreational opportunities accessible to the public.

Policies:

Improve coordination and funding of coastal recreational planning and management; and;

Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- *Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
- *Requiring replacement of coastal resources having significant recreational value including, but not limited to surfing sites, 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;*
- *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
- *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
- *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;*
- *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
- *Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*
- *Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.*

Discussion: The Project Area is partially on private lands. Although there is no public access through these areas, people in the surrounding communities are allowed access to the higher elevations of the Project Area for cultural purposes, mainly hunting and gathering. The result of the CIA concluded that there are no specific traditional cultural properties, valued resources, or any traditional and customary practices identified that would be impacted by the Project.

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:

Identify and analyze significant archaeological resources;

Maximize information retention through preservation of remains and artifacts or salvage operations; and

Support state goals for protection, restoration, interpretation and display of historic resources.

Discussion: The AIS (Appendix C) documented three features within the Project Area. For two sites, no further action is required because they have been recorded and are unlikely to be directly impacted by the Project; for the third site, preservation is recommended and, as such, the ranching wall will be preserved. Section 2.9 – Archaeological and Historical Resources addresses issues and potential impacts to archaeological resources in more detail.

Scenic and Open Space Resources

Objective:

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

Policies:

Identify valued scenic resources in the coastal zone management areas;

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;

Preserve, maintain and where desirable, improve and restore shoreline open space and scenic resources; and

Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion: The presence of Project turbines would result in low to moderate levels of visual impacts, although they would be visible in the distance from the two KVAs selected for the visual analysis. Section 2.13 – Visual Resources address issues and potential impacts to open space in more detail.

Coastal Ecosystems

Objective:

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

Policies:

Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

Improve the technical basis for natural resource management;

Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

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 Project will not have an adverse impact on coastal ecosystems. There is no fringing reef along the coastline. Section 2.5 – Hydrology and Fresh Water Resources addresses potential impacts related to surface water and storm water runoff.

Economic Uses

Objective:

Provide public or private facilities and improvements important to the state's economy in suitable locations.

Policies:

Concentrate coastal dependent development in appropriate areas;

Ensure that coastal dependent development such as harbors and ports, visitor industry facilities and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area;

Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

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

Discussion: The Project would help to meet the need for renewable energy generation to power the existing Department of Water Supply wells; thereby reducing the cost energy to the Department of Water Supply, and ultimately, its customers. Section 2.17 – Socioeconomic Resources and Section 2.13 – Visual Resources address issues and potential impacts related to minimizing adverse social and visual impacts in the coastal zone management area, respectively. Potential impacts to biological resources are discussed in Sections 2.7 – Botanical Resources and 2.8 – Wildlife Resources. There are no listed plants within the Project Area. The Project Area does not contain suitable habitat for listed species, although listed birds and bats could transit through (see Section 2.8 – Wildlife Resources). Avoidance and minimization measures would reduce the likelihood of bird (including MBTA species) and collisions with turbines or seabird attraction to Project lighting.

Coastal Hazards

Objective:

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

Policies:

Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

Prevent coastal flooding from inland projects.

Discussion: The Project is not along the coastline and outside the tsunami inundation zone. There are no streams within the Project Area. Additionally, there is no danger of erosion, subsidence, and nonpoint source pollution hazard for or from the Project.

Managing Development

Objective:

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

Policies:

Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and

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: Throughout the planning process, the Department of Water Supply has actively engaged government regulators, stakeholders, community groups, and individuals. The submittal of this Draft EA will continue to facilitate the review process and public participation.

Public Participation

Objective:

Stimulate public awareness, education, and participation in coastal management.

Policies:

Promote public involvement in coastal zone management processes;

Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion: Throughout the planning process, the Department of Water Supply has actively engagement the public. Section 8.0 – Consultation discusses the public involvement activities related to the Project.

Beach Protection

Objective:

Protect beaches for public use and recreation.

Policies:

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;

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;

Minimize the construction of public erosion-protection structures seaward of the shoreline;

Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and

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 Project is not located within a beach or a coastal land area. It is set inland, or mauka, and east of the shoreline. Nonetheless, best management practices would be implemented to avoid and minimize impacts to storm water runoff that may affect beach processes.

Marine Resources

Objective:

Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

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;

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; and

Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion: No impacts to marine resources are anticipated from the Project. Section 2.5 – Hydrology and Fresh Water Resources addresses potential impacts related to surface water and storm water runoff.

3.1.5 Hawai'i State Plan

The Hawai'i State Plan (Chapter 226, HRS) establishes goals, objective, policies, and priorities that serve as long-range guidelines for the growth and development of the State. The following is a discussion of the applicable objectives and policies.

HRS 226-14: Objectives and policies for facilities systems – in general.

Objective:

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

Policies:

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

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

Discussion: The Project will utilize the abundant natural wind resource of the area to provide electrical energy to the existing Department of Water Supply wells. The use of the renewable wind energy will help to offset energy cost for the Department of Water Supply, and ultimately, its customers.

HRS 226-18: Objectives and policies for facility systems – energy.

Objective:

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

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

(2) *Increase energy self-sufficiency where the ratio of indigenous to imported energy use is increased;*

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

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

Policies:

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

Discussion: The Project will utilize the least-cost energy supply option for the wells with the re-powering of the wind farm. Alternatively, if not for the wind farm, the Department of Water Supply would utilize HELCO's system to power the wells at a higher cost to Department of Water Supply and its customers. In addition, the new turbines would utilize a more efficient technology to convert the wind energy into electricity, thereby reducing the amount of turbines needed from 120 to 5. As with all renewable energy resources, including the Project, greenhouse gas emissions would be avoided.

3.2 COUNTY OF HAWAI'I

The County of Hawai'i's General Plan is the policy document for the long-range comprehensive development of the Island and County of Hawai'i. The purposes, amongst others, of the General Plan include guiding the pattern of development in the County and providing the framework for regulatory decisions and capital improvement priorities. The most recent General Plan was completed in 2005 and undergoes a review every 10 years.

The LUPAG provides the policy land use maps as part of the General Plan. It is intended to provide guidance for future development in a planned manner. The LUPAG indicates the general location of various land uses for the County. The main Project components are within an area designated as Extensive Agriculture while the transmission line and portions of the access roads is designated as Open Area as well as portions of the construction access road, Lālāmilo-Parker Access Road, is designated as Urban Expansion (Figure 1-4). Wind energy facilities are permitted within the Extensive Agriculture designation. As a result, the Project is consistent with the LUPAG.

Specific General Plan goals, policies, and course of action applicable to the Project are discussed below.

Energy

3.2 Goals

(a) Strive towards energy self-sufficiency.

(b) Establish the Big Island as a demonstration community for the development and use of natural energy resources.

3.3 Policies

(a) Encourage the development of alternate energy resources.

(f) Strive to assure a sufficient supply of energy to support present and future demands.

(j) Encourage the continuation of studies concerning the development of power that can be distributed at lower costs to consumers.

Discussion: The Project seeks to utilize an alternative renewable resource to provide electric energy to the wells in the Lālāmilo-Parker Water System. The wind generated energy will cost less than HELCO-provided fossil-fuel generated energy; thereby, reducing the cost to provide County water to its consumers.

3.2.1 South Kohala Community Development Plan

The County of Hawaiʻi General Plan includes Community Development Plans (CDPs) to further define the broader goals, policies, and standards of the General Plan for specific geographic regions on the island. The CDPs allow for community input with respect to land use, government services, and other land use issues within the CDP region. The Project Area is located within the South Kohala CDP planning area. A specific district-wide policy listed below reflects consistency with the South Kohala CDP.

> *5.11 **Promote Alternative Energy**. South Kohala is blessed with strong wind and ample sunlight throughout the year. The County should support the development of more natural energy generating facilities.*

3.2.2 County of Hawai'i Zoning

The HCC regulates the type and location of development permitted on the island. Hawaiʻi County zoning designations, Chapter 25 HCC, regulates permitted uses within a zoning district. The Project Area is zoned A-5a (Agricultural) and Open Space. Pursuant to Section 25-5-72 (a) Wind facilities are permitted within the Agricultural district. In addition, Section 25-4-22 (e) states that wind machines may be exempt from height limitations, provided that they shall be setback from all property lines one foot for each foot of height, measured from the highest vertical extension of the system. The turbines 198.5 feet (60.5 m) tall and setback as required from the to the property lines.

3.2.3 Special Management Area

The Project Area is not located within the Special Management Area.

3.3 APPROVALS AND PERMITS

A table of anticipated permits and approvals required for the Project is presented below in Table 3-1.

Table 3-1. Anticipated Approvals and Permits

Permit / Approval	Responsible Agency
Chapter 343, HRS Compliance	Hawaiʻi Department of Water Supply Office of Environmental Quality Control
National Pollutant Discharge Elimination System (NPDES) Permit, if applicable	Hawaiʻi Department of Health
Grading / Building Permits	Hawaiʻi Department of Public Works
Oversize Load Permits	Hawaiʻi Department of Transportation
FAA Form 7460-1 Notice of Proposed Construction or Alternative	Federal Aviation Administration (FAA)

4.0 ALTERNATIVES

4.1 NO ACTION ALTERNATIVE

Under the No Action alternative, the Project would not be constructed, and wind-generated electricity would not be supplied to the Lālāmilo-Parker well system. The No Action alternative would have no effect to resources of the biological or human environment, including the beneficial effects of stabilizing water rates for consumers and providing a clean, renewable source of energy to the pumps. Therefore, it would not meet the purpose of and need for the Project, which is to provide a cost savings to Department of Water Supply consumers over the long term and contribute to the State's Clean Energy Initiative goal.

4.2 ALTERNATIVES ELIMINATED FROM FURTHER STUDY

This section describes alternatives that were considered but eliminated from detailed study in this EA.

4.2.1 Alternative Type of Renewable Energy

The Department of Water Supply's intent in proposing this Project is to reduce energy costs for water customers by replacing a large portion of its pumping energy demands with renewable wind energy at a discounted rate, as compared with current HELCO rates. There are a number of other types of renewable energy technology that could be considered for powering the Department of Water Supply's wells including geothermal, pumped-storage hydroelectric, or solar. However, these sources were considered infeasible due to the lack of resource (i.e., insufficient geothermal in the South Kohala region); inadequate available or controlled land area (i.e., not enough water storage capacity for pumped-storage hydroelectric) or space required for the quantity of solar panels necessary to meet generation needs of the Project; or excessive capital costs to develop, construct, and operate (i.e., pumped-storage hydroelectric and solar).

In December 2009, the National Renewable Energy Laboratory (NREL) under the U.S. Department of Energy (DOE) conducted a preliminary analysis for repowering the original Lālāmilo wind farm by replacing the original 120 Jacobs wind turbines with modern technology. The wind farm site is categorized by DOE as a Class 7 "Optimal" wind resource, which is the highest classification for a wind energy project. Additionally, some of the facilities and infrastructure from the original wind farm, which could be used for a repowered wind farm, were left in place after decommissioning the site in 2010. These included an office building/workshop, power poles, power transmission lines, conduits, radio towers, and internal access roads. Thus, in light of the DOE's classification of the wind resource in the Project Area as optimal for a wind farm, and the historical use of the site as a wind farm, alternative forms of renewable energy were eliminated from further consideration.

4.2.2 Larger or Smaller Wind Projects

The Project is intended to produce an amount of energy roughly equivalent to the original Lālāmilo wind farm. The preliminary analysis conducted by NREL (NREL 2009) was performed to assess the technical economic viability of a project. The analysis used the Micropower Optimization Model

HOMER to optimize the capacity of wind power that would yield the lowest Levelized Cost of Energy for the Department of Water Supply. The analysis concluded that the 120 original Jacobs turbines could be replaced by 1 to 10 modern turbines, depending on the technology and unit size selected.

The Proposed Action would result in 3.3 MW of generation capacity. A smaller project would not provide as much of an economic benefit for the Department of Water Supply and would not meet the purpose and need of the Project, or the Project's goals for percent of fossil-fuel generated energy usage with renewable energy. A larger project would exceed the current load demand of the existing Lālāmilo-Parker pumps, and because HELCO cannot currently accept any wind energy to the grid if the amount of wind energy generated exceeds the amount of energy required by the pumps, there is no benefit to the owner/operator of the wind farm to offset capital costs for more generation capacity. Therefore, smaller or larger projects were eliminated from further consideration at this time.

5.0 UNAVOIDABLE ADVERSE IMPACTS

Construction may result in unavoidable short-term, localized adverse impacts related to noise and air quality. However, construction-related impacts are temporary and mitigated through implementation of BMPs. In the long term, the Project would result in a beneficial impact to the climate through reduction of greenhouse gases and reduced cost for the Department of Water Supply that would be passed to its consumers.

6.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A commitment of resources is irreversible when the primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use, or consumption of, resources that are neither renewable nor recoverable for future use.

The Project repowers the original Lālāmilo Wind Farm with newer technology; the use of land resource was thereby already committed. Agricultural grazing activities within the Project Area will still continue with the operations of Project.

The Project would require the commitment of fiscal, human, and material resources to the construction and operation of the Project. Impacts to these resources are negligible compared to the long-term positive benefits of reduced costs and the use of renewable wind energy.

7.0 FINDINGS AND DETERMINATION

To determine whether the construction and operation of the Project may have a significant impact on the physical and human environment, all expected consequences of the Project have been evaluated, including potential primary, secondary, short-range, long-range, and cumulative impacts. Based on this evaluation, the Proposing Agency (County of Hawaiʻi Department of Water Supply) anticipates issuing a Finding of No Significant Impact (FONSI). The supporting rationale for this finding is presented in this chapter.

7.1 SIGNIFICANCE CRITERIA

The discussion below evaluates the significance of the Project's impacts based on the significance criteria set forth in the HAR Section 11-200-12.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*

Discussion: The Project will not result in an irrevocable commitment to loss or destruction of any natural or cultural resources. The Project Area is dominated by introduced plant species. No listed or rare plant species were observed within the Project Area during surveys. The Project Area does not provide a unique habitat and there is no evidence of threatened and endangered plant species. Based on surveys, there is a low likelihood of listed seabirds and bats transiting through the Project Area. Avoidance and minimization measures identified in Chapter 2 would reduce the likelihood of Project impacts to these resources.

As the Project Area is already highly disturbed, only three archaeological sites were identified, two of which require no further action because they would not be directly impacted by the Project and were documented as a result of the AIS (Appendix C) conducted for the Project; preservation is recommended for the third. Additionally, access to the Project Area is limited to the Department of Water Supply and Parker Ranch employees, and no cultural practices are presently occurring within the Project Area as documented in the CIA (Appendix D).

2. *Curtails the range of beneficial uses of the environment;*

Discussion: The Project would not curtail the range of beneficial uses of the environment. The Project repowers the original Lālāmilo Wind Farm using newer technology. The renewable energy generated from the Project would lower the cost of electric energy for the Department of Water Supply, and ultimately its consumers, while reducing greenhouse gas emissions due to reliance on HELCO fossil-fuel generated energy. As a result, the Project would be beneficial to the environment.

3. *Conflicts with the State's long-term environmental policies or goals, and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;*

Discussion: The Project is consistent with the State's environmental polices established in Chapter 344, HRS, which seek to "encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawaiʻi."

The Project is consistent with the following Chapter 344 guidelines:

(2) *Land, water mineral, visual, air, and other natural resources.*

(A) Encourage management practices which conserve and fully utilize all natural resources;

(7) Energy.

(A) Encourage the efficient use of energy resources.

(10)Citizen participation.

(A) Encourage all individuals in the State to adopt a moral ethic to respect the natural environment; to reduce waste and excessive consumption; and to fulfill the responsibility as trustees of the environment for the present and succeeding generations; and

(B) Provide for expanding citizen participation in the decision making process so it continually embraces more citizens and more issues.

4. *Substantially affects the economic or social welfare of the community or State:*

Discussion: The Project would have a beneficial effect on the economic and social welfare of the Department of Water Supply consumers by providing lower cost of energy to power the Department of Water Supply's wells which is a pass through savings to the consumer. In addition, the Project would create construction jobs and up to three permanent jobs in the South Kohala area.

5. *Substantially affects the public health;*

Discussion: Construction-related impacts to air quality and noise would be temporary and minimal; however in the long-term, the Project would reduce green-house gas emissions and would have a positive impact on public health.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*

Discussion: The Project would not lead to an increase in population. The Project would provide a positive impact to public facilities by providing lower cost energy to power the Department of Water Supply wells which in turn would reduce costs to its consumers.

7. *Involves a substantial degradation of environmental quality;*

Discussion: The Project would not substantially degrade the environmental quality. Construction-related impacts to air quality and noise would be temporary, and will be minimized and mitigated to avoid environmental impacts. Erosion and dust, and their associated effects to water resources and air quality, would be minimized during construction by implementing common dust suppression techniques, such as regularly watering exposed soils, stockpiling soils, and stabilizing soils. The Project would reduce green-house gas emissions and would have a long-term, positive impact to the environment.

8. *Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;*

Discussion: The Project would not result in measureable cumulative effects on the environment nor involve a commitment for larger actions. The Project repowers the original Lālāmilo Wind Farm with new technology, which would have a positive effect on the environment due to reduced greenhouse gas emissions.

9. *Substantially affects a rare, threatened or endangered species or its habitat;*

Discussion: No rare, threatened, or endangered plant species or their habitat would be impacted by the Project. Although the Project Area does not contain suitable habitat for rare, threatened, or endangered wildlife species, there is minimal potential for individual Hawaiian petrels, Newell's shearwaters, Hawaiian short-eared owl, Pacific golden-plovers, Hawaiian hawk, Hawaiian goose, and Hawaiian hoary bats to transit through the Project Area. Avoidance and minimization measures including marking the transmission line with bird flight diverters, strategic curtailment of turbines, and use of downshielded lighting on Project structures would reduce the chance of collisions with structures (birds and bats) or attraction to lighting (seabirds). A post-construction monitoring program would also be implemented to assess Project-related effects to these species during Project operation.

10. *Detrimentally affects air or water quality or ambient noise levels;*

Discussion: The Project would not impact ground water quality. In addition, the Project would not impact marine water quality by utilizing best management practices for stormwater control systems.

The Project would not impact ambient noise levels. Construction-related activities would temporarily affect noise levels, which would be mitigated by the contractor's use of best management practices to minimize noise. Additionally, all construction activities would comply with the Chapter 11-46 HAR regarding noise standards.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;*

Discussion: The Project Area is not located in an environmentally sensitive area.

12. *Substantially affects scenic vistas and view planes identified in County or State plans or studies; or;*

Discussion: The Project would result in low to moderate visual impacts, with turbines being viewed in the distance from key viewing areas in the vicinity of the Project. Therefore, no substantial effects to scenic vistas or view planes are anticipated.

13. *Requires substantial energy consumption.*

Discussion: The Project makes use of renewable wind resources to generate energy, offsetting energy consumption from HELCO to power the Department of Water Supply wells; thereby having a net negative energy consumption.

7.2 ANTICIPATED DETERMINATION

Pursuant to Chapter 343, HRS, the approving authority, the County of Hawaiʻi Department of Water Supply, anticipates issuing a FONSI for this EA. This finding is founded on the basis of impacts and mitigation measures examined in this document, public comments received during the pre-consultation and public review phases, and analyzed under the above criteria.

8.0 CONSULTATION

In the course of planning for the Project, community meetings were held and pre-consultation letters were mailed to solicit comments to be addressed in the EA. These efforts are summarized in the following subsections.

8.1 COMMUNITY MEETINGS

Community outreach for the Lālāmilo Repowering Project began in March 2013. The Department of Water Supply has hosted three community meetings for the purpose of introducing the Project, providing an overview of the planning process, and meeting with community members. These include:

- A stakeholder meeting held in Waimea on March 27, 2013;
- A meeting with the Waimea Community Association held on April 4, 2013; and
- A meeting with the Kona Rotary Club held on April 11, 2013.

Invitations were e-mailed to community members and other representatives. A fact sheet with Project information was provided at the meetings.

8.2 PRE-ASSESSMENT CONSULTATION

Pre-assessment consultation letters were mailed in March 2014, prior to preparation of the Draft EA. The purpose of the pre-assessment consultation is to consult with Federal, State, and local agencies; organizations; and individuals with technical expertise, or which may have an interest in or may be affected by the Project. Early consultation is part of the scoping process for the Draft EA, and input received in response to the pre-assessment consultation letters is used to inform the content of the Draft EA. A total of 15 submissions were received in response to the pre-assessment letters. A list of the agencies and other stakeholders to whom pre-assessment consultation letters were sent is provided in Table 8-1. Copies of the written comments and responses are included in Appendix A.

Table 8-1. Company and Agency Early Consultation Correspondence

Company/Agency
U.S. Army Corps of Engineers, Honolulu District
U.S. Fish and Wildlife Service
U.S. Department of Agriculture Natural Resources Conservation Service
U.S. Federal Aviation Administration
State of Hawaiʻi Department of Agriculture
State of Hawaiʻi Department of Business, Economic Development & Tourism
State of Hawaiʻi Department of Hawaiian Home Lands
State of Hawaiʻi Department of Health
State of Hawaiʻi Department of Health, Clean Water Branch
State of Hawaiʻi Department of Land and Natural Resources
State of Hawaiʻi Department of Land and Natural Resources State Historic Preservation Division
State of Hawaiʻi Department of Land and Natural Resources Division State Parks
State of Hawaiʻi Department of Land and Natural Resources Land Division
State of Hawaiʻi Department of Transportation
State of Hawaiʻi Department of Transportation, Waimea-Kohala Airport
Office of Hawaiian Affairs
State of Hawaiʻi Office of Environmental Quality Control
Senator Malama Solomon
County of Hawaiʻi Mayor's Office
County of Hawaiʻi Department of Environmental Management
County of Hawaiʻi Department of Public Works
County of Hawaiʻi Hawaiʻi Fire Department
County of Hawaiʻi Planning Department
County of Hawaiʻi Department of Research and Development
County of Hawaiʻi Police Department
Hawaiʻi County Council - District 9
Kohala Coast Resort Association
Na Koa O Puʻukoholā
Natural Energy Laboratory of Hawaiʻi Authority
Parker Ranch
Puakō Community Association
Waikoloa Community Association
Waimea Community Association
Hawaii Water Service Company

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APPENDIX A

PRE-CONSULTATION COMMENTS AND RESPONSES

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT , U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

May 1, 2014

Regulatory Office **File No. POH-2014-00067**

Ms. Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, Hawaii 96813

Dear Ms. Pulmano:

Your request for comments on behalf of Tetra Tech dated March 17, 2014, for the re-powering of the Lalamilo Wind Farm in Lalamilo, South Kohala, Hawaii, has been received. It has been assigned number POH-2014-00067, which should be referred to in all future correspondence with this office.

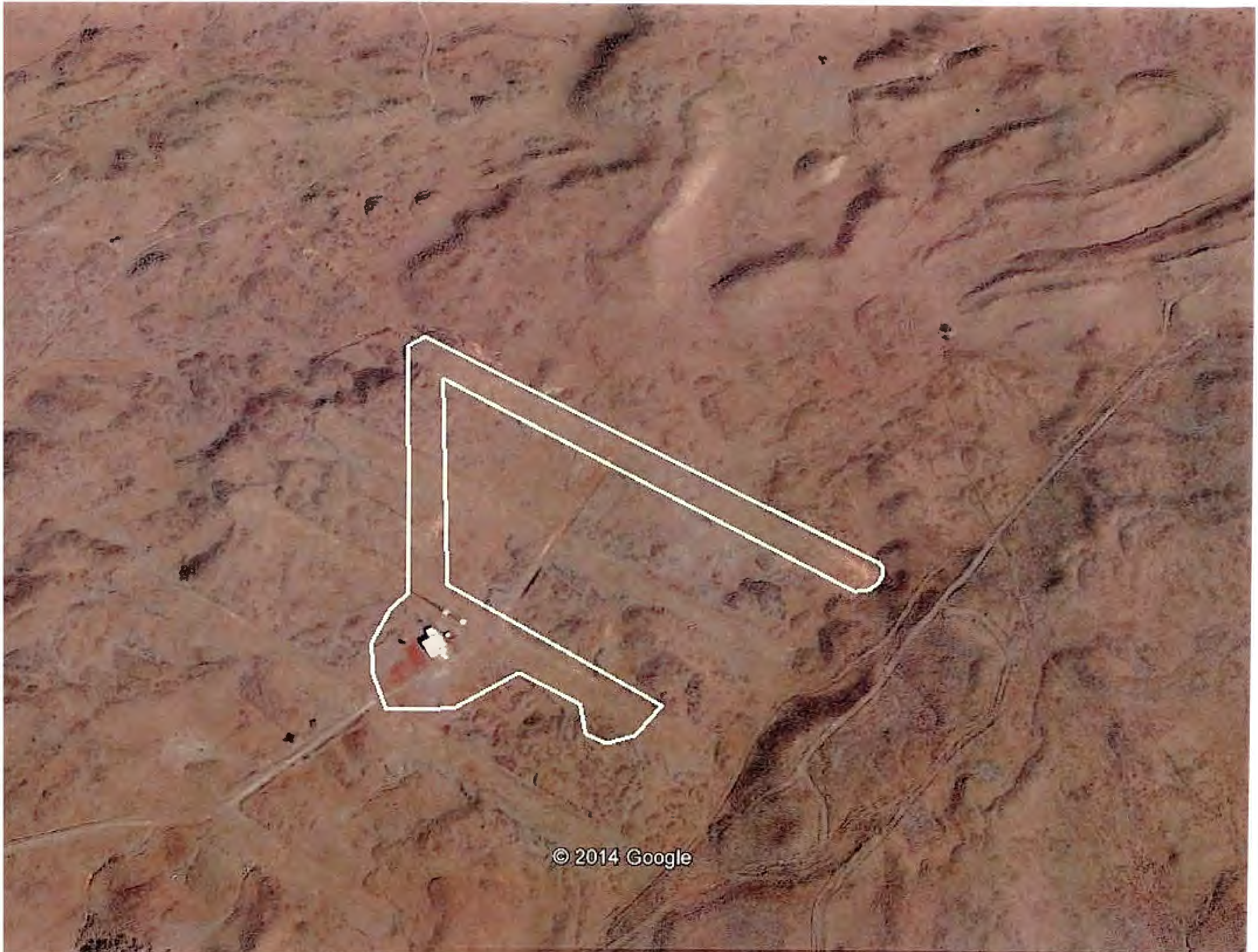
Based on our review of the information you provided March 17, 2014, we have determined the subject property where the wind turbines would be placed does not contain waters of the United States (U.S.) under the U.S. Army Corps of Engineers (Corps) jurisdiction. Therefore, a DA permit is not required for that portion of your project; a map depicting the location is attached. However, the placement of poles for the new above-ground electric power line is not clearly shown and a drawing showing each of those locations would be needed to determine whether the Corps has jurisdiction over those areas. By planning carefully you may be able to locate all poles in areas outside the Corps jurisdiction, if you would like to have a pre-application meeting to discuss that I am available to do so.

Please refer to file number POH-2014-00067 in any future correspondence with this office regarding this matter. Should you have further questions please contact Mary Romero via email at mary.r.romero@usace.army.mil, by phone at (808) 835-4106, by mail at the above address, or by FAX at (808) 835-4126. Please be advised you can provide comments on your experience with the Honolulu District's Regulatory Office by accessing our web-based customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:6446375171654.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Office

Enclosures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June 3, 2014

TTCES-4899-OUT-14-001
File No. POH-2014-00067

George P. Young, P.E.
Attention: Mary Romero
Department of the Army
Honolulu District, U.S. Army Corps of Engineers
Fort Shafter, Hawai‘i 96858-5440

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Young:

Thank you for your letter dated May 1, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

Thank you for confirming that the property where the wind turbines are located does not contain waters of the U.S. and a Department of Army (DA) permit is not required. As you suggested, placement of the transmission line poles can vary; and as such, will avoid any pole placement within the bed or banks of any gulches or drainage ways. Therefore, the Project will avoid any waters of the U.S. and the potential for a DA permit.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department’s involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LJPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

APR 10 2014

Ms. Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, Hawaii 96813

Subject: Comments on the Proposed Re-powering of the Lalamilo Wind Farm, South Kohala, Hawaii

Dear Ms. Pulmano:

The U.S. Fish and Wildlife Service (Service) is in receipt of your letter, dated March 24, 2014, requesting our comments regarding the re-powering of the Lalamilo Wind Farm in South Kohala, Hawaii. The previous Lalamilo Wind Farm consisted of 120 small wind turbines and was constructed in the mid-1980s and decommissioned in 2010. The County of Hawaii Department of Water Supply (DWS) is proposing to install five new 660 kW (3.0 MW total) wind turbines to power eight water wells at this site. The project would also entail installation of approximately 2 km of new, above-ground power lines. A new Environmental Assessment will be required for DWS to obtain a lease from the State Department of Land and Natural Resources (DLNR). The following comments are in accordance with the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.).*

On November 24, 2010, our office sent a letter (record Number 2011-TA-0051) to DLNR regarding the re-powering of the Lalamilo Wind Farm. In our letter, we recommended surveys be conducted to determine species diversity and densities at the site. During a site visit in December, 2013, our staff was informed that bat and seabird surveys were being conducted to determine the presence of the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Hawaiian petrel (*Pterodroma sandwichensis*) and the threatened Newell's shearwater (*Puffinus auricularis newelli*). The results of these surveys can help inform us of the potential impact to these species due to your proposed action. We recommend you coordinate with our office to discuss survey results and next steps to move your project forward.

Section 9 of the ESA (16 U.S.C. 1538) and Federal regulations prohibit the take of fish and wildlife species listed as endangered or threatened. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. 1532 (19)). If it is determined that the proposed project may affect federally listed species, we recommend the applicant apply for an incidental take permit under section

10(a)(1) of the ESA. A section 10 permit application must include a Habitat Conservation Plan (HCP) that identifies the effects of the action on listed species and their habitats, and defines measures to minimize and mitigate those adverse effects.

From our site visit on December 10, 2013, the Service is certain that a HCP is necessary for this project. All entities, including corporations and government organizations, through their ownership or operation of this wind project are responsible for ensuring the project's compliance with the ESA. In addition, individual managers are responsible for ensuring compliance with the ESA and may face personal liability for any knowing failure to do so.

For assistance developing a HCP for this project, please contact Jodi Charrier (email: Jodi_Charrier@fws.gov, Alternative Energy Coordinator) or Dr. Tim Langer (email: Tim_Langer@fws.gov, Fish and Wildlife Biologist). They can also be reached via phone at 808-792-9400.

Sincerely,

Tim Langer

FOR Loyal Mehrhoff
Field Supervisor

June 3, 2014

TTCES-4899-OUT-14-016

Loyal Mehrhoff
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Service Office
Attention: Jodi Charrier
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaiʻi 96850

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Mehrhoff:

Thank you for your letter dated April 10, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply, please see the following responses to your comments.

The Draft Environmental Assessment (EA) will address potential impacts to listed wildlife species. This will include a summary of the results of surveys, including avian radar and bat acoustic monitoring, conducted to date.

As recommended, the Project's operator, Lālāmilo Wind Company, LLC. will continue to consult with U.S. Fish and Wildlife Service (USFWS), and Hawaiʻi Department of Land and Natural Resources/Division of Forestry and Wildlife (DOFAW), to discuss biological survey results, to quantify the Project's potential effects to listed species, and identify measures to avoid and minimize potential adverse impacts during Project construction and operation.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's feedback on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC
Dr. Tim Langer, U.S. Fish and Wildlife Service

Pulmano, Leilani

From: Gordon.Wong@faa.gov
Sent: Wednesday, March 26, 2014 2:58 PM
To: Pulmano, Leilani
Cc: Dave.Washino@faa.gov; Ken.Reyes@faa.gov; Debbie.Saito@faa.gov; Moses.Akana@faa.gov; kimberly.k.evans@hawaii.gov; lynn.becones@hawaii.gov; Lynette.Kawaoka@hawaii.gov; Ron.V.Simpson@faa.gov; Kandyce.Watanabe@faa.gov
Subject: Proposed Re-Powering of Lalamilo Wind Farm, South Kohala, Hawaii
Attachments: Proposed Lalamilo Wind Farm 17MAR2014.pdf; 7460-1 Form.pdf

Reference your letter of March 17, 2014, for pre-consultation for the Proposed Re-Powering of the Lalamilo Wind Farm located at Lalamilo, South Kohala, Hawaii.

Per Federal Aviation Regulation (FAR) Part 77, Notice of Proposed Construction or Alteration, notice to the Federal Aviation Administration (FAA) is required if:

a. Any construction or alteration of more than 200 feet in height above the ground level at its site.

b. Any construction or alteration of greater height than an imaginary surface extending outward and upward at one of the following slopes:

(1) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with at least one runway more than 3,200 feet in actual length, excluding heliports.

(2) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with its longest runway no more than 3,200 feet in actual length, excluding heliports.

(3) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport specified in paragraph (a)(5) of this section.

c. Any highway, railroad, or other traverse way for mobile objects, of a heightwhich, if adjusted upward 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance, 16 feet for any other public roadway, 10 feet or the height of the highest mobile object that would normally traverse the road, whichever Is greater, for a private road, 23 feet for a railroad, and for a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of paragraph (a) (1) or (2) of this section.

d. When requested by the FAA, any construction or alteration that would be in an instrument approach area (defined in the FAA standards governing instrument approach procedures) and available information Indicates It might exceed a standard of Subpart C of this part.

Because wind farms have been known to interfere with FAA radar, we request submittal of FAA Form 7460-1, Notice of Proposed Construction or Alteration. The proponent should notify the FAA through the following website and provide the data needed for FAA Form 7460-1: https://oeaaa.faa.gov

An airspace analysis will be conducted upon submittal of the information to determine its effects on airspace/navaids.

Should you have any questions, please do not hesitate to contact me.

Gordon Wong
FAA Honolulu Airports District Office
Tel: 808-541-3565

June 3, 2014

TTCES-4899-OUT-14-009

Gordon Wong
Federal Aviation Administration
Honolulu Airports District Office
P.O. Box 50244
Honolulu, Hawai‘i 96850

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Wong:

Thank you for your email sent March 26, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

As requested, an FAA Form 7460-1 Notice of Proposed Construction or Alternation will be submitted for the Project.

Again, thank you for your email, which will be included in the Draft EA, and we look forward to your department’s involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LipL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LINDA ROSEN, M.D., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

04001PCTM.14

April 3, 2014

Ms. Leilani Pulmano
Senior Project Manager
Tetra Tech, Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

Dear Ms. Pulmano:

SUBJECT: Pre-Consultation Comments for the Re-Powering of the Lalamilo Wind Farm located at Lalamilo Project South Kohala, Island of Hawaii, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated March 17, 2014, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/10/CWB_Oct22.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for pollutant discharges into State surface waters and for certain situations involving storm water (HAR, Chapter 11-55).

a. Discharges into Class 2 or Class A State waters can be covered under an NPDES general permit only if all of the NPDES general permit requirements are met. Please see the DOH-CWB website (http://health.hawaii.gov/cwb/) for the NPDES general permits and instructions to request coverage.

b. All other discharges into State surface waters and discharges into Class 1 or Class AA State waters require an NPDES individual permit. To request NPDES individual permit coverage, please see the DOH-CWB forms website located at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms/

c. NPDES permit coverage for storm water associated with construction activities is required if your project will result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. NPDES permit coverage is required before the start of the construction activities.

   Land disturbance includes, but is not limited to clearing, grading, grubbing, uprooting of vegetation, demolition (even if leaving foundation slab), staging, stockpiling, excavation into pavement areas which go down to the base course, and storage areas (including areas on the roadway to park equipment if these areas are blocked off from public usage, grassed areas, or bare ground).

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

04001PCTM.14

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

CTM:tg

c: Ms. Julie Myhre, P.E., County of Hawaii Department of Water Supply
[via email jmyhre@hawaiidws.org only]

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June 3, 2014

TTCES-4899-OUT-2014-005
EMD/CWB 04001PCTM.14

Alex Wong, P.E., Chief
State of Hawai‘i
Department of Health
Clean Water Branch
P.O. Box 3378
Honolulu, Hawai‘i 96801

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Wong:

Thank you for your letter dated April 3, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

1 The Project will comply with the provisions on potential impacts to State waters, specifically Hawai‘i Administrative Rules (HAR) §11-54-1.1, §11-54-3, and §11-54-4 to §11-54-8.

2 A National Pollutant Discharge Elimination System (NPDES) permit will be obtained as applicable.

3 We are consulting with the Army Corp of Engineers, Regulatory Branch to verify permit requirements.

4 We acknowledge that all discharges related to the Project construction and operation will need to comply with the State’s Water Quality Standards, and understand noncompliance may be subject to penalties of $25,000 per day per violation.

As suggested in your letter, we read your standard comments on your website to determine if any standard comments are applicable. The applicable comments were included as part of your comment letter.

Again, thank you for your letter, which will be included in the Draft Environmental Assessment, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LINDA ROSEN, M.D., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:
[EPO 14-052]

March 25, 2014

Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

Dear Leilani Pulmano:

SUBJECT: Pre-consultation for the Proposed Re-Powering of the Lalamilo Wind Farm located at Lalamilo, South Kohala, Hawaii

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter dated March 17, 2014. Thank you for allowing us to review and comment on the subject document. The document was routed to the Safe Drinking Water Branch and the District Health Office in Hilo. They will provide specific comments to you if necessary. EPO recommends that you review the standard comments at: http://health.hawaii.gov/epo/home/landuse-planning-review-program/. You are required to adhere to all applicable standard comments.

Mahalo,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

cc: Joanna Seto, Safe Drinking Water Branch Chief
Newton Inouye, District Health Office, Hilo

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June 3, 2014

TTCES-4899-OUT-14-006
EPO-14052

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office
State of Hawaiʻi
Department of Health
P.O. Box 3378
Honolulu, Hawaiʻi 96801

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Ms. McIntyre:

Thank you for your letter dated March 25, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply (DWS), please see the following responses to your comments.

We appreciate you routing the pre-consultation request to the Safe Drinking Water Branch and the District Health Office in Hilo. We reviewed the standard comments and the following provides a response to the applicable standard comments:

1. Clean Air Branch

   The Project will comply with the provisions of Hawaiʻi Administrative Rules (HAR) §11-60.1-33 on Fugitive Dust. The contractor will provide adequate measures to control fugitive dust during construction of the Project.

2. Hazard Evaluation & Emergency Response Office

   In October and November 2010 the 1980's vintage wind farm equipment was removed and the site was restored to nearly preconstruction conditions. A Phase I and Phase II Environmental Site Assessment and Remediation Report were completed in November 2010. Five locations were investigated, and only one of the five locations contained soil contaminated with Diesel-Range Organics (DRO) at concentrations above the Hawaiʻi Department of Health Tier 1 Environmental Action Level (EAL). On November 4, 2010, the soil was removed and the remaining exposed surface soil was sampled again. The results from the subsequent sampling effort showed concentrations of 31.1, 38.8 and 30.7 mg/kg, which is below the EAL. The contaminated soil was tested and was found to contain chromium at 127 mg/kg, however further testing using the toxicity characteristic leaching procedure (TCLP) found that chromium was not detected in the extract; and therefore, the contaminated soil was determined to have chromium concentrations less than the maximum contaminant level (MCL) of 5 mg/l in accordance with TCLP. The Remediation Report concluded that the contaminated area was properly remediated and does not contain contaminants of concern at concentrations greater than the EALs. The previous owner of the wind farm equipment, HELCO, properly disposed of the soil in the West Hawaiʻi Landfill on November 11, 2010.

3. Noise, Radiation & Indoor Air Quality Branch

    a. The Project will comply with the provisions of HAR §11-39 Air Conditioning and Ventilating; §11-45 Radiation Control; and §11-46 Community Noise Control.

    b. Construction of the Project will not introduce, and is not anticipated to require handling of any asbestos-containing material.

4. Safe Drinking Water Branch

    a. The Project does not involve providing a new source of potable water or a new public water system. The Project's purpose is to provide an alternative renewable energy source to power the pumping of the DWS Lālāmilo-Parker Wells System.

    b. The Project does not involve construction of a new injection well.

5. Solid and Hazardous Waste Branch

    a. The Project will comply with HAR §11-260 to §11-280 Hazardous Waste Management.

    b. Solid waste generation from the Project is anticipated to be minimal. Solid waste will be disposed of properly and delivered to permitted solid waste management facilities.

    c. The Project does not involve construction of an underground storage tank.

6. Wastewater Branch

    Wastewater will be accommodated by port-a-potties that will be serviced several times a week as there are no wastewater systems within or nearby the Project Area.

Clean Water Branch provided pre-consultation comments which we will be responding to separately.

Again, thank you for your letter, which will be included in the Draft Environmental Assessment, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LIPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

NEIL ABERCROMBIE
GOVERNOR
STATE OF HAWAII

JOBIE M. K. MASAGATANI
CHAIRMAN
HAWAIIAN HOMES COMMISSION

DARRELL T. YOUNG
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

March 31, 2014

Ms. Leilani Pulmano
Tetra Tech, Incorporated
737 Bishop Street, Suite 2340
Honolulu, Hawaii 96813

Aloha Ms. Pulmano:

Subject: Early Consultation on Environmental Assessment (EA) for Proposed Re-Powering of the Lalamilo Wind Farm (TMK: (3)6-6-001:001 (portion Easement J, K, L, and M), 002 (portion Easement J and K), 071 (portion), and 076 (portion), South Kohala, Island of Hawaii

The Department of Hawaiian Home Lands (DHHL) received the above-mentioned letter dated March 17, 2014, for the Proposed Re-Powering of the Lalamilo Wind Farm (TMK: (3)6-6-001:001 (portion Easement J, K, L, and M), 002 (portion Easement J and K), 071 (portion), and 076 (portion). The proposed action involves will provide a renewable energy source for eight (8) water wells in the Lalamilo-Parker well system.

DHHL has land holdings in the ahupuaa of Lalamilo of approximately 250 acres and has plans to develop 400 residential homesteads on its lands.

(1) Consistency with DHHL Plans

The EA for this project should evaluate the project's potential positive or negative impact on DHHL's 2012 "Waimea Nui Regional Plan." Please also include in the draft EA an assessment of how this project may affect DHHL plans to build approximately 400 residential homesteads in the region.

(2) Early Consultation with the Lalamilo Residence Lots Association

DHHL also recommends that Tetra Tech consult with DHHL's Lalamilo Residence Lots Association for this project.

(3) Project Location Map

In the draft EA, please provide a more detailed location map so we can better determine the proximity of this proposed project to DHHL's Lalamilo lands.

Mahalo for the opportunity to comment. If you have further questions, please contact Andrew Choy at (808) 620-9279 or email him at andrew.h.choy@hawaii.gov.

Aloha,

Jobie M. K. Masagatani, Chairman
Hawaiian Homes Commission

c: DHHL West Hawaii District Office
DHHL Land Development Division

June 3, 2014

TTCES-4899-OUT-14-002

Jobie Masagatani
Attention: Andrew Choy
State of Hawaiʻi
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaiʻi 96805

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Ms. Masagatani:

Thank you for your letter dated March 31, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply, please see the following responses to your comments.

We acknowledge that the Department of Hawaiian Home Lands (DHHL) lands closest to the Project include the Pauahi, Lālāmilo, Keoniki, Pu’ukapu, Kamoku-Kapulena, Honokāia, and Nienie. These parcels are covered under the Waimea Nui Regional Plan, which outlines DHHL’s plans to build approximately 400 residential homesteads in the region. For your convenience, a map from the DHHL Waimea Nui Regional Plan is attached locating the DHHL lands in relation to the Project.

Please note that the Project will repower the old Lālāmilo Wind Farm of 120 turbines that existed from 1984 to 2009 and decommissioned in 2010 in order to install newer turbines. The Project will have no effect on the Waimea Nui Regional Plan or future use of these DHHL parcels in the vicinity of the Project. Please note that the DHHL lands are outside of the Lalamilo-Parker well system service area. Based on topography and the size and location of the proposed wind turbines, the Project may be visible in the far distance from portions of Pauahi, Lālāmilo, and Keoniki lands. The Project would not be visible from the remaining DHHL’s lands as it is more than eight miles away and screened by topography and vegetation. As requested, we will be conducting a public informational meeting following the publication of the Draft EA and will invite the DHHL’s Lālāmilo Residence Lots Association to attend.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

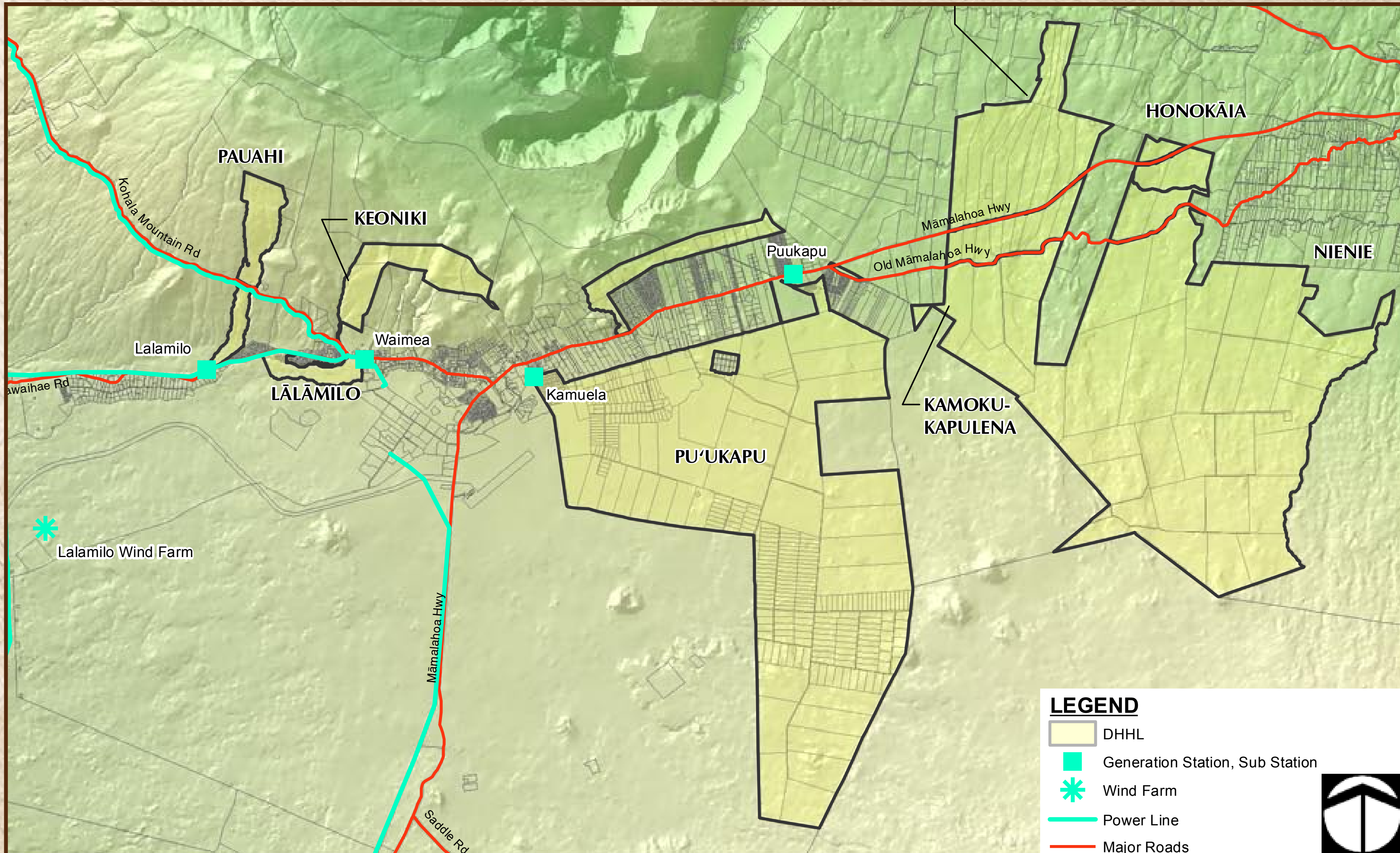
TETRA TECH, INCORPORATED

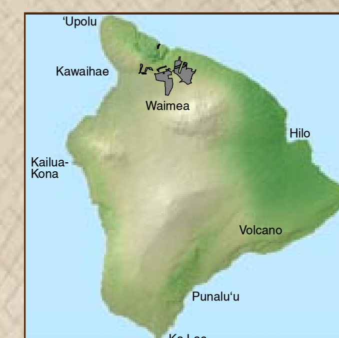
Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

Attachment: Infrastructure – Utilities

INFRASTRUCTURE - UTILITIES





Electrical Utilities in Lālāmilo, August 2011.

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NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
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 22, 2014

Tetra Tech, Inc.
Attn: Ms. Leilani Pulmano
737 Bishop St., Suite 2340
Honolulu, HI 96813

via email: leilani.pulmano@tetratech.com

Dear Ms. Pulmano:

SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm, Department of Water Supply, County of Hawaii, Applicant, Lalamilo, South Kohala, Hawaii, TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments previously sent under cover of our letter dated April 21, 2014, enclosed is a response from the Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to call Kevin Moore at 587-0426.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION

2014 APR 21 PM 2:33

WILLIAM J. AILA, JR.
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

2014 ... 21 PM 1:23

March 27, 2014

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

ER.

TO.

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm
LOCATION: Lalamilo, South Kohala, Hawaii, TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)
APPLICANT: Tetra tech on behalf of Department of Water Supply, County of Hawaii

Transmitted for your review and comment is information on the above referenced project. We would appreciate your comments on this project. Please submit any comments by April 17, 2014.

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 Kevin Moore at 587-0426. Thank you.

Attachment

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed: [signature]

Print name: William M. Tam
Date: 4/17/14

cc: Central Files

FILE ID: RFD.3946.8
DOC ID: 11532.1

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

April 17, 2014

REF: RFD.3946.8

TO: Russell Tsuji, Administrator
Land Division

FROM: William M. Tam, Deputy Director
Commission on Water Resource Management

SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm, South Kohala

FILE NO.:
TMK NO.: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program

☐ 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/info_permits.htm.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 11. A Well Construction Permit(s) is (are) required before any well construction work begins.

☐ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☒ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ OTHER:

If there are any questions, please contact Dean Uyeno at 587-0234.

TETRA TECH

June 3, 2014

TTCES-4899-OUT-14-003

William Tam, Deputy Director
State of Hawaiʻi
Department of Land and Natural Resources
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawaiʻi 96809

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Tam:

Thank you for your letter dated April 17, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply, please see the following responses to comments from the Commission on Water Resource Management.

We understand that a Stream Channel Alteration Permit(s) would be required before any alteration(s) can be made to the bed and/or banks of a stream channel. At this time, there are no plans to alter the bed and/or banks of a stream channel for the Project.

Again, thank you for your letter, which will be included in the Draft Environmental Assessment, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LIPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
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 21, 2014

Tetra Tech, Inc.
Attn: Ms. Leilani Pulmano
737 Bishop St., Suite 2340
Honolulu, HI 96813

via email: leilani.pulmano@tetratech.com

Dear Ms. Pulmano:

SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm, Department of Water Supply, County of Hawaii, Applicant, Lalamilo, South Kohala, Hawaii, TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from the (i) Engineering Division, and (ii) Division of Forestry and Wildlife on the subject matter. Should you have any questions, please feel free to call Kevin Moore at (808) 587-0426.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

RECEIVED
ENG DIVISION

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

2014 APR -1 PM 2:46

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

March 27, 2014

'14 MAR 28 PM 4:13 ENGINEERING

MEMORANDUM

~~TO:~~ FD:

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

TO:
~~FROM:~~ Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm
LOCATION: Lalamilo, South Kohala, Hawaii, TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)
APPLICANT: Tetra tech on behalf of Department of Water Supply, County of Hawaii

Transmitted for your review and comment is information on the above referenced project. We would appreciate your comments on this project. Please submit any comments by April 17, 2014.

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 Kevin Moore at 587-0426. Thank you.

Attachment

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:

Print name: Carty S. Chang, Chief Engineer
Date: 4/1/14

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
Ref.: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm
Hawaii.022

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone X. The National Flood Insurance Program (NFIP) does not regulate developments within Zone X.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project site must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.

( ) Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.

( ) Mr. Stanford Iwamoto at (808) 241-4884 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: ______________________________

( ) Other: ______________________________

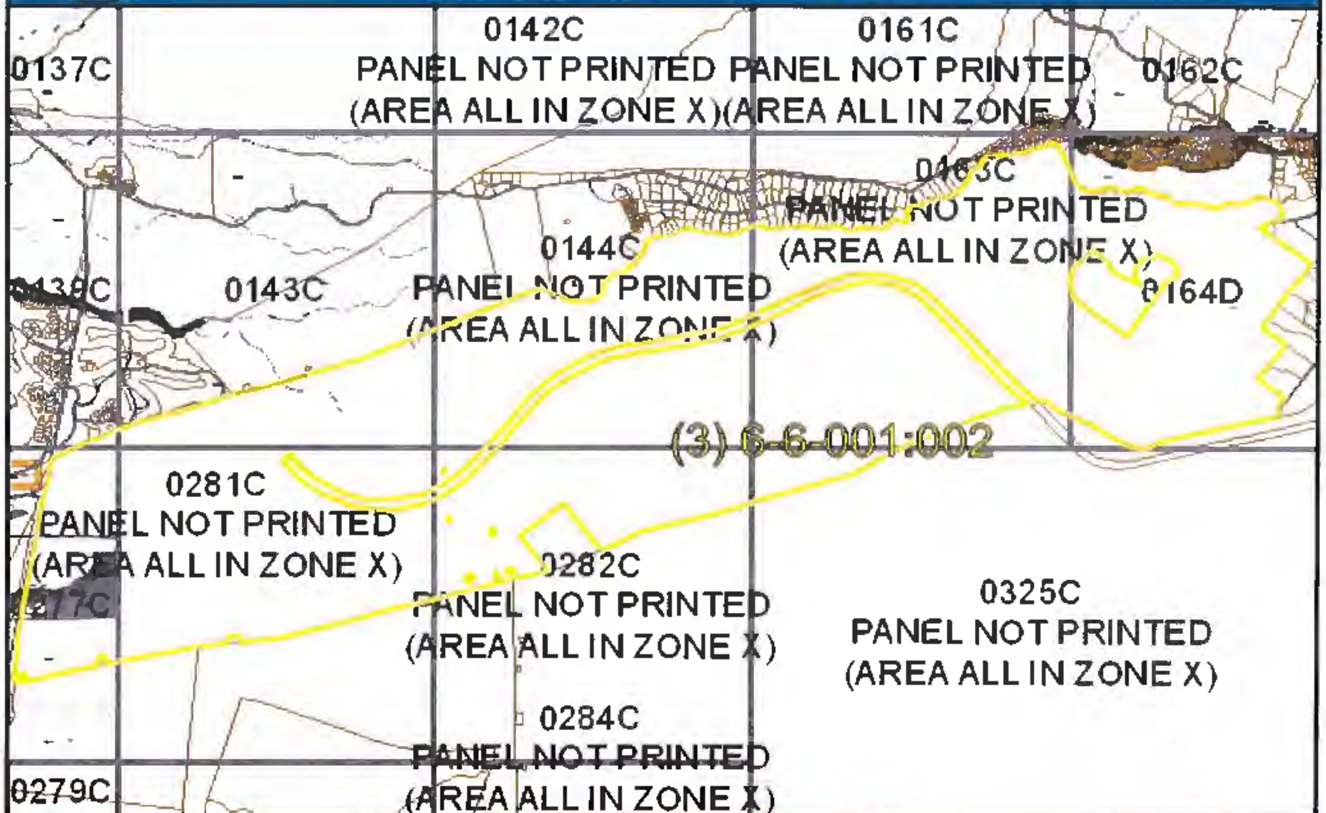
Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: ______________________________
CARTY S. CHANG, CHIEF ENGINEER

Date: 4/1/14

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

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

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

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

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

OTHER FLOOD AREAS

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

PROPERTY INFORMATION

COUNTY:	HAWAII
TMK NO:	(3) 6-6-001-002
PARCEL ADDRESS:	
FIRM INDEX DATE:	APRIL 02, 2004
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	

1551660164D-JULY 16, 1990 1551660163C - PANEL NOT PRINTED 1551660144C - PANEL NOT PRINTED 1551660143C-SEPTEMBER 16, 1988 1551660139C-SEPTEMBER 16, 1988 1551660325C - PANEL NOT PRINTED 1551660282C - PANEL NOT PRINTED 1551660281C - PANEL NOT PRINTED 1551660277C-SEPTEMBER 16, 1988

PARCEL DATA FROM:	JUNE 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

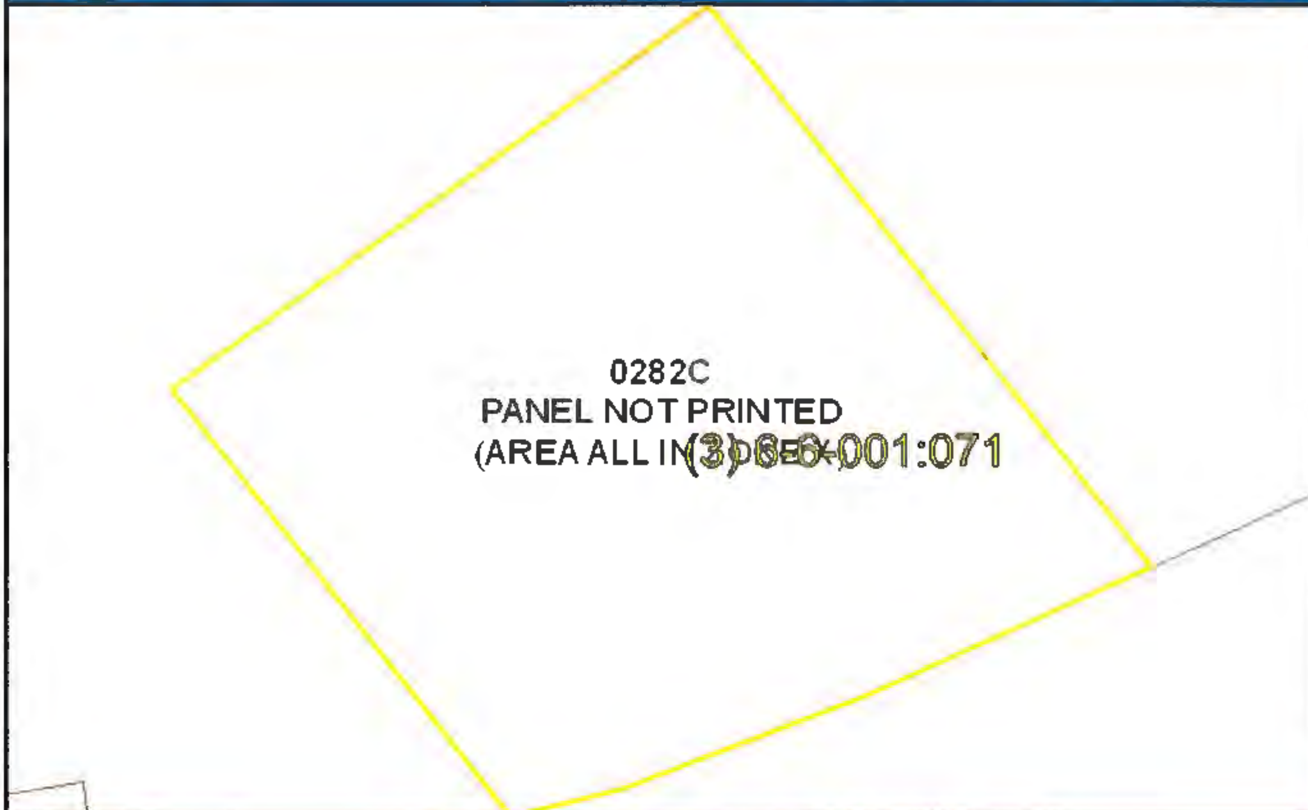
County NFIP Coordinator
County of Hawaii
Frank DeMarco, CFM (808) 961-8042
State NFIP Coordinator
Carol Tyau-Beam, P.E., CFM (808) 587-0267

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

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

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

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

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

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

OTHER FLOOD AREAS

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

PROPERTY INFORMATION

COUNTY:	HAWAII
TMK NO:	(3) 6-6-001-071
PARCEL ADDRESS:	
FIRM INDEX DATE:	APRIL 02, 2004
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1551660282C
PANEL EFFECTIVE DATE:	PANEL NOT PRINTED
PARCEL DATA FROM:	JUNE 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator
County of Hawaii
Frank DeMarco, CFM (808) 961-8042
State NFIP Coordinator
Carol Tyau-Beam, P.E., CFM (808) 587-0267

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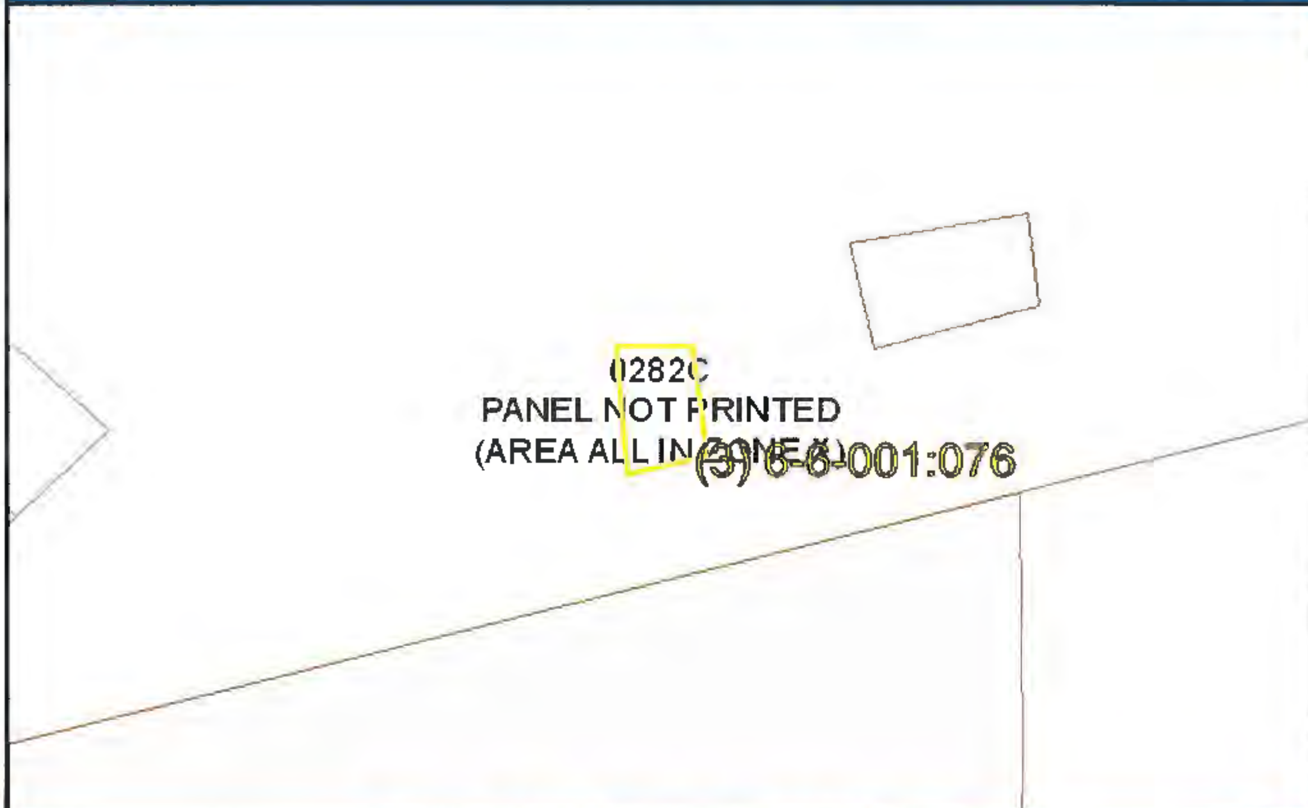
State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

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

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

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

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

OTHER FLOOD AREAS

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

PROPERTY INFORMATION

COUNTY:	HAWAII
TMK NO:	(3) 6-6-001-076
PARCEL ADDRESS:	
FIRM INDEX DATE:	APRIL 02, 2004
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1551660282C
PANEL EFFECTIVE DATE:	PANEL NOT PRINTED
PARCEL DATA FROM:	JUNE 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator
County of Hawaii
Frank DeMarco, CFM — (808) 961-8042
State NFIP Coordinator
Carol Tyau-Beam, P.E., CFM — (808) 587-0267

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
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 27, 2014

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

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm
LOCATION: Lalamilo, South Kohala, Hawaii, TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)
APPLICANT: Tetra tech on behalf of Department of Water Supply, County of Hawaii

Transmitted for your review and comment is information on the above referenced project. We would appreciate your comments on this project. Please submit any comments by April 17, 2014.

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 Kevin Moore at 587-0426. Thank you.

Attachment

RECEIVED 14 MAR 28

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Print name: LISA HADWAY
Date: 4/15/17

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

JESSE K. SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

April 14, 2014

MEMORANDUM

To: Russell Y. Tsuji, Land Administrator
DLNR, Land Division

From: Lisa J. Hadway, Administrator
DLNR, Division of Forestry and Wildlife (DOFAW)

Subject: Comments on the Pre-Consultation for the Proposed Re-Powering of the Lalamilo Wind Farm, Lalamilo, South Kohala, Hawaii
TMK: (3) 6-06-001:001 (por.), 002 (por.), 071 and 076 (por.)

Thank you for the memo received on March 28, 2014 and the opportunity to comment on the proposal to re-power the Lalamilo Wind Farm. The proposed action includes the re-powering of five Vesta V47-660 wind turbines for the purpose of powering eight Hawaii Department of Water Supply (DWS) wells in the Lalamilo-Parker well system, and the construction of a new aboveground power line within the existing DWS right-of-way and easement. The turbine maximum height, including the height of the blades, will be 61 meters (199 feet).

The proposed project has the potential to impact several state and federally-listed endangered species including the Hawaiian Hoary Bat or 'Ope'ape'a *(Lasiurus cinereus semotus)*, Hawaiian Petrel or 'Ua'u *(Pterodroma sandwichensis)*, Hawaiian goose or Nēnē *(Branta sandvicensis)*; state and federally-listed threatened species the Newell's Shearwater or 'A'o *(Puffinus auricularis newelli)*; and the state-listed endangered Band-rumped Storm Petrel or 'Ake 'ake *(Oceanodroma castro)*.

Generation of energy via wind farms is renewable technology that reduces greenhouse gas emissions and water use. However, the impact of wind farms on wildlife species, particularly avian and bat species, is well-documented in the literature. Collision rates vary by region, but nationwide estimates suggest that 2.19 (Erickson *et al.*, 2001) to 2.3 (NWCC, 2004) avian collision fatalities occur per turbine, per year. Birds are also known to collide with power lines and guy wires (Erickson *et al.*, 2005; Drewitt & Langston, 2008), and seabird collisions with utility lines and wind turbines are well-documented in the Hawaiian Islands (Griesemer & Holmes, 2011; DOFAW Annual Reports). Artificial lighting can also adversely impact seabirds during the fledging period (September – December) causing disorientation and collision with manmade structures. Unable to take off, these birds become vulnerable to predation from predators such as cats, pigs, and dogs. The number of bat fatalities has surpassed the number of avian fatalities at many wind energy facilities in the continental U.S., although these estimates also vary widely depending on geography, and bat fatalities have been documented at all five wind farms currently in possession of Incidental Take Licenses (ITLs) in the State of Hawaii (DOFAW Annual Reports).

In a meeting that took place in December 2013, it was communicated to DOFAW that acoustic and radar surveys for bats and birds, respectively, had been conducted at the facility. It was stated that both birds and bats were detected at the site, and passage rates for both were "low;" however, no data or reports have been provided to DOFAW to date. DOFAW is concerned that take of endangered species is likely and, in the absence of sufficient monitoring efforts, currently going undocumented.

As this project has potential for impacts to transiting individuals of at least four state and federally-listed threatened and endangered species (Newell's Shearwater, Hawaiian Petrel, Hawaiian Hoary Bat, and Nēnē), as well as the state-listed Band-rumped Storm-petrel, DOFAW recommends that Lalamilo institute an intensive survey and monitoring program. Each of these species may be more vulnerable at different times of the year when they return to breeding sites or migrate elevationally through the area, and designing an effective avoidance and minimization program will need to take these life history traits into account.

DOFAW also recommends that Lalamilo continue to consult with DOFAW and the US Fish and Wildlife Service (USFWS) to determine if it is appropriate to pursue an ITL and Incidental Take Permit (ITP). As described above, DOFAW recommends continued monitoring to document any injuries or fatalities, and to determine the success of their avoidance and minimization measures. If an endangered species is likely to be impacted by the project, we request that the developer schedule a meeting with our staff to consult on the potential impacts of the project, evaluating any relevant information or surveys available to make an informed assessment.

DOFAW appreciates the opportunity to provide comments on this project and requests that Land Division continue to seek input from DOFAW on impacts to wildlife.

If you have any questions, please contact Dr. Marie Morin, Wildlife Program Manager, at 808-587-4187.

cc: Hans Sin, DOFAW Hawaii Branch Wildlife Manager

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June 3, 2014

TTCES-4899-OUT-14-017

Russell Y. Tsujii, Land Administrator
State of Hawai‘i
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai‘i 96809

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Tsujii:

Thank you for your letter dated April 21, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to comments from the Engineering Division and the Division of Forestry and Wildlife (DOFAW).

Engineering Division

Thank you for confirming that the Project site is located within Zone X of the Flood Insurance Rate Map.

Division of Forestry and Wildlife

The Draft Environmental Assessment (EA) will address potential impacts to listed wildlife species. This will include a summary of the results of surveys, including avian radar and bat acoustic monitoring, conducted to date.

As recommended, the Project’s operator, Lālāmilo Wind Company, LLC. will continue to consult with DOFAW, and U.S. Fish and Wildlife Service (USFWS), to quantify the Project’s potential effects on listed species, and to identify measures to avoid and minimize these effects during Project construction and operation. Please note that the Project has yet to be constructed; therefore, there is currently no potential for adverse impacts to endangered species. Lālāmilo Wind Company, LLC. will also continue to work with DOFAW, and the USFWS, to develop a post-construction monitoring program for the Project.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's feedback on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

April 14, 2014

Lelani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

LOG NO: 2014.1337
DOC NO: 1404MV15
Archaeology

Dear Ms. Pulmano:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Pre Consultation for Environmental Assessment (EA) for the
Proposed Re-Powering of the Lalamilo Wind Farm
Lalamilo Ahupua'a, South Kohala District, Island of Hawai'i
TMK: (3) 6-6-001:001 & :002

Thank you for the opportunity to review the subject pre-consultation that was received by our office on March 24, 2014. According to the pre-EA, the proposed project involves the construction of five 199ft. vestas V47-660 wind turbines at the former location of the Lalamilo wind farm. The project will also require the construction of a new above ground power line. The exact extent of the proposed ground disturbance is not described in this notice. A review of our records indicates that this area is one of the most intact cultural landscapes on the island. An archaeological survey by Reith and Morrison (2012) was conducted in the vicinity of this project area. This survey was limited to a proposed roadway corridor, and recorded 391historic properties with 1350 component features. In addition, the Waimea-Lalamilo field system was recorded in this area by Clark and Kirch (1983). Therefore we believe that historic properties may exist in the proposed project area **and we request that an archaeological inventory survey (AIS) is conducted on the proposed project area**. We believe that the AIS report should be submitted to SHPD prior to the publication of the EA, to ensure that historic properties have been identified so that the effects of the project on historic properties can be adequately considered. In addition, we request that the visual effects of this project on the entire historic landscape are considered.

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@hawaii.gov for any questions or concerns regarding this letter.

Aloha,

Mike Vitousek

Michael Vitousek,
Lead Archaeologist Hawaii Island Section
Historic Preservation Division

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TETRA TECH

June 3, 2014

TTCES-54899-OUT-14-013
LOG NO. 2014.1337
DOC NO. 1404MV15
Archaeology

Michael Vitousek
State of Hawai‘i
Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Boulevard, Room 555
Kapolei, Hawai‘i 96707

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Vitousek:

Thank you for your letter dated April 14, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

An Archaeological Inventory Survey is being conducted on the Project Area and will be included within the Draft Environmental Assessment (EA). Additionally, effects on the visual landscape will be assessed and a discussion will be included in the Draft EA.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LIPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
FORD N. FUCHIGAMI
RANDY GRUNE
AUDREY HIDANO
JADINE URASAKI

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

IN REPLY REFER TO:
STP 8.1534

April 28, 2014

Ms. Leilani Pulmano
Tetra Tech, Incorporated
737 Bishop Street, Suite 2340
Honolulu, Hawaii 96813

Dear Ms. Pulmano:

Subject: Lalamilo Wind Farm
Pre-Consultation for Draft Environmental Assessment
TMK: (3) 6-6-001:001 (por), 002 (por), 071 (por) and 076 (por)

Our Department of Transportation's (DOT) comments on the subject project are as follows:

The Department of Water Supply is required to obtain a permit from DOT Highways Division, Hawaii District Office, for the transport of oversized and/or overweight materials and equipment on State highway facilities.

The proposed wind farm lies beneath the aircraft approach and departure paths for Waimea-Kohala Airport. Therefore, we request the developer provide specific geographic locations for the wind turbines so that they may be included in aeronautical charting to ensure aircraft operators are aware of the potential hazard.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

June 3, 2014

TTCES-4899-OUT-14-008
STP 8.1534

Ford Fuchigami, Acting Director
State of Hawai‘i
Department of Transportation
Honolulu, Hawai‘i 96813

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Okimoto:

Thank you for your letter dated April 28, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

We acknowledge that the Project will be required to obtain a permit for the transport of oversized and/or overweight materials and equipment that will be utilizing State highways.

Upon completion of construction plans, the contractor and/or developer will provide your department specific geographic locations for the wind turbines to be included in aeronautical charting to ensure that aircraft operators are aware of the potential hazard. To this end, and as requested by Airports Division, a FAA Form 7460-1 Notice of Proposed Construction or Alternation will be submitted for the Project.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LpL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
FORD N. FUCHIGAMI
RANDY GRUNE
AUDREY HIDANO
JADINE URASAKI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
Kona International Airport at Keahole
73-200 Kupipi Street
Kailua-Kona, Hawaii 96740-2645

IN REPLY REFER TO:
AIR-H
14.0038

01 April 2014

Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

Attn: Ms. Leilani Pulmano

Subject: **Pre-consultation for the Proposed Re-Powering of the Lalamilo Wind Farm located at Lalamilo, South Kohala, Hawaii, TMK (3) 6-6-001: 001 (Ref: TTCES-PTLD-2014-041)**

Thank you for your letter of March 17, 2014, and the opportunity to comment on your proposal to re-power the Lalamilo Wind Farm at South Kohala, Hawaii.

The primary elements of your project are all outside of the distances from our Waimea-Kohala and Kona International Airports that would automatically trigger FAA 7460 obstruction evaluations. But the proposed permanent height of 199' above ground level (AGL) could be a concern to the FAA. We encourage you to file an FAA form 7460-1 Notice of Proposed Construction or Alteration for both the permanent structures and for the temporary erection equipment required during construction. Please provide copies of the subsequent FAA "determination" regarding airspace hazard requirements to our office once you have received them.

If you have any other questions, please contact our District Engineer, Mr. David Hein, at (808) 987-3191.

Very truly yours,

Chauncey Wong-Yuen
Hawaii District Manager

CWY:dkh

bc: AIR-L AIR-H
FAA – R.Simpson

TETRA TECH

RECEIVED

14.0017

March 17, 2014

TTCES-PTLD-2014-041

Chauncey Wong Yuen
Waimea-Kohala Airport
State of Hawaii
73-200 Kupipi St.
Kailua-Kona, HI 96740

Subject: Pre-consultation for the Proposed Re-Powering of the Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai'i, TMK (3) 6-6-001: 001 (portion Easement J, K, L, and M), 002 (portion Easement J and K), 071 (portion), and 076 (portion)

Dear Chauncey Wong Yuen:

In accordance with HAR § 11-200 Environmental Impact Statement Rules, the County of Hawai'i Department of Water Supply (DWS), is seeking input on its proposed re-powering of the Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai'i from agencies having jurisdiction or expertise as well as those citizen groups and individuals which may be affected. The project will be located on the above-referenced land parcels to be formally leased by the DWS, and the DWS has obtained a lease approval-in-concept from the State Department of Land and Natural Resources to re-power the wind farm on this site. An Environmental Assessment (EA) is required prior to obtaining the direct lease.

Project Description

The previous Lālāmilo Wind Farm constructed in the mid-1980s with a 120 wind turbines for a total generating capacity of 2.7 megawatts (MW) was decommissioned in 2010 in anticipation of re-powering the site. The proposed new Lālāmilo Wind Farm (Project) will provide a renewable energy source for eight (8) water wells in the Lālāmilo-Parker well system. The Project is located adjacent to the DWS water wells and will generate significant energy savings for the DWS and, ultimately, its consumers. See Project map.

The Project will consist of five Vestas V47-660 wind turbines to power the eight DWS water wells. Each Vestas wind turbine can produce up to 660 kilowatts (kW) for a total generating capacity of 3.0 MW. The wind turbine's maximum height including the height of the turbine blades will measure 61 meters (m; 199 feet [ft]) tall.

On an adjacent parcel south of the wind farm site, a new, above-ground electric power line will be constructed within the existing DWS right-of-way and easement. The power line will extend to the north, from the DWS Parker Well No. 4 approximately 2 kilometers (6,700 ft) terminating within the existing Hawaii Electric Light Company interconnect and switchgear. All eight (8) wells and the switch gear will be equipped with new electronic Supervisory Control and Data Acquisition (SCADA) equipment supporting maximum use of the wind-generated electricity by the wells. The existing meteorological tower, two existing radio towers, and office/shop building remaining from the original Lālāmilo Wind Farm will continue to be used as part of this Project.

Request

As part of the Environmental Assessment process, and on behalf of the DWS, we are seeking input on the proposed Project. Please send your comments to the address below. We would appreciate receiving your comments by April 4, 2014.

Attention: Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, Hawai'i 96813
leilani.pulmano@tetratech.com

If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LIPL

Leilani Pulmano
Senior Project Manager

cc: Julie Myhre, P.E. County of Hawai'i Department of Water Supply

Enclosure: Project Map

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June 3, 2014

TTCES-4899-OUT-14-007
AIR-H 14.0038

Chauncey Wong Yuen
State of Hawaiʻi
Department of Transportation
Airports Division
Kona International Airport At Keahole
72-200 Kupipi Street
Kailua-Kona, Hawaiʻi 96740-2645

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Yuen:

Thank you for your letter dated April 1, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply, please see the following responses to your comments.

As requested by Airports Division, a FAA Form 7460-1 Notice of Proposed Construction or Alternation will be submitted for the Project. A copy of the determination regarding airspace hazard will be forwarded to your department.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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William P. Kenoi
Mayor

BJ Leithead Todd
Director

John A. Medeiros
Deputy Director

County of Hawai'i

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

345 Kekūanaō'a St., Suite 41• Hilo, Hawai'i 96720

(808) 961-8083 · Fax (808) 961-8086

https://www.hawaiicounty.gov/environmental-management/

April 2, 2014

Tetra Tech, Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

Attention: Leilani Palmano

RE: Pre-consultation for the Proposed Re-Powering of the Lalamilo Wind Farm located at Lalamilo, South Kohala, Hawai'i, TMK: 6-6-001:001 (portion Easement J,K,L, and M), 002, (portion Easement J and K), 071 (portion), and 076 (portion)

We have no comments on the subject project.

Thank you for allowing us to review and comment.

Sincerely,

BJ Leithead Todd
DIRECTOR

enclosure

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William P. Kenoi
Mayor

Walter K. M. Lau
Managing Director

Warren H. W. Lee
Director

Brandon A. K. Gonzalez
Deputy Director

County of Hawai'i

DEPARTMENT OF PUBLIC WORKS

Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
www.co.hawaii.hi.us

April 1, 2014

Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, Hawaii 96813

SUBJECT: Pre-consultation for the Proposed Re-Powering of the Lalamilo Wind Farm
Applicant: Tetra tech, Inc.
Location: South Kohala, Hawaii
TMK: 3/6-6-001:001 (portion Easement J, K, L & M), 002 (portion Easement J &K), 071 (portion) and 067 (portion)

We reviewed the subject application and have no comments on the proposed project.

Should there be any questions concerning this matter, please feel free to contact Kiran Emler of our Kona Engineering Division office at (808)323-4851.

a BEN ISHII, Division Chief
Engineering Division

BO

Copy: ENG HILO/KONA

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William P. Kenoi
Mayor

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i

PLANNING DEPARTMENT

Duane Kanuha
Planning Director

Bobby Command
Deputy Planning Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

April 4, 2014

Ms. Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, HI. 96813

Dear Ms. Pulmano:

Request for Comments for Pre-Consultation for the Draft Environmental Assessment for the Re-Powering of the Lalamilo Wind Farm
TMK: (3) 6-6-001:001, 002, 071 & 076; Lalamilo, South Kohala, Hawai'i

We have the following comments regarding the forthcoming Environmental Assessment for the Re-Powering of the Lalamilo Wind Farm:

TMK (3) 6-6-001:001 is no longer an active parcel, could you have meant (3) 6-8-001:001, if so please update your application.

The project would involve TMKs (3) 6-6-001:002, 071 & 076. Please be aware that a portion or all of the subject parcel(s) is identified as a Formerly Used Defense Site (FUDS) by the U.S. Army Corps of Engineers, who will manage the investigation, clean-up and long-term monitoring on lands formerly used as an artillery firing range. For more information, please contact Honolulu District Public Affairs, US Army Corps of Engineers 808-835-4004/4002, http://www.poh.usace.army.mil/Missions/Environmental/FUDS.aspx or www.poh.usace.army.mil.

The Parcels identified as TMK (3) 6-6-001:002, 071 & 076, (3) 6-8-001:001 are situated within the State Land Use (SLU) Agriculture district. County zoning of the parcel(s) are Agricultural District (A-5a).

According to the Hawai'i County Code Section 25-5-72 Permitted Uses within the Agricultural District "Wind Energy Facilities" are an allowable use.

The South Kohala Community Development Plan supports the improvement of utility infrastructures within South Kohala District. The Draft EA should identify and discuss how the proposed project addresses the South Kohala Community Development Plan.

Thank you for the opportunity to comment on the proposed project. Should you have questions, please contact Deanne Bugado of our Kona office at 323-4770.

Sincerely,

DUANE KANUHA
Planning Director

DEB: deb

K:\Staff\Deanne\Letters\L-Pre-EA for Re-Powering of the Lalamilo Wind Farm.doc

xc: Planning Department, Kona

June 3, 2014

TTCES-4899-OUT-14-010

Duane Kanuha, Planning Director
Attention: Deanne Bugado
County of Hawai'i
Planning Department
West Hawai'i Office
74-5044 Ane Keohokalole Highway
Kailua-Kona, Hawai'i 96740

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai'i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Kanuha:

Thank you for your letter dated April 4, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai'i, Department of Water Supply (DWS), please see the following responses to your comments.

The following TMKs are included as part of the Project and all involved TMKs will be listed in the Draft EA.

Tax Map Key (3)	Project Component
6-6-001:002 por. (Easement J – access)	Existing access road from the interconnect site to the windfarm site
6-6-001:002 por. (Easement E – access)	Existing Lālāmilo-Parker access road
6-6-001:002 por. (Easement K – electrical)	Existing transmission line connecting Lālāmilo Wells A-D
6-6-001:071 (main windfarm site)	Wind farm site (turbines, internal access road, electrical collection system, operations building)
6-6-001:076 por. (interconnect site)	Existing Hawaii Electric Light Company transmission interconnect
6-8-001:001 por. (Easements J, K, L, and M – pipeline)	Proposed transmission line connecting Parker Wells 1-4

Thank you for the information regarding Formerly Used Defense Site (FUDS) by the U.S. Army Corps of Engineers. We are aware that the Army Corps is conducting investigation and clean-up efforts on these lands. Past assessments have been completed for the Project Area and have not found any unexploded ordnances.

Thank you for the information regarding the State Land Use District and County zoning of the parcels listed in your letter. We acknowledge that "Wind Energy Facilities" are permitted within Agricultural Zoning District (A-5a).

We acknowledge that the Project is located within the region guided by the South Kohala Community Development Plan. The Draft EA will include a discussion on compliance with this plan.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC
Lucas Mead, Planning Department

William P. Kenoi
Mayor

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

Duane Kanuha
Director

Bobby Command
Deputy Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

April 2, 2014

Ms. Leilani Pulmano
Tetra Tech Inc.
737 Bishop Street, Suite 2340
Honolulu, HI 96813

Dear Ms. Pulmano:

Subject: Pre-Consultation for Draft Environmental Assessment
Project: Re-Powering of the Lālāmilo Wind Farm
TMKs: (3) 6-8-001:001, 6-6-001:002, 071 and 076; Lālāmilo, S. Kohala, Hawai'i

Thank you for your letter dated March 17, 2014, requesting comments from this office regarding the preparation of a Draft Environmental Assessment (DEA) for the subject project.

The subject parcels are located within the State Land Use Agricultural district, zoned Agricultural (A-5a) by the County, and designated Extensive Agriculture and Urban Expansion by the Hawai'i County General Plan Land Use Pattern Allocation Guide (LUPAG) map. No portion of the project is within the Special Management Area (SMA).

We understand that the County of Hawai'i Department of Water Supply (DWS) is proposing to repower the decommissioned Lālāmilo Wind Farm with five new wind turbines to supply renewable energy to power eight water wells in the Lālāmilo-Parker well system. Also proposed is the installation of approximately 2 km of power lines and new electronic SCADA equipment. Pursuant to Chapter 25 of the Hawai'i County Code (HCC), Section 25-5-72(a)(25), wind energy facilities are a permitted use within the Agricultural district and are exempt from height limitations as long as they are set back from all property lines one foot for each foot of height per Section 25-4-22(e), HCC.

We note that the new proposed collection route is very near a historic site or trail that runs between parcels (3) 6-6-001:076 and 072 as identified by the State Historic Preservation Division (SHPD); as such, the SHPD should be consulted in planning of this project. Please also be aware that a portion or all of the subject parcels are identified as a Formerly Used Defense Site (FUDS) by the U.S. Army Corps of Engineers, who will manage the investigation, clean-up and long-term monitoring on lands formerly used as an artillery firing range. For more information, please contact Honolulu District Public Affairs, US Army Corps of Engineers 808-835-4004/4002, http://www.poh.usace.army.mil/Missions/Environmental/FUDS.aspx or www.poh.usace.army.mil.

The County of Hawai'i General Plan 2005 (amended December 2006) is the policy document for the long range comprehensive development of the island of Hawai'i and identifies the visions, values, and priorities important to the people of this County. It can be found electronically at (http://www.cohplanningdept.com/community-planning/general-plan/).

General Plan policies related to Energy, and relevant to this EA, include:

3.3(a) "Encourage the development of alternate energy resources."
3.3(k) "Strive to diversity the energy supply and minimize the environmental impacts associated with energy usage."

The South Kohala Community Development Plan (SKCDP), adopted by ordinance in 2008, is the community-specific plan that translates broad statements within the General Plan into specific actions as they apply to the community. Copies of the SKCDP can be provided upon request. SKCDP policies relevant to this EA, include:

5.11 "**Promote Alternative Energy**. South Kohala is blessed with strong wind and ample sunlight throughout the year. The County should support the development of more natural energy generating facilities."

We recommend that the DEA include a discussion of the proposed project's alignment with both the General Plan and the SKCDP.

We have no further comments to offer, at this time. However, please keep us informed and provide our department with a copy of the DEA for our review and comment. If you have any questions or if you need further assistance, please feel free to contact Lucas Mead of this office at (808) 961-8140.

Sincerely,

for DUANE KANUHA
Planning Director

LM:
P:\wpwin60\Luke\dEA, EA, & EIS Comments\preconsultdraftea Re-power_Lalamilo_wind_farm.doc

June 3, 2014

TTCES-4899-OUT-14-011

Duane Kanuha, Planning Director
Attention: Lucas Mead
County of Hawai‘i
Planning Department
West Hawai‘i Office
74-5044 Ane Keohokalole Highway
Kailua-Kona, Hawai‘i 96740

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawai‘i, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Kanuha:

Thank you for your letter dated April 2, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawai‘i, Department of Water Supply, please see the following responses to your comments.

Thank you for the information regarding the State Land Use District and County zoning of the parcels listed in your letter. We acknowledge that “Wind Energy Facilities” are permitted within Agricultural Zoning District (A-5a). We also acknowledge that the Project is not within the Special Management Area.

We will be consulting with State Historic Preservation Division (SHPD) on the Project. The Draft Environmental Assessment (EA) will include the Cultural Impact Assessment and an Archaeological Inventory Survey for the Project, which will also be submitted to SHPD.

Thank you for the information regarding Formerly Used Defense Site (FUDS) by the U.S. Army Corps of Engineers. We are aware that the Army Corps is conducting investigation and clean-up efforts on these lands. Past assessments have been completed for the Project Area and have not found any unexploded ordnances.

Thank you for the General Plan polices related to Energy. The Draft EA will include a discussion on compliance with the General Plan.

We acknowledge that the Project is located within the region guided by the South Kohala Community Development Plan. The Draft EA will include a discussion on compliance with this plan.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC
Deanne Bugado, Planning Department

William P. Kenoi
Mayor

Harry S. Kubojiri
Police Chief

Paul K. Ferreira
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

April 8, 2014

Ms. Leilani Pulmano
Senior Project Manager
Tetra Tech Inc.
737 Bishop Street
Honolulu, Hawaii 96813

Dear Ms. Pulmano:

This is in response to your correspondence of March 17, 2014 in which you requested any comments our department may have with regard to the proposed re-powering of the Lalamilo Wind Farm, located in South Kohala. Staff has reviewed the proposal and has concluded that at this time there are no concerns from a law enforcement or related public safety standpoint.

Should you require any additional information, please feel free to contact Captain Randall Medeiros, Commander of the South Kohala district at (808) 887-3080.

Sincerely,

HARRY S. KUBOJIRI
POLICE CHIEF

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June 3, 2014

TTCES-4899-OUT-14-012

Harry S. Kubojiri, Police Chief
County of Hawaiʻi
Police Department
349 Kapiʻolani Street
Hilo, Hawaiʻi 96720

Subject: Pre-consultation for the Proposed Re-Powering of Lālāmilo Wind Farm located at Lālāmilo, South Kohala, Hawaiʻi, TMK (3) 6-6-001:002 (portion), 071, and 076 (portion); (3) 6-8-001:001 (portion)

Dear Mr. Kubojiri:

Thank you for your letter dated April 8, 2014 on the proposed Re-Powering of the Lālāmilo Wind Farm (Project). On behalf of the County of Hawaiʻi, Department of Water Supply, we acknowledge your comment that you have no concerns from a law enforcement or related public safety standpoint.

Again, thank you for your letter, which will be included in the Draft EA, and we look forward to your department's involvement on the Project. If you have any questions, please contact Leilani Pulmano at 808.441.6652 or by email at leilani.pulmano@tetratech.com.

Sincerely,

TETRA TECH, INCORPORATED

LIPL

Leilani Pulmano
Senior Project Manager

cc: Department of Water Supply
Lālāmilo Wind Company, LLC

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APPENDIX B

BIOLOGICAL RECONNAISSANCE SURVEY REPORT

2013 Biological Reconnaissance Survey

Lālāmilo Wind Farm Repower Project
Hawai‘i County, Hawai‘i

Prepared for

Site Constructors, Inc.
January 2014

TETRA TECH

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Site Constructors, Inc. (Site Constructors) is proposing to repower the Lalamilo Wind Farm, located northeast of Waikoloa Village, Hawaii County, Hawaii. The proposed 3.3-megawatt Lalamilo Wind Farm Repower Project (Project) would include the construction and operation of 5 Vestas V47-660 turbines to provide power to existing wells in the Lalamilo-Parker well system, previously connected to the original Lalamilo Wind Farm. The Project is located on approximately 80 acres (32 hectares) of state land, and would operate under a lease issued by the County of Hawaii Department of Water Supply.

Tetra Tech was contracted by Site Constructors to conduct a biological reconnaissance survey to document biological resources within the lease area and along a portion of the existing access road leading into the lease area (hereafter referred to as the Survey Area) and evaluate natural resource constraints associated with the design, permitting, construction, and operation of the Project. Should these constraints identify potential occurrence of federal or state listed threatened or endangered species, Site Constructors may consider using this information in consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 10 of the federal Endangered Species Act and Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) under Section 195D of the Hawaii Revised Statutes, respectively. The objectives of this field survey and this report are to:

- Characterize vegetation within Survey Area;
- Characterize fauna observed or expected to occur within the Survey Area; and
- Identify any federal or state listed threatened or endangered species, candidates for listing, and other species of concern (e.g., species protected under the Migratory Bird Treaty Act [MBTA]), or rare/native vegetative communities within the Survey Area.

This report summarizes the methods and results of the biological reconnaissance survey conducted December 16 – 17, 2013. In addition, this report provides recommendations for next steps.

2.0 DESCRIPTION OF PROJECT SITE

2.1 LOCATION AND VICINITY

The Project is located on the northwestern portion of Hawaii Island and situated on the lower slopes of the saddle between Mauna Kea and the Kohala Mountains, approximately 3 miles (4.8 kilometers) northeast of Waikoloa Village, Hawaii (Figure 1). The Survey Area was defined by the County of Hawaii lease boundary and an approximately 98-foot (30-meter) wide corridor centered on the a portion of the existing access road, which extends from the Queen Kaahumanu Highway (Highway 11) to the lease area (Figure 1). The Survey Area included the area in which Project turbines, turbine pads, operational facilities, and electrical infrastructure are proposed. The proposed above ground transmission line segment which would be constructed adjacent to the existing transmission line and outside of the lease area was not included in the scope of this survey. The Survey Area encompasses a total of approximately 87 acres (36 hectares). The site is accessed from Queen Kaahumanu Highway north of Kailua-Kona via unpaved ranch and service roads. The Survey Area is surrounded on all sides by undeveloped lands used principally for grazing cattle (*Bos taurus*). Topography of the Survey Area consists of a relatively flat plateau falling off to the west and north of the Survey Area, respectively (Figure 2). Elevation within the Survey Area ranges from 1,401 feet (427 meters) above mean sea level (amsl) to 1,145 feet (349 meters) amsl. Several small dry gulches score the landscape around the western and northern portions of the Survey Area. These show evidence of draining surface water from the area during rare significant rainstorms (Appendix 1).

2.2 LAND USE

The Survey Area is located on state lands (TMKs 366001071, 366001002, 366001072). Lands in the Survey Area are undeveloped agricultural lands that have been used to raise livestock since the 1850s. The original Lalamilo Wind Farm began operation in 1985 using 120 17.5- to 20-kilowatt turbines and was decommissioned in 2010. The Survey Area is within the State of Hawaii’s Agricultural land use district and includes areas that are zoned Open Agricultural and Open, respectively, by Hawaii County.

3.0 METHODS

Tetra Tech conducted a review of the scientific and technical literature with respect to biological resources in and near the Survey Area. This review included available scientific journals and reports, environmental assessments, environmental impact statements, state and federal government documents, and unpublished data that were likely to contain information relevant to the natural history and ecology of the area. In addition, Tetra Tech reviewed available geospatial data, aerial photographs, and topographic maps of the area to identify any unique vegetative communities or features that could harbor federal or state listed species or other elements of interest.

The biologist covered the Survey Area on December 16 and 17, 2013, via driving and a meandering pedestrian transect. The pedestrian transect enabled the biologist to 1) characterize vegetative communities and dominant flora and fauna species within the Survey Area, 2) locate areas of native or rare vegetation, and 3) identify habitats potentially used by special status fauna species. While conducting the meandering pedestrian transect, the biologist maintained a spacing of approximately 328-feet (100-meters) between adjacent passes of the continuous transect

(Figure 2). Approximately every 656-feet (200-meters) along the transect, the biologist stopped at an observation point to characterize the vegetative community, as well as to document observations of flora and fauna species since the previous observation point. Each observation point and the transect track were recorded using a handheld GPS unit. Areas that appeared to have different topography or soil conditions than the surrounding environment, including areas away from the primary transect, were given extra scrutiny, as they were considered more likely to support native or uncommon plants. Locations of increased search effort included such places as rocky outcroppings, gulches, and shady areas. For fauna species, the biologist recorded individuals that occurred within approximately 164 feet (50 meters) of the transect to minimize double-counting individuals between adjacent transect segments, and observations were logged continuously throughout the day.

3.1 FLORA

This biological reconnaissance survey was intended to document common plant species and dominant vegetative community types. The relative abundance of plant species observed was quantified by assessing the frequency at which each species was observed along the transect segments. A comprehensive list of all plant species was not within the scope of this survey. Plants recorded during this survey are indicative of the season and environmental conditions at the time of the survey. Typically December falls within the wet season in Hawaii; however, the region has been experiencing a prolonged and on-going severe drought (National Drought Mitigation Center 2014). Therefore, some plant species were only detected as dead remnants. When identifiable dried remains of resident plants were recorded, these were included among observed species. Plant communities are dynamic and influenced by seasonal and temporal changes; therefore, there may be additional species that occur on site but which were not present during this survey. Scientific nomenclature follows Wagner et al. 1990 for flowering plants.

3.2 FAUNA

Observations of all fauna (birds, mammals, reptiles, amphibians, and invertebrate species) were recorded during the pedestrian transect survey (described above). The relative abundance of avian species observed was quantified by assessing the frequency at which each species was observed along the transect segments; presence was noted for other taxa.

To supplement this information, 20-minute fixed-radius point count surveys were also conducted for avian species. While both techniques provide information on species presence, abundance, and diversity, avian point counts are more likely to detect rare or uncommon avian species, as the observer is positioned in an area with good visibility and has sufficient time to detect rare movements or vocalizations. Field observations of birds were documented using 10 x 42-mm binoculars to facilitate identification of distant birds, and all species detected by sight and sound were recorded.

Two rounds of 20-minute avian point counts were conducted (i.e., a point count was conducted once on each of two survey days). Due to the size of the Survey Area, a single 2,625-foot (800-meter) radius point count circle covered the entire Survey Area. Therefore, a central point was selected with good visibility in all directions from which to survey. During the 20-minute point count surveys the biologist continuously logged any visual or auditory observations of birds within the 2,625-foot (800-meter) circle, recording species, number of individuals, the time the observation occurred, height above ground, and behavior for each observation.

The biological reconnaissance survey was intended to detect regularly occurring diurnal resident fauna species. Documentation of nocturnal species including the Hawaiian hoary bat and seabirds was not part of this scope of work. Scientific nomenclature follows AOU 1998 for birds, Tomich 1986 for mammals, and Liebherr 2003 for insects.

In addition to observations of fauna, habitats or plants that could support federal or stated listed threatened or endangered species were noted. Specifically, this effort included: collecting GPS locations of larval host plants or nectar plants used by the Blackburn's sphinx moth; identifying potential roost trees for the Hawaiian hoary bat; and assessing habitat suitability for Hawaiian waterbirds (e.g., wetlands or water sources that could support habitats used by these species), the Hawaiian goose, and the Hawaiian hawk.

4.0 RESULTS

The field biologist covered 4.0 miles (6.5 kilometers) of pedestrian transects and visited 21 observation points (Figure 2). No federal or state listed threatened or endangered species or candidate for listing (Mitchell et al. 2005, BPBM 2014, USFWS 2014) were found during the biological reconnaissance survey. The Survey Area does not encompass any designated or proposed critical habitat for threatened or endangered species. The flora, fauna, and single vegetative community observed within the Survey Area, are typical of disturbed areas and grazed agricultural areas found at similar elevations on the lower elevation dry slopes of western Mauna Kea and the southwestern Kohala Mountains. Representative photographs from the site visit are presented in Appendix 1.

4.1 FLORA

The Survey Area consists of a single, heavily disturbed, dry grassland vegetative community. Fountain grass (*Pennisetum setaceum*) and buffelgrass (*Cenchrus ciliaris*) were the dominant species, both of which are non-native, aggressive, introduced grasses. Isolated or small groups of introduced kiawe (*Prosopis pallida*), klu (*Acacia farnesiana*), and koa haole (*Leucaena leucocephala*) were broadly distributed along the access road and gulches, and a mixture of introduced and native herbaceous and shrub species were widely scattered among the dominant grasses.

Twenty-three plant species including four indigenous species were observed during the biological reconnaissance survey. The relative abundance of all species observed is reported in Appendix 2. The four indigenous species were: uhaloa (*Waltheria indica*), ilima (*Sida fallax*), aalii (*Dodonaea viscosa*), and koali awahia (*Ipomoea indica*). All native plants observed within the survey area are widespread in appropriate habitat on the island of Hawaii and elsewhere in the Hawaiian Islands. Uhaloa was scattered throughout the Survey Area, whereas aalii, ilima, and the single observed koali awahia plant were concentrated in the vicinity of a topographical ridgeline in the northeastern portion of the Survey Area (Figure 2). There was no intact native dryland plant community that is likely to support listed plant species.

4.2 FAUNA

Fauna within the Survey Area were scarce, widely distributed, and dominated by non-native species. Fauna observed during the biological reconnaissance survey are presented in Appendix 3. No federal or state listed species were observed.

Five bird species were detected during the survey, including 17 observations of individual birds or small groups. Two species are protected by the MBTA, including the introduced sky lark (*Alauda arvensis*) and house finch (*Carpodacus mexicanus*). There is ample suitable nesting habitat for the ground-nesting sky lark within the Survey Area, and this species was observed flying at heights that coincide with the rotor-swept area of the turbines. Unoccupied African silverbill (*Lonchura cantans*) nests were present in the rafters of the old operations building.

Domestic cattle were the only mammals observed in the Survey Area. However, it is likely that other introduced species such as feral goat (*Capra hirca*), small Indian mongoose (*Herpestes auropunctatus*), cat (*Felis catus*), house mouse (*Mus musculus*), and rats (*Rattus spp.*) also occur within the Survey Area.

No reptiles or amphibians were observed during the surveys. None of the terrestrial reptiles or amphibians that occur in Hawaii are native to the Hawaiian Islands and therefore not a species of concern.

Two insect species were recorded in the Survey Area, the globe skimmer (*Pantala flavescens*), an indigenous dragonfly, and house fly (*Musca domestica*). These are both common and widespread species in the Hawaiian Islands and across the planet.

Habitat or plants that have the potential to support federal and state listed endangered species in the Survey Area were very limited. A single Blackburn's sphinx moth adult nectar plant, koali awahia, was observed, but no larvae host plants were recorded. Adult Blackburn's sphinx moths use a variety of flowering plants for nectar, and larvae host plants include native and introduced species in the Solanaceae family (Mitchell et al. 2005). The similarity of the habitat surrounding the Survey Area, suggests plants used by this species are similarly sparse across the broader area.

The Survey Area could occasionally be used by the Hawaiian goose. The Hawaiian goose uses a broad array of open habitats ranging from golf courses to lava flows, occasionally including non-native grassland communities such as those found in the Survey Area (Mitchell et al. 2005, Pyle and Pyle 2009). However, due to lack of food availability this would not be considered high quality habitat. A review of aerial imagery in the vicinity of the Survey Area indicates that there is an abundance of similar habitat in the surrounding area.

No trees observed within or adjacent to the Survey Area are suitable roost trees for the endangered Hawaiian hoary bat. Hawaiian hoary bats roost among dense foliage at the outer ends of branches of a wide variety of native and introduced trees, including kiawe, which was present in the survey area (Mitchell et al, 2005). However, all trees observed in the Survey Area had sparse leaves that were insufficient to provide cover for roosting habitat.

The dry grassland vegetative community is not suitable for Hawaiian hawk foraging or nesting. The Hawaiian hawk uses forest and savanna habitats with a preference for these habitats on the windward side of the island (Pyle and Pyle 2009, NatureServe 2014).

No evidence of permanent or temporary bodies of surface water was observed that could attract listed waterbirds. Listed Hawaiian waterbirds require permanent or temporary wetlands or other waterbodies for all life history functions. A review of aerial imagery in the area further indicated a paucity of wetland habitat in the larger area, as well. The Survey Area showed evidence of rare surface water runoff (Appendix 1: Photo 2). However, due to the topography and porous soils in the Survey Area, such events would not create even temporary habitat suitable for use by listed waterbird species.

5.0 DISCUSSION

5.1 FLORA

No federal or state listed threatened or endangered plant species were identified during the reconnaissance survey. Although this reconnaissance survey was conducted during a significant and prolonged drought, no additional survey is needed due to the disturbed nature of the site and its past land use, including a long history of cattle grazing and the former use of the Survey Area as a wind farm development.

The lack of intact native habitats, highly disturbed nature of the Survey Area, and lack of endangered plant species observed during this reconnaissance survey support the conclusion that there is a very low likelihood of the presence of any listed plants. This assessment is further supported by the absence of threatened or endangered plant species during a botanical survey at the proposed Waikoloa Highlands subdivision 3 miles away in 2006 (David and Guinther 2006). Topographic features in the northeastern portion of the Survey Area may have reduced grazing pressure from cattle in the vicinity allowing for a greater concentration of native plants (Figure 2). Although more native plants were observed here, the habitat was still dominated by aggressive non-native grasses, and the area has a very low likelihood of harboring threatened or endangered plant species.

5.2 FAUNA

The Survey Area does not contain any designated or proposed critical habitat for threatened or endangered animal species. No federal or state listed species were observed during the survey. Of species detected during the surveys, sky lark and house finch are protected under the MBTA. These are both common in appropriate habitat on the island of Hawaii and elsewhere in the Hawaiian Islands.

Hawaiian hawk and Hawaiian waterbirds have the potential to pass through the Survey Area while in transit between areas of off-site suitable habitat. The Hawaiian hawk range includes all habitats below tree line on the island of Hawaii (NatureServe 2014). Suitable nesting and foraging habitat for this species occurs in the Kohala Mountains to the north and on the forested slopes of Hualalai to the south, and they may move between such areas of suitable habitat and transit the Survey Area. Similarly, the absence of streams or waterbodies in the Survey Area means there is no suitable habitat for listed waterbirds. Furthermore, the paucity of wetlands in this region of the island makes the occurrence of waterbirds in the Survey Area highly improbable.

The Hawaiian goose uses a wide variety of habitats including introduced grasslands such as those found in the Survey Area. However, the abundance of similar habitat throughout the region suggests that there is a low probability of the species using the specific Survey Area. The species is rare in this area of the island but has been documented approximately 10 miles from the Survey Area at Puuanahulu (Pyle and Pyle 2009), and therefore the species has the potential to occur in transit of the Survey Area.

No Hawaiian hoary bat roosting habitat was observed in the Survey Area. However, it is likely that bats may use the area for foraging, and this was supported by detections during a 1-year acoustic study done for this Project (Insight Environmental 2013). Recent research on the species has found that they forage in all habitats from sea level to above 13,000 feet amsl (Gorressen et al. 2013). Therefore, although Project development is unlikely to affect bat roosting habitat, the potential for impacts to the species as a result of collision with Project wind turbines exists.

A single nectar plant for the Blackburn's sphinx moth was observed during the survey which does not alone indicated suitable Blackburn's sphinx moth habitat. The apparent absence of larvae host plants and rarity of nectar plants suggests a low likelihood of occurrence for this species. This further suggests that Project development has a very low likelihood of potential impact to this species.

While not within the scope of this survey, listed Hawaiian seabirds may fly over the Survey Area in transit from the ocean to potential nesting colonies in the mountains to the north, south, or southeast of the Project. These species typically arrive on their breeding colonies in April and depart in November. Nocturnal radar surveys for these species are necessary to evaluate the potential for the Project to impact these species, and USFWS and DOFAW have recommended radar surveys be conducted during three periods of the breeding season, pre-breeding (~April), peak breeding (~June), and fledging (~October), for 1 – 2 years. Hawaiian petrel (*Pterodroma sandwichensis*)/Newell's shearwater (*Puffinus newelli*)-like targets were documented during the one season of radar survey work conducted for the Project (ABR 2013).

5.3 RECOMMENDATIONS AND NEXT STEPS

Based on the results of this survey, no additional surveys are warranted at this time within the Survey Area. However, a general survey along the proposed transmission line corridor is recommended to provide complete coverage of the Project area. Tetra Tech anticipates that the findings along the transmission line will be similar to the results of the Survey Area covered in this report.

In siting and operating the proposed Project, Tetra Tech recommends developing avoidance and minimization measures focused on avian species and bats. General measures to consider are provided below but more detailed, Project-specific measures should be developed as the Project moves forward.

- For erosion control, replanting disturbed areas after construction, or landscaping, consider the use of native or naturalized Hawaiian plants compatible with Project operations.
- As recommended by USFWS and DOFAW, to minimize potential impacts to the Hawaiian hoary bat, woody plants greater than 15 feet (4.5 meters) tall with a canopy closure greater than 50 percent should not be removed or trimmed between June 1 and September 15 during the installation and ongoing maintenance of the Project structures.
- If any fences are installed as part of the Project, barbless top-strand wire fence should be used to prevent entanglement of the Hawaiian hoary bat. If existing fences contain barbed wire, the top strand of barbed wire should be removed.

- To minimize potential impacts to wildlife, on-site lighting at the O&M building should consist only of fixtures that will be shielded and/or directed downward and triggered by a motion detector.
- Development of a post-construction monitoring protocol that would be implemented during Project operations.

6.0 REFERENCES

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FIGURES

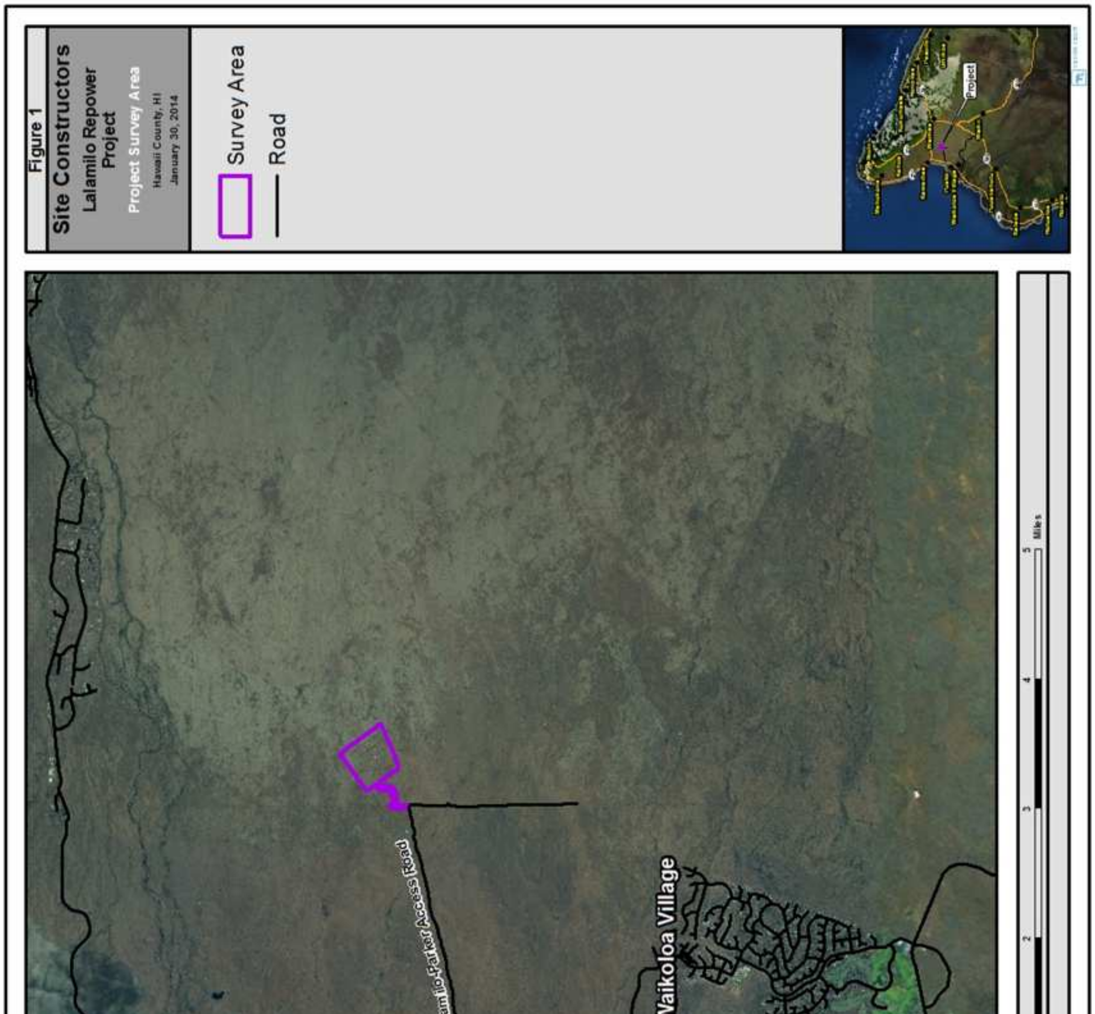
Figure 1
Site Constructors
Lalamilo Repower Project
Project Survey Area
Hawaii County, HI
January 30, 2014
Survey Area
Road
Waikoloa Village
Lalamilo-Parker Access Road
Queen Kaahumanu Hwy
1:50,000 WGS84 UTM 5
Miles
Data Sources Site Constructors: project survey area / Hawaii Statewide GIS Program: roads / ESRI: background imagery

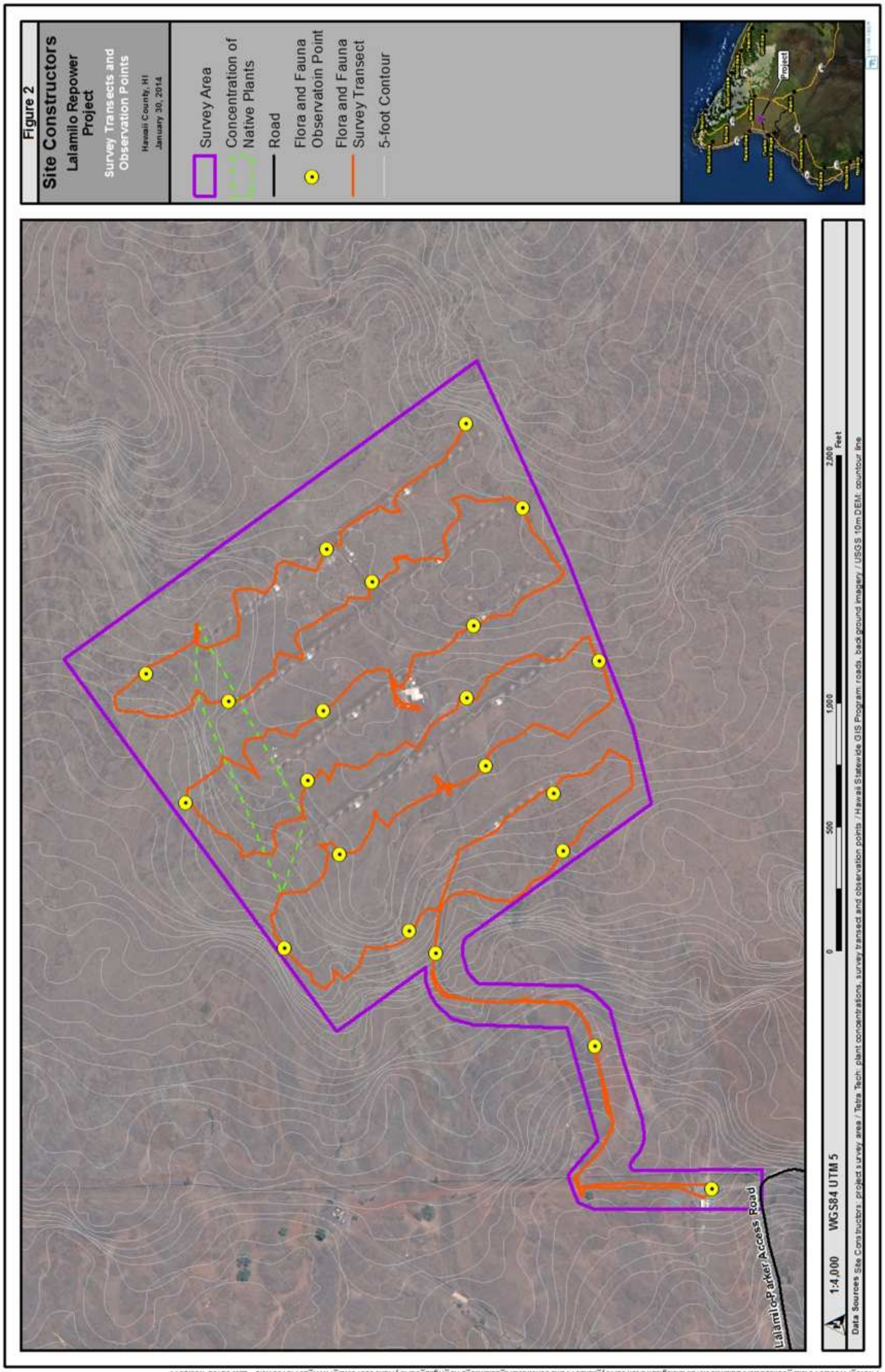
Figure 2
Site Constructors
Lalamilo Repower Project
Survey Transects and Observation Points
Hawaii County, HI
January 30, 2014
Survey Area
Concentration of Native Plants
Road
Flora and Fauna Observatoin Point
Flora and Fauna Survey Transect
5-foot Contour
Project
1:4,000
WGS84 UTM 5
0
500
1,000
2,000
Feet
Lalamilo-Parker Access Road
Data Sources Site Constructors: project survey area / Tetra Tech: plant concentrations, survey transect and observation points / Hawaii Statewide GIS Program: roads, background imagery / USGS 10m DEM: countour line

APPENDICES

Appendix 1

Representative Site Photographs at the Lalamilo Repower Project

Photo 1: Typical vegetation and topography within Survey Area

Photo 2: Eroded runoff channel below within Survey Area

Photo 3: Looking east from western edge of Survey Area

Photo 4: Aalii (*Dodonaea viscosa*)

Photo 5: Operations building for decommissioned Lalamilo Wind Farm

Photo 6: Kohala Mountains looking north from Survey Area

Photo 7: Looking west from avian point count survey location

Photo 8: Looking south from avian point count location, showing typical kiawe (*Prosopis pallida*) along Survey Area access road

Appendix 2

Flora Observed During Reconnaissance Surveys at the Lalamilo Repower Project.

Scientific Name	Common Name	Status and Blackburn's Sphinx Moth Suitability[1]	Abundance[2]
MONOCOTS			
Poaceae			
Cenchrus ciliaris	buffelgrass	NN	A
Rhynchelytrum repens	natal red top	NN	R
Pennisetum clandestinum	Kikuyu grass	NN	R
Pennisetum setaceum	fountain grass	NN	A
Xanthorrhoeaceae			
Aloe sp.	aloe	NN	R
DICOTS			
Asteraceae			
Ageratum conyzoides	maile hohono	NN	U
Conyza bonariensis	hairy horseweed	NN	U
Galinsoga parviflora		NN	R
Emilia fosbergii	pualele	NN	U
Senecio madagascariensis	Madagascar ragwort	NN	O
Sonchus oleraceus	sow thistle	NN	R
Cactaceae			
Opuntia ficus-indica	panini	NN	R
Casuarinaceae			
Casuarina equisetifolia	ironwood	NN	R
Chenopodiaceae			
Chenopodium oahuense	aheahea	NN	U
Convolvulaceae			
Ipomoea indica	koali awahia	IN-CON	R
Fabaceae			
Acacia farnesiana	klu	NN	C
Chamaecrista nictitans	partridge pea	NN	U
Indigofera suffruticosa	indigo	NN	R
Leucaena leucocephala	koa haole	NN	U
Prosopis pallida	kiawe	NN	U
Malvaceae			
Sida fallax	ilima	IN	C
Sapindaceae			
Dodonaea viscosa	aalii	IN	O
Sterculiaceae			
Waltheria indica	uhaloa	IN	A

[1] NN=Non-native, IN=Indigenous, CON=Confirmed nectar plant for Blackburn's sphinx moth
[2] Relative abundance was quantified by assessing the frequency at which species were observed along transect segments.
A=Abundant (at least 2 plants detected in each of >50% of survey segments)
C=Common (at least 2 plants detected in >25 – 50% of survey segments or 1 detected in >50% of survey segments)
O=Occasional (at least 2 plants detected in >10 – 25% of survey segments or 1 detected in >25 – 50% of survey segments)
U=Uncommon (detected in >5 – 10% of survey segments or 1 detected in 10 – 25% of survey segments)
R=Rare (detected >0 – 5% of survey segments)

Appendix 3

Fauna Observed During Reconnaissance Surveys at the Lalamilo Repower Project.

Scientific Name	Common Name	Status[1]	Federal Protection[2]	Abundance[3]
Birds				
Pterocles exustus	chestnut-bellied sandgrouse	NN	None	U
Geopelia striata	zebra dove	NN	None	I
Alauda arvensis	sky lark	NN	MBTA	O
Carpodacus mexicanus	house finch	NN	MBTA	I
Lonchura cantans	African silverbill	NN	None	O
Mammals				
Bos taurus	domestic cow	DO	None	X
Insects				
Pantala flavescens	globe skimmer	IN	None	X
Musca domestica	house fly	NN	None	X

[1] NN=Non-native, IN=Indigenous, DO=Domesticated

[2] MBTA=Protected under the Migratory Bird Treaty Act

[3] Measures of abundance for avian species was limited to those individuals that occurred within approximately 164 feet (50 meters) distance of the transects to minimize double-counting of individual birds between transects. The relative abundance of avian species was quantified by assessing the frequency at which each species was observed along the transect segments; presence is noted for other taxa.

A=Abundant (at least 2 individuals detected in each of >50% of survey segments)

C=Common (at least 2 individuals detected in >25 – 50% of survey segments or 1 detected in >50% of survey segments)

O=Occasional (at least 2 individuals detected in >10 – 25% of survey segments or 1 detected in >25 – 50% of survey segments)

U=Uncommon (detected in >5 – 10% of survey segments or 1 individual detected in 10 – 25% of survey segments)

I=Incidental detection (no detections within 164 feet [50 meters] of a transect and no detections within Survey Area)—avian point count surveys included habitat outside of the Survey Area

X=Species detected within survey area, but abundance not determined

APPENDIX C

ARCHAEOLOGICAL INVENTORY SURVEY

An Archaeological Inventory Survey of the Lālāmilo Wind Farm Repowering Project

TMKs: (3) 6-6-01:002 (por.), 071, and (3) 6-8-01:001 (por.)

Lālāmilo and Waikōloa *ahupua'a*
South Kohala District
Island of Hawai'i

DRAFT VERSION

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April 2014

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ASM Project Number 21850

An Archaeological Inventory Survey of the Lālāmilo Wind Farm Repowering Project

TMKs: (3) 6-6-01:002 (por.), 071, and (3) 6-8-01:001 (por.)

Lālāmilo and Waikōloa *ahupua‘a*
South Kohala District
Island of Hawai‘i

ASM affiliates

EXECUTIVE SUMMARY

At the request of Lālāmilo Wind Company, LLC, ASM Affiliates, Inc. conducted an archaeological inventory survey of approximately 87.5 acres for the Lālāmilo Wind Farm Repowering Project in the *ahupuaʻa* of Lālāmilo and Waikōloa, South Kohala District, Island of Hawaiʻi. The proposed development of the Lālāmilo Wind Farm will occur on parcels and easements in Lālāmilo Ahupuaʻa (TMKs: (3) 6-6-01:002 (por.) and 071; Figure 2) that are owned by the State of Hawaiʻi and were originally created for an earlier wind farm which operated on the premises between 1985 and 2010, but has since been removed. Construction of the new wind energy generation system will supply electricity to four existing County of Hawaiʻi, Department of Water Supply (DWS) wells in Lālāmilo Ahupuaʻa (Lālāmilo wells A, B, C, and D) that were formerly connected to the Lālāmilo Wind Farm (between 1985 and 2010), and four existing Parker Ranch wells (Parker wells No. 1, 2, 3, and 4) in Waikōloa Ahupuaʻa. Connecting the existing Parker wells to the new wind farm equipment will require the installation of new power lines within an access easement across TMK: (3) 6-8-01:001 (por.), owned by the Richard P. Smart Trust. Two previous archaeological studies, one for the earlier wind farm in Lālāmilo Ahupuaʻa (Soehren 1984) and one for the Parker wells in Waikōloa Ahupuaʻa (Rosendahl 1992a, 1992b), have included portions of the current project area.

Archaeological fieldwork for the current project was conducted on March 19 and 20, 2014, and as a result three archaeological sites, a rock wall (SIHP Site 9012), a World War II military encampment (SIHP Site 30109), and a complex of cairns marking the boundary between Lālāmilo and Waikōloa *ahupuaʻa* (SIHP Site 30110), were recorded within the project area. Site 9012 is an early nineteenth century dry-stacked rock wall that was purportedly built during the reign of Kamehameha I (at his direction) to keep the growing population of "*kapu*" cattle out of the fertile agricultural areas of Lālāmilo. As such this site is associated with both significant events and persons important in Hawaiian history, and is evaluated as significant under Criterion A and B. This site is also considered significant under Criterion D for its research value. The current proposed project will have no effect on this site as the wall has an existing gated breach at the current access easement, and the continued preservation of this site is the recommended treatment. Site 30109 is a WWII-era military encampment associated with training activities conducted within the greater Camp Tarawa Waikoloa Maneuver Area. This site reflects activities that when considered in their totality were important locally, nationally, and ultimately globally; and as such this site is considered significant under Criterion A. It is also considered significant under Criterion D for its historical research value. Although this site will not likely be directly impacted by the proposed wind farm construction activities, it may be indirectly impacted by increased use of the area; however, the thorough documentation of this site during the current study has mitigated such potential impacts and no further work is the recommended treatment. Site 30110 is a series of Historic/Modern boundary markers that are considered significant under Criterion D. This site has been fully and comprehensively documented as a result of the current study and no further work is the recommended treatment.

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1. INTRODUCTION

At the request of Lālāmilo Wind Company, LLC, ASM Affiliates, Inc. conducted an archaeological inventory survey of approximately 87.5 acres for the Lālāmilo Wind Farm Repowering Project in the *ahupua‘a* of Lālāmilo and Waikōloa, South Kohala District, Island of Hawai‘i (Figure 1). The proposed development of the Lālāmilo Wind Farm will occur on parcels and easements in Lālāmilo Ahupua‘a (TMKs: (3) 6-6-01:002 por. and 071; Figure 2) that are owned by the State of Hawai‘i and were originally created for an earlier wind farm which operated on the premises between 1985 and 2010, but has since been removed. Construction of the new wind energy generation system will supply electricity to four existing County of Hawai‘i, Department of Water Supply (DWS) wells in Lālāmilo Ahupua‘a (Lālāmilo wells A, B, C, and D) that were formerly connected to the Lālāmilo Wind Farm (between 1985 and 2010), and four existing Parker Ranch wells (Parker wells No. 1, 2, 3, and 4) in Waikōloa Ahupua‘a (Figure 3). Connecting the existing Parker wells to the new wind farm equipment will require the installation of new power lines within an access easement across TMK: (3) 6-8-01:001 (por.), owned by the Richard P. Smart Trust. The proposed Lālāmilo Wind Farm Repowering Project will also utilize an existing facility that is located on TMK: (3) 6-6-01:076 (see Figure 2), but the use of this facility will only involve the pulling of cable through existing underground conduits and the overhead connecting of power lines on existing infrastructure. No new ground disturbance will occur within Parcel 076, thus this parcel was not included in the current archaeological study. Two previous archaeological studies, one for the earlier wind farm in Lālāmilo Ahupua‘a (Soehren 1984) and one for the Parker wells in Waikōloa Ahupua‘a (Rosendahl 1992a, 1992b), have included portions of the current project area. As a result of the current study three archaeological sites, a rock wall (SIHP Site 9012), a World War II military encampment (SIHP Site 30109), and a complex of cairns marking the boundary between Lālāmilo and Waikōloa *ahupua‘a* (SIHP Site 30110), were recorded within the project area.

This study was undertaken in accordance with Hawai‘i Administrative Rules, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawai‘i Administrative Rules 13§13–284. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawai‘i Planning Department. This report contains background information outlining the project area’s physical and cultural contexts, a presentation of previous archaeological work in the vicinity of the project area, and current survey expectations based on that previous work. Also presented is an explanation of the project’s methods, detailed descriptions of the archaeological features encountered, interpretation and evaluation of those resources, and treatment recommendations for the documented sites.

PROJECT AREA DESCRIPTION

The current project area consists of approximately 87.5 acres located at elevations ranging from roughly 354 to 427 meters (1,160 to 1,400 feet) above sea level in the *ahupua‘a* of Lālāmilo and Waikōloa, South Kohala District, Island of Hawai‘i (see Figure 1). The project area is situated on Mauna Kea (hm) lava flows that are 250 to 65 thousand years old (Wolfe and Morris 1996). Soils that have developed on these lava flows are classified as belonging to the Hapuna-Waikui-Lalamilo complex, which is typically comprised of 35 percent Hapuna and similar soils, 35 percent Waikui and similar soils, 20 percent Lalamilo and similar soils, and 10 percent minor components (USDA 2013). Mean annual rainfall within the project area ranges from 250 to 280 millimeters, with most of the rain falling during the wettest winter months of December and January, and very little rainfall occurring during the driest summer months of June, July, and August (Giambelluca et al. 2013). This area often experiences strong easterly/northeasterly trade winds that blow down the mountains at speeds of 20-30 miles per hour during the nighttime. Daytime sea breezes, which blow on-shore, are often of similar strength (Jurvik and Jurvik 1998). As a result of the arid conditions, strong winds, periodic wildfires, and nearly two centuries of use as cattle pasture, vegetation within the project area is relatively sparse. Introduced grasses, including buffelgrass (*Pennisetum ciliare*) and fountain grass (*Pennisetum setaceum*), along with various other introduced weeds, blanket most of the project area, but a few native species, including *‘Uhaloa* (*Waltheria indica*), *‘Akia* (*Wikstroemia pulcherrima*), and *Pā‘ū o Hi‘iaka* (*Jacquemontia ovalifolia*), were also observed. Trees are relatively scarce within the project area, but a few scattered *kiawe* (*Prosopis pallida*) are present, along with a single pine tree planted next to the former Lālāmilo Wind Farm parking lot.

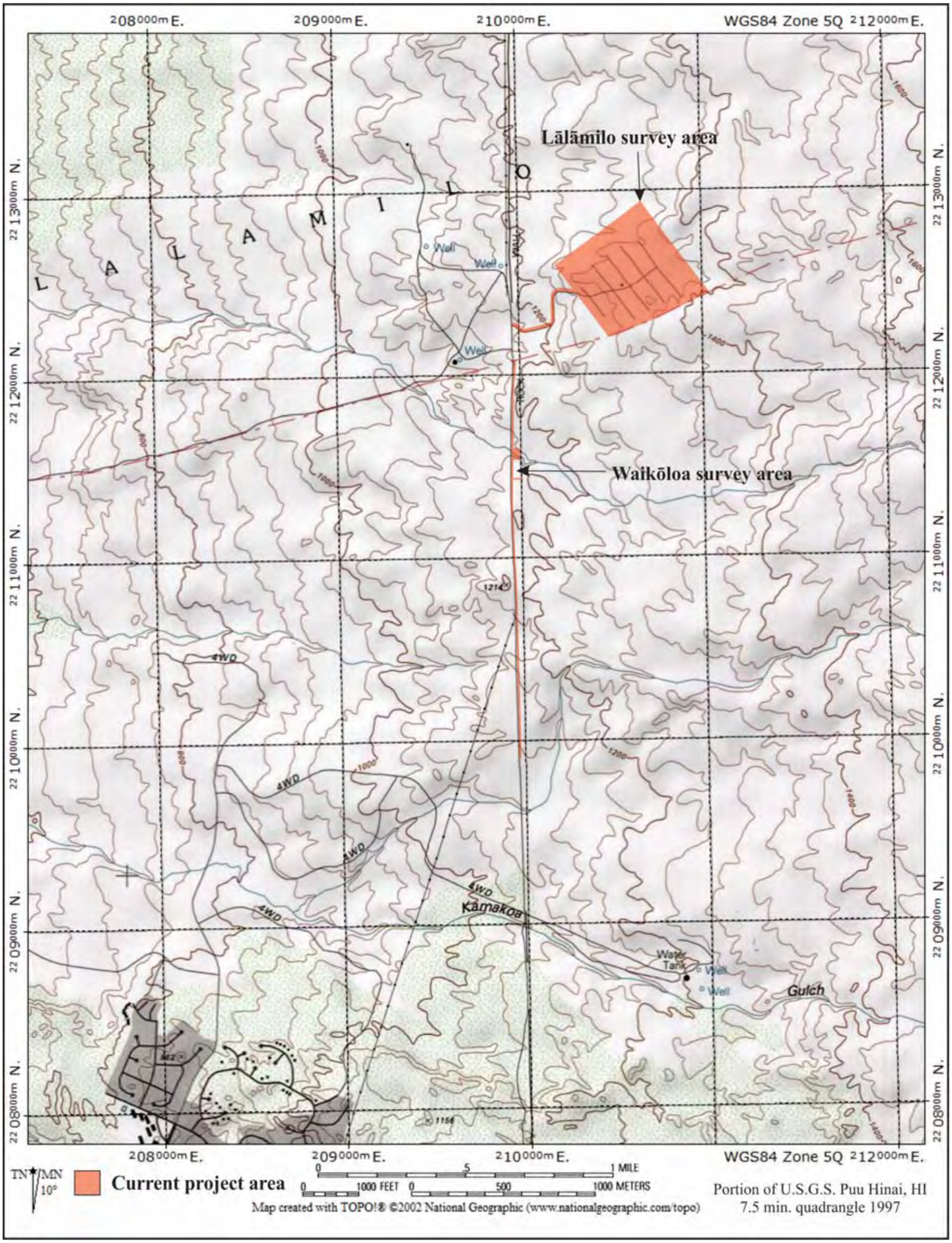

Figure 1. Project area location.

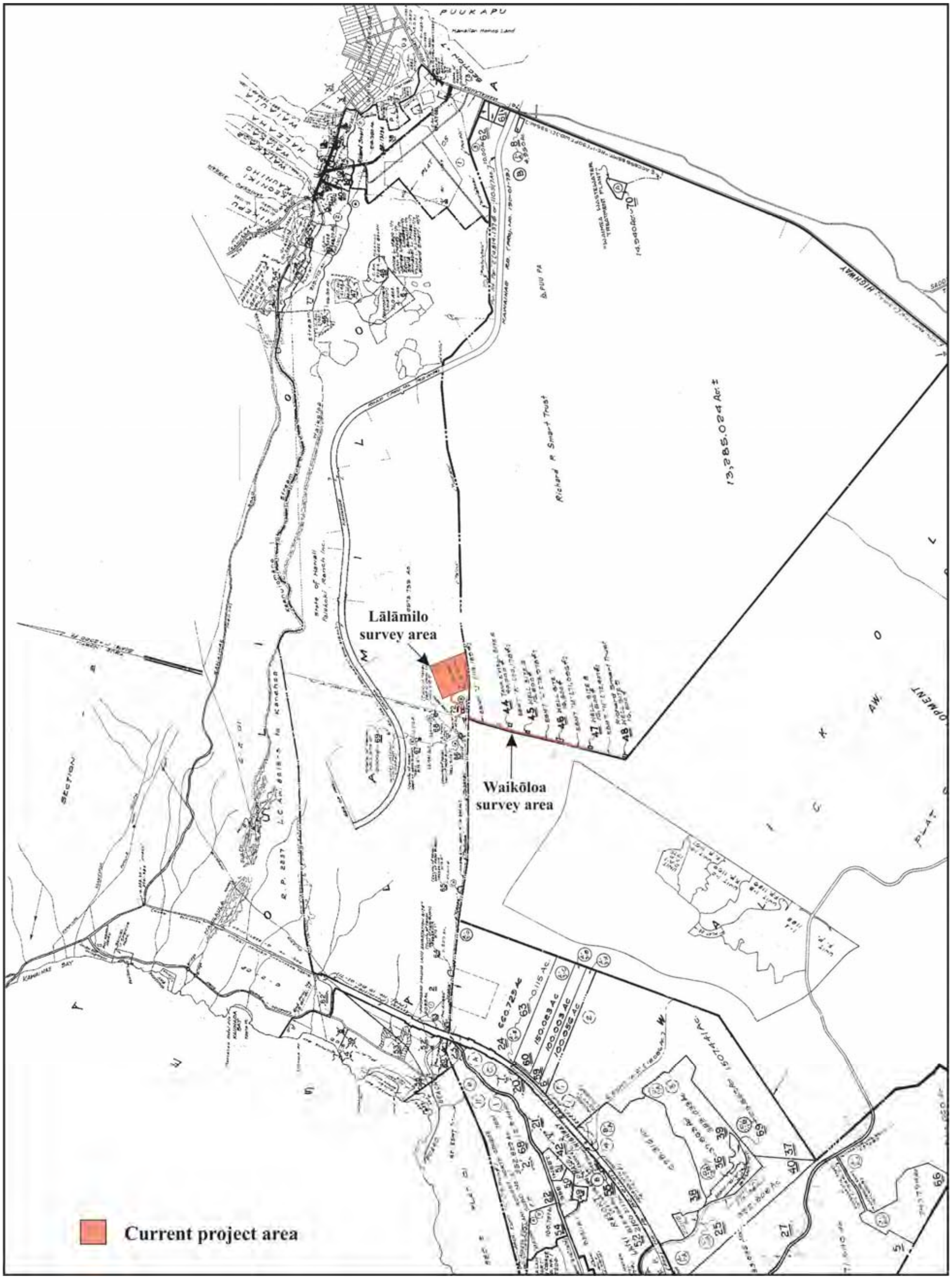

Figure 2. Portions of Tax Map Keys (TMKs): (3) 6-6-01 and 6-8-01 showing the location of the current project area.

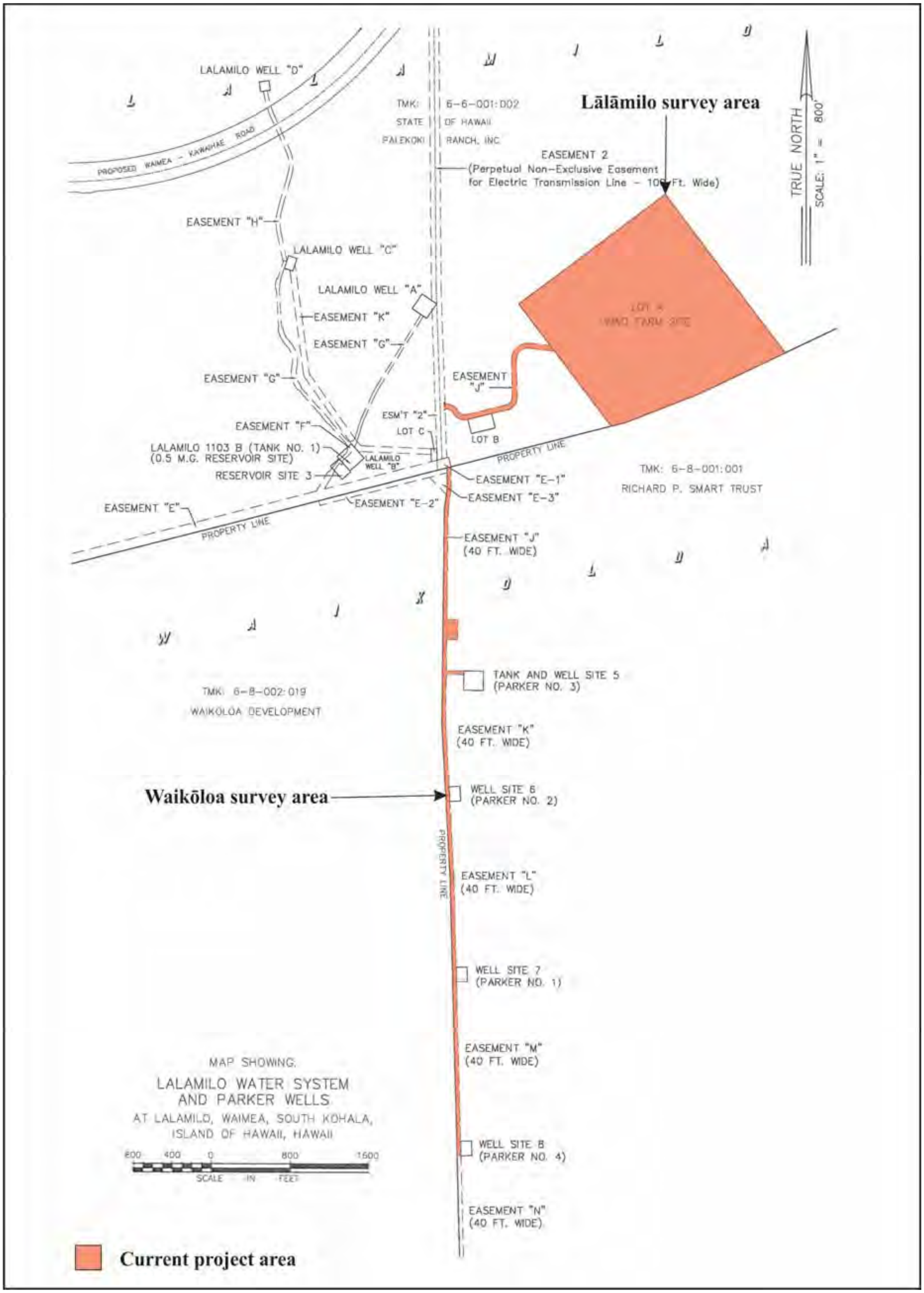

Figure 3. Map of the Lālāmilo Water System and Parker Wells (revised April 30, 2012) showing the current project area.

The project area includes two distinct archaeological survey areas; one within Lālāmilo Ahupuaʻa (80 acres) for the construction of the wind farm and another within Waikōloa Ahupuaʻa (7.5 acres) for the installation of new power lines to the existing Parker wells (see Figures 2 and 3). Development of the wind farm will occur on one parcel within the Lālamilo survey area, the 78.081-acre Lot A (TMK: (3) 6-6-01:071) and on a 1.947-acre easement (Easement J) across TMK: (3) 6-6-01:002 (por.). The installation of the power lines to Parker wells No. 1, 2, 3 and 4 will occur on four continuous, 40-foot wide easements (Easements J, K, L, and M) across TMK: (3) 6-8-01:001 (por.) within the Waikōloa survey area. Large portions of both the Lālāmilo and Waikōloa survey areas have been previously developed (Figure 4).

The Lālāmilo survey area, previously the location of the Lālāmilo Wind Farm and its associated infrastructure (from ca. 1985 to 2010), includes Lot A that is both accessed by a 20-foot wide roadway within the 1.947-acre Easement J (see Figure 3). This existing gravel/paved road extends (within the easement) for a total distance of roughly 495 meters. It follows a meandering course up a hill from a gate in a rock wall (SIHP Site 9012) at the western end of Easement J to the western boundary of Lot A (Figures 5 and 6). Along its route to Lot A the road crosses over a culvert within a small drainage (Figure 7), and passes above-ground electrical boxes (Figure 8) for an existing buried conduit within which the proposed collected line will be pulled. At the western boundary of Lot A the access road continues north for roughly 250 meters to the old wind farm’s office and maintenance (O & M) building, which has two adjacent towers, a parking area, a water catchment tank, and a more recently erected meteorological tower nearby (an older meteorological tower is located in the northern portion of Lot A).

In addition to the O & M building (Figure 9), the 78.081-acre Lot A formerly housed 120 Jacobs wind generators, aligned in five arrays. The wind turbines and towers (with the exception of two) have been removed from the property, but the locations of the five arrays are marked by five parallel swaths of bulldozed land (four of equal length, and one of shorter length; see Figure 4) that extend northwest/southeast across the lot (Figure 10). The four corners of the Lot A are each marked by a metal pipe stuck in concrete. A fence line, with old bulldozed roads along either side of it, that marks the boundary between Lālāmilo and Waikōloa *ahupuaʻa*, extends along the roughly 587 meter long southern boundary of Lot A (Figure 11). The remaining boundaries, are not visually marked, but are straight lines projected between the corner pins. The five former wind turbine arrays occupied the southwestern portion of Lot A where the flattest terrain occurs (Figure 12). At the northwestern end of the four, equal length, bulldozed swaths a short northwest facing slope is present, and to the northeast of *mauka* most swath the land gradually becomes steeper and hillier. A prominent double ridge formation, with a natural drainage channel between, occurs in the western corner of Lot A at the northwestern end of the *makai* most bulldozed swath. This ridge is likely why that array was the shortest at the former Lālāmilo Wind Farm.

The Waikōloa survey area, where power lines will be installed to four existing wells (Parker wells No. 1, 2, 3, and 4), includes four contiguous, 40-foot wide, access easements (Easements J, K, L, and M) across TMK: (3) 6-8-01:001 that total 7.5 acres (see Figure 2). This survey area contains an existing 20-foot wide paved roadway that extends for 2.1 kilometers along the *mauka* (eastern) edge of a rock wall (SIHP Site 9012) from a gate at the northern end of Easement J (Figure 13) to the termination of the pavement at the southern end of Easement M (Figure 14). Easement J also includes a 55-meter long stub road at its southern end that access Parker well No. 3 (see Figure 3). Nearly the entire length of the Waikōloa survey area has been disturbed by bulldozing, including the space between the existing road and the wall, and the area along the eastern edge of the road to a distance of at least six meters (20 feet). At one location within Easement J, between the northern gate and Parker well No. 3, the road crosses a small drainage and skirts a small hill, veering away from the rock wall (Figure 16); the area between the wall and the road at this location is the only portion of the Waikōloa survey area that has not been disturbed by bulldozing.

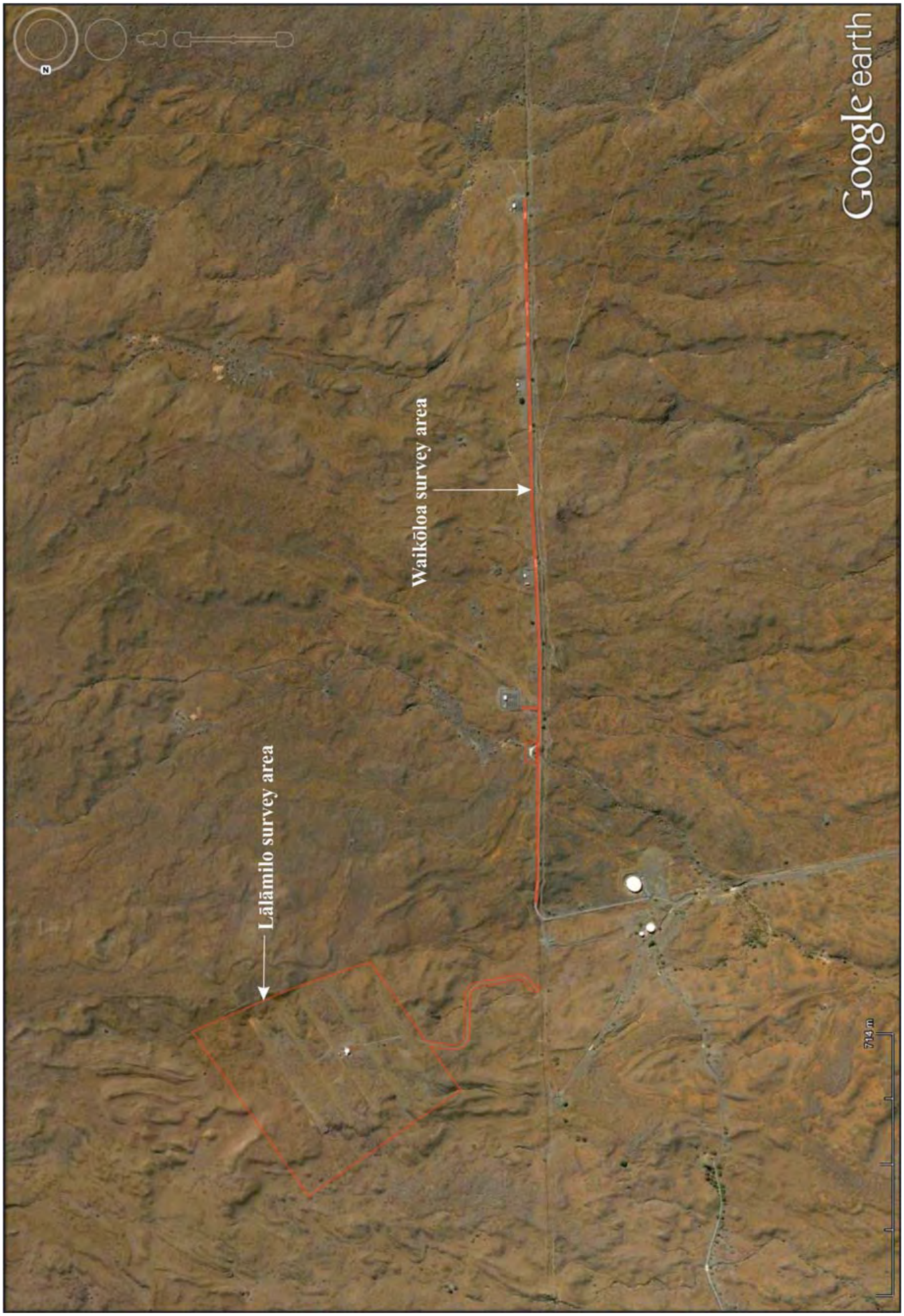

Figure 4. Current Google Satellite™ image showing the current project area outlined in red.

Figure 5. Lālāmilo survey area, gravel road and gate at the western end of Easement J, view to the northwest.

Figure 6. Lālāmilo survey area, paved road near the western boundary of Lot A, view to the southwest.

Figure 7. Lālāmilo survey area, culvert beneath the existing access road, view to the west.

Figure 8. Lālāmilo survey area, electrical along the southern edge of the existing road, view to the southwest.

Figure 9. Lālāmilo survey area, the old wind farm's office and maintenance building on Lot A, view to the northeast.

Figure 10. Lālāmilo survey area, bulldozed swath of land within Lot A that formerly housed an array of wind towers, view to the northwest.

Figure 11. Lālāmilo survey area, fence line along the southern boundary of Lot A, view to the southwest.

Figure 12. Lālāmilo survey area, southwestern portion of Lot A where the five arrays of wind turbines were formerly located, view to the northwest.

Figure 13. Waikōloa survey area, existing road at the western end of Easement J, view to the north.

Figure 14. Waikōloa survey area, termination of the paved road at the southern end of Easement M, view to the north.

Figure 15. Waikōloa survey area, existing paved road within Easement L, view to the north.

Figure 16. Waikōloa survey area, undisturbed portion of Easement J between the rock wall and the road, view to the south.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the project area, and to establish an environment within which to access the significance of any such resources, a general cultural-historical background for the region and previous archaeological studies relative to the project area are presented.

CULTURE-HISTORICAL CONTEXT

The current project area is situated on the Island of Hawai‘i within the District of South Kohala in the *ahupua‘a* of Lālāmilo and Waikōloa (Figure 17). As described by Handy and Handy:

> The district of Kohala is the northernmost land area of the island of Hawaii. ‘Upolu 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. (1991:528)

Comprehensive and detailed culture-historical (both archival and oral) background information relative to the general project area can be found in Barrera and Kelly (1974), Clark (1987), Clark and Kirch (1983), Jensen (1994), and Maly (1999). The prehistory of South Kohala is understood only in broad terms (Kirch 1985; Rosendahl and Carter 1988). In a general, Precontact population was centered both in the uplands and along the coast. Initial occupation of the area probably began at small coastal settlements at selected areas, where early inhabitants exploited the diverse marine resources (Jensen 1994). The upland habitation that followed focused on agricultural field systems, which undoubtedly provided much of the produce for the coastal inhabitants (Carlson and Rosendahl 1990). The earliest inhabitants emphasized the use of natural caves and overhangs, along with the construction of small, simple surface features for habitation purposes, but as populations increased and expanded, so did the occurrence of more permanent habitation structures in both the coastal and upland areas (Jensen 1994). A network of coastal and inland trails, over which the exchange of goods occurred, connected the coastal and upland population centers and resource areas (Hommon 1976). The current study area occupies a dry environmental zone intermediate between the coastal *kula* and the fertile agricultural uplands.

It is within this context that the following discussion of the history and culture of the study area is framed. The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes the presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to the study *ahupua‘a* and a discussion of the general settlement patterns for South Kohala. The discussion of Prehistory is followed by a summary of Historic 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 life ways and population decline of the early Historic Period, a review of land tenure in the study *ahupua‘a* during the *Māhele ‘Āina* of 1848, and documentation of the transition to the sugar and ranching industries during the last quarter of the nineteenth century and the first three-quarters of the twentieth century. A synthesis of the Precontact settlement patterns and the Historically documented land use, combined with a review of the findings of previously conducted archeological studies, provides a means for predicting the types of archaeological features that may be encountered within the project area, and a basis for assessing the function, age, and significance of any encountered archaeological sites.

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). The conventional wisdom has been that first inhabitants of Hawai‘i Island probably arrived by at least A.D. 300, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). However, there is no archaeological evidence for occupation of Hawai‘i Island (or perhaps anywhere in Hawai‘i) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) has convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter 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, and the Expansion Period to A.D. 1350 to 1650.

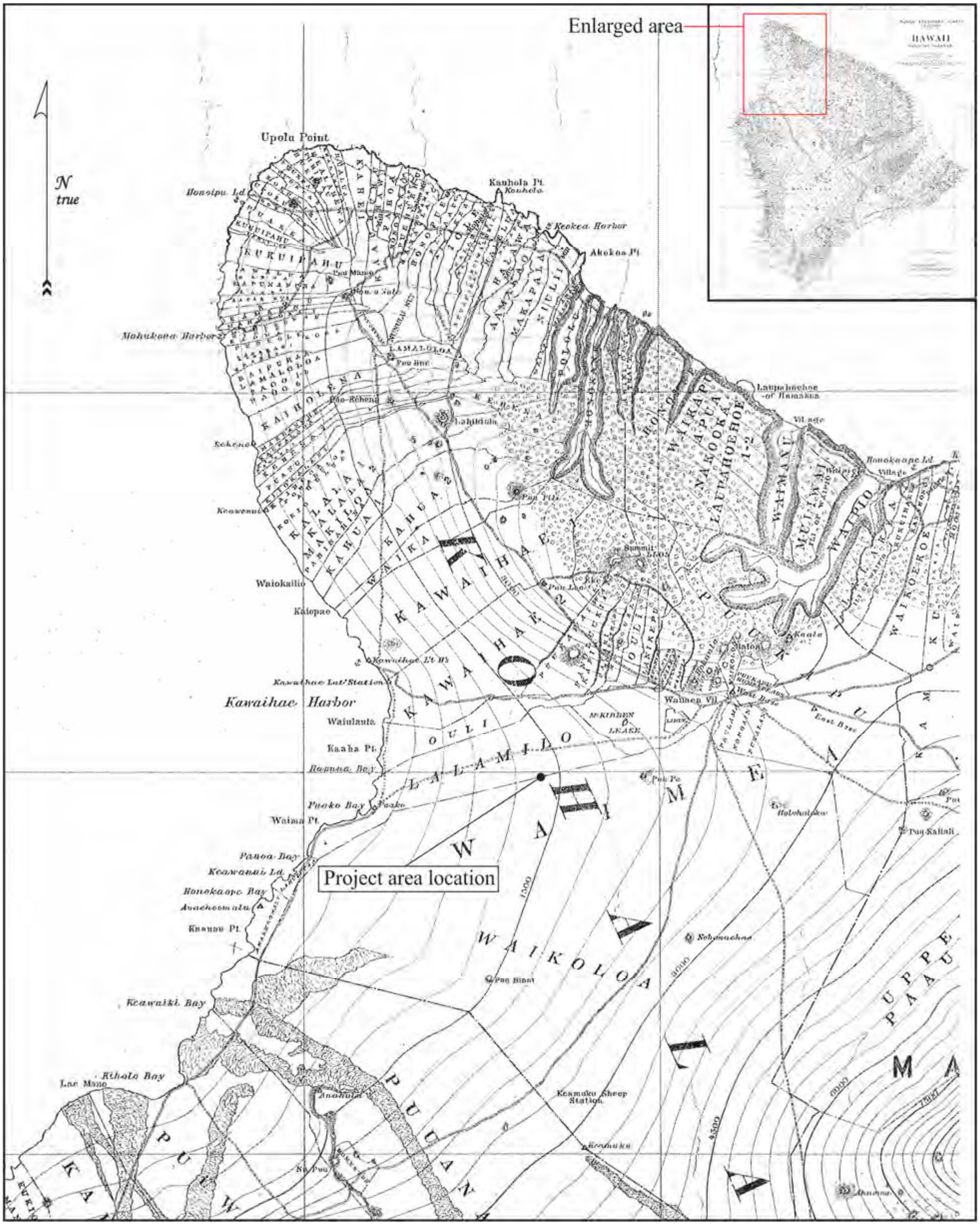

Figure 17. Portion of Hawai‘i Registered Map No. 2124 showing Lālāmilo and Waikōloa *ahupua‘a* (prepared by John M. Donn in 1901).

The initial settlement in Hawaiʻi is believed to have occurred from the southern Marquesas Islands. This was a period 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). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *ʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*.

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 has been collected from Kapaʻanui, where Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 461, and from ʻAnaehoʻomalu where Barrera (1971) reported A.D. 900 as the initial date for settlement. These early dates should be viewed with suspicion (see Kirch 2011), but it is possible that they represent the earliest establishment of small, short-term camps to exploit seasonal, coastal resources. 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 Development Period (A.D. 1100 to 1350) brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period 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. A few areas in Hawaiʻi produced quality basalt for adze production. Mauna Kea, on the island of Hawaiʻi, possessed a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *ʻulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (Kirch 1985). Soon, large areas of Hawaiʻi were controlled by a few powerful chiefs.

The Expansion Period (A.D. 1350 to 1650) 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. It was during the Expansion Period 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 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 (Kamakau 1991). In 1866, Kamakau told the following story of their arrival in Hawaiʻi:

> Puna on Hawaiʻi Island was the first land reached by Pāʻao, and here in Puna he built his first *heiau* for his god Ahaʻula and named it Ahaʻula [Wahaʻula]. It was a *luakini*. From Puna, Pāʻao went on to land in Kohala, at Puʻuepa. He built a *heiau* there called Moʻokini, a *luakini*.
>
> It is thought that Pāʻao came to Hawaiʻi in the time of the *aliʻi* Laʻau because Pili ruled as *moʻi* after Laʻau. You will see Pili there in the line of succession, the *moʻo kūʻauhau,* of Hanalaʻanui. It was said that Hawaiʻi Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawaiʻi Island had been without a chief for a long time, and the chiefs of Hawaiʻi were *aliʻi makaʻāinana* or just commoners, *makaʻāinana,* during this time.
>
> . . . There were seventeen generations during which Hawaiʻi Island was without chiefs—some eight hundred years. . . . The lack of a high chief was the reason for seeking a chief in Kahiki, and that is

> perhaps how Pili became the chief of Hawaiʻi. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawaiʻi Island. (1991:100–102)

There are several versions of this story that are discussed by Beckwith (1970), 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.

The period from A.D. 1300–1500 was characterized by population growth and expanded efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to 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. Hommon (1976) 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 a then 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* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). 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 name of an *ahupuaʻa* sometimes indicates its importance, records its history, or reveals something about its resources or population. Waikōloa may have been named for a cold northwest wind that sometimes blows across the Hawaiian Islands (Pukui et al. 1974). There is slight discrepancy in the pronunciation of this *ahupuaʻa* however, either Waikōloa or Waikoloa, which literally translates as "duck water". The name Lālāmilo literally translates as "*milo* tree branch" (Pukui et al. 1974). The Hawaiian language newspaper *Ka Hoku o Hawaii* contained the following traditional *moʻolelo* of the naming of the *ahupuaʻa* of the region in a two-part article published on July 5 and 19, 1917:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert *lawaiʻa hī-ʻahi* (deep sea tuna lure fisherman) and Pili-a-moʻo, a powerful priestess and ʻōlohe. Kanakanaka and Piliamoʻo were the parents of Nēʻula (a fishing goddess), and she married Puʻu Hīnai a chief of the inlands. Nēʻula and Puʻu-hīnai were the parents of Lālāmilo. Kanakanaka's sister was the wind goddess, Waikōloa, for whom the lands are now named.
>
> Lālāmilo gained fame as an expert ʻōlohe and fisherman. And through his wife Puakō, he came to possess the supernatural leho (cowry 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 . . .
>
> Puakō was the daughter of Waʻawaʻa (kāne) and Anahulu (wahine), and the sister of: ʻAnaehoʻomalu (wahine); Pūʻāla'a (kane); and Maui-loa (kāne). Puakō's great desire was to eat he'e (octopus), and Puʻāla'a was kept continually busy acquiring heʻe for Puakō, and getting paʻouʻou fish for ʻAnaehoʻomalu. When he could no longer provide sufficient numbers of fish for his sisters they left Puna and set out in search of suitable husbands who could provide for their needs.
>
> Because of their great love for ʻAnaehoʻomalu and Puakō, Anahulu, Waʻawaʻa, their relatives and attendants also moved to the Kona - Kohala region and dwelt at sites which now bear their names; only Pūʻālaʻa remained in Puna. This is how Puʻu- Huluhulu, Puʻu-Iki, and Mauiloa came to be named; and Puʻu Anahulu (Ten day hill [ceremonial period]) was named for Anahulu, the chiefess wife of Waʻawaʻa (Puʻu Waʻawaʻa).
>
> Arriving at Kapalaoa in the Kekaha lands of Kona, ʻAnaehoʻomalu married Nāipuakalaulani, son of the chiefess Kuaīwa of Kapalaoa. Puakō went on to Waimea where she met with natives of that area, and was introduced to the chiefess Nēʻula, mother of Lālāmilo. When Nēʻula learned that

> Puakō greatly coveted heʻe, she told Puakō that her son was the foremost lawaiʻa ʻōkilo heʻe (octopus fisherman) of the region. And because Puakō was so beautiful, Nēʻula introduced her to Lālāmilo. Lālāmilo saw Puakō, and compared her to the foremost "heʻe" which he could catch. (translated in Maly and Maly 2002: 22-23)

Traditionally, Waikōloa and Lālāmilo were *ʻili* of the *kalana* (or ʻokana) of Waimea, a land division that in ancient times was treated as a sub-district, smaller than a district (*moku o loko*), but comprised of several other land divisions that 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 ʻŌuli, Waiʻaka, Lālāmilo, Puakō, Kalāhuipuaʻa, ʻAnaehoʻomalu, Kanakanaka, Alaʻōhiʻa, Paulama, Puʻukalani, Puʻukapu, and Waikōloa (Figure 18). 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 1832:14)

In some early accounts Waikōloa is referred to as Waikōloa Nui and Lālāmilo is referred to as Waikōloa Iki (Maly 1999). In other references Lālāmilo is referred to as Puakō, which today is the name of a small village on the coast within Lālāmilo. According to Dunn and Rosendahl (1992) land records of the mid-1800s reveal that Lālāmilo was actually the name of an *ʻili* in Puakō, but Puakō either got absorbed into other *ahupuaʻa* and the *ʻili* of Lalamilo became an *ahupuaʻa*, or the names just got switched around on Historic maps. Unlike the map of Waimea prepared by S. C. Wiltse in June 1866 (see Figure 18), a 1901 map prepared by John M. Donn (see Figure 17) and a 1928 Hawaiian Government Survey map (Figure 19) both show the *ahupuaʻa* of Waikōloa and Lālāmilo as they appear today.

The *aliʻi* and the *makaʻāinana* (commoners) were not confined to the boundaries of the *ahupuaʻa*; when there was a perceived need, they also shared with their neighbor *ahupuaʻa ohana* (Hono-ko-hau 1974). The *ahupuaʻa* were further divided into smaller sections such as the *ʻili, moʻoʻaina, paukuʻaina, kihapai, koele, hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *moʻi* (king). *Heiau* building 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 it was the need to supply chiefs' staying at Kawaihae with food that eventually lead to an expansion of upland agriculture in the Waimea area (Barrére 1983:27). Rechtman and Prasad (2006) suggest that the uplands of the region were exploited for forest resources possibly as early as the 13th and 14th centuries, followed by agriculture and prolonged residence in the 16th century. Kirch (1985) notes that dates attained by archaeological investigations demonstrate active, intensive use of the Waimea-Lālāmilo area for agriculture by the mid-17th century.

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 and irrigated taro (Kirch 1985). Here, an agricultural complex with an extensive network of fields fed by a system of irrigation ditches running from the Waikoloa and Kahakohau Streams, dominated the landscape. Burtchard and Tomonari-Tuggle (2002) note that the Waimea-Lālāmilo field complex was also characterized by spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along (Waikoloa Stream) at the eastern margins of the system. Kirch surmises that the fields were perhaps intermittently irrigated, and that "simple furrows" were utilized to "direct water across the sloping field surfaces," as "the capacity of the ditches was insufficient to have kept all fields constantly watered, and some method of rotation must have been practiced" (1985:231). In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke, mamaki*, 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 sizable permanent population), Handy and Handy 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" (1991:532). The name of the village of Puakō, which literally translates as "sugarcane blossom" (Pukui et al. 1974), 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).

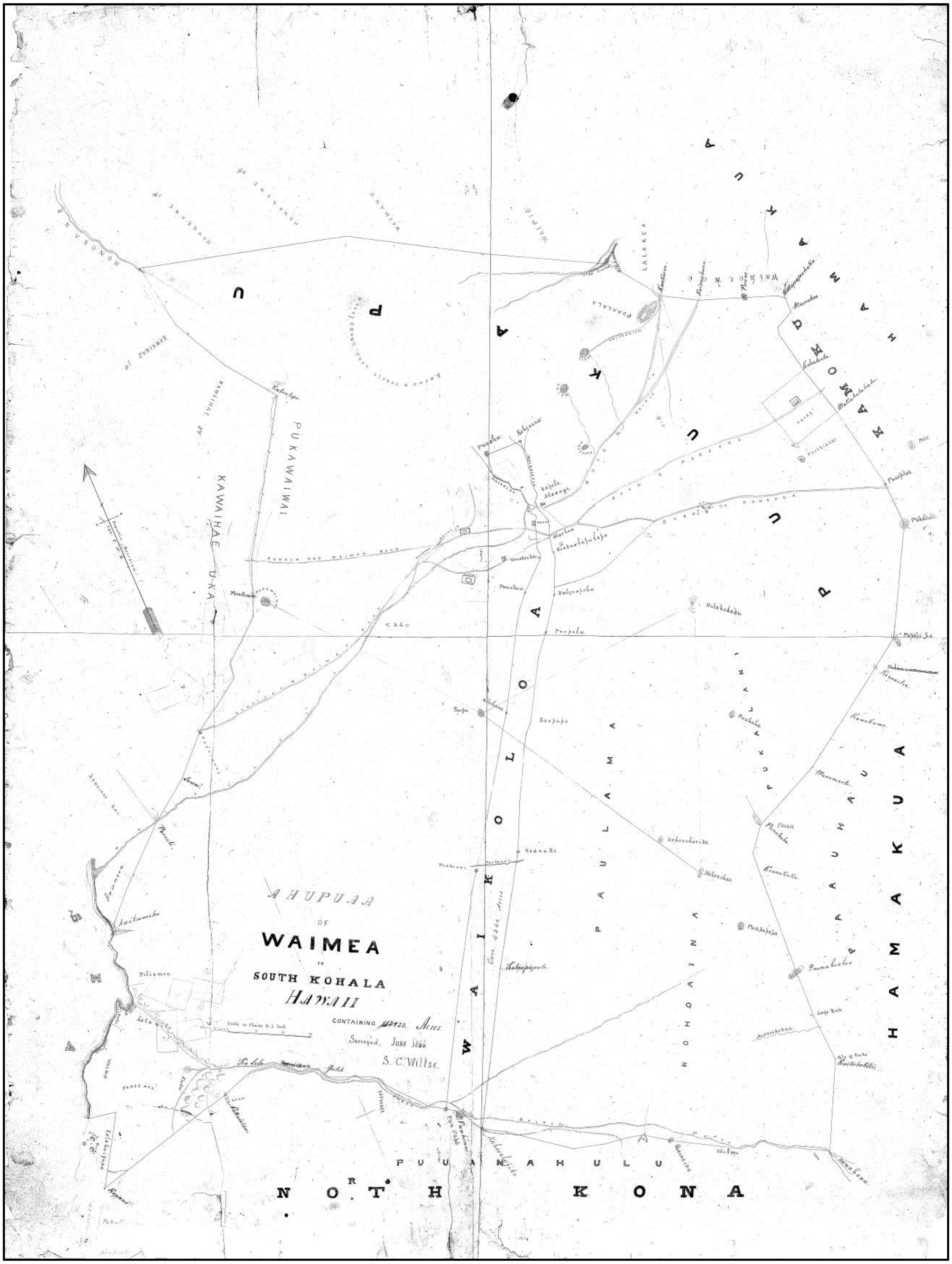

Figure 18. Hawai‘i Registered Map No.712 showing the *ahupua‘a* of Waimea, prepared by S. C. Wiltse, June 1866.

Figure 19. Registered Map No. 1080 showing *kalana* of Waimea (prepared by C.J. Lyons in 1885).

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 and Handy 1991:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy and Handy 1991:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903).

Pukui (1983) cites a proverb that reference Kohala. She provides an explanation and notes that Hawaiian proverbs have layers of meaning 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.

Pukui interprets this proverb as follows:

> 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. (1983:127)

By the seventeenth century, large areas of Hawaiʻi Island (*moku āina* – districts) were controlled by a few powerful *aliʻi ʻai 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 Hawaiʻi, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ʻUmi a Līloa, a renowned *aliʻi* of the Pili line who ruled from Waipiʻo Valley, is often credited with uniting the island of Hawaiʻi under one rule (Cordy 1994). According to Kamakau (1992) ʻUmi was skilled fisherman, and fishing for *aku*, his favorite fish, often brought him to the beaches of South Kohala from Kalahuipuaʻa to Makaula, where he also fished for *ʻahi* and *kala* with many other famed fishermen and all the chiefs of the kingdom. ʻUmi's reign lasted until around ca. A.D. 1620, and was followed by the rule of his son, Keawenui a ʻUmi, and then his grandson, Lonoikamakahiki (Cordy 1994).

Kirch (1985) places the beginning of the Proto-Historic Period (A.D. 1650–1795) during the rule of Lonoikamakahiki. This was a time marked by both political intensification and stress an continual conquest by the reigning *aliʻi*. Wars occurred regularly between intra-island and inter-island polities during this period, and included battles that transpired in the vicinity of the current project area. One such battle was fought between Lonoikamakahiki (Lono) and his older brother, Kanaloakuaʻana, who rebelled against him. According to Fornander, Kanaloakuaʻana and his rebel forces were situated at:

> . . . the land called Anaehoomalu, 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 the 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 Kaunooa [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 [on the plain north of Waikōloa] and Puukohala, near the Heiau of that name, in both of which Lono was victorious. . . (Fornander 1996:120-121)

Later, Lonoikamakahiki battled the forces of Maui led by Kamālālawalu (Kama) on the plain of Waikōloa below Puʻu ʻŌāʻoaka (Maly and Maly 2002). According to Kamakau:

> After Kama-Iala-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 Kaʻu and Puna were coming down from Mauna Kea, and those of Waimea and Kohala were on the level plain of Waimea [Waikōloa]. The men covered the whole of the grassy plain of Waimea like locusts. Kamalalawalu with his warriors dared to fight. The battlefield of Puʻoaʻoaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led [Kamalalawalu's forces] 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 lightning, breaking the bones into pieces and causing sudden death as if by bullets . . .
>
> . . . The Maui men who were used to slinging shiny, water-worn stones grabbed up the stones of Puʻoaʻoaka. 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 . . . The warriors of Maui were put to flight, and the retreat to Kawaihae was long. [Yet] there were many who did reach Kawaihae, but because of the lack of canoes, only a few escaped with their lives ... Kamalalawalu, ruler of Maui, was killed on the grassy plain of Puako, and some of his chiefs were also destroyed. (1991:58-60)

By the 1700s, the rule of Hawaiʻi Island was divided amongst the chiefs of Kona and Hilo (Kamakau 1992). Keawe, a Pili line ruler and the son of Kanaloakapulehu, was the chief of Kohala, Kona, and Kaʻū. When Keawe died, he split the rule of his lands between two of his sons, further dividing the island's chiefdoms; Kalaninuiʻiamamao became the ruling chief of Kaʻū, and Keʻeaumoku became the ruling chief of Kona and Kohala (Kamakau 1992). Wars between the *aliʻi* continued unabated through this transition.

After Keawe's death, Alapaʻinui, the son of former Kona war chief Kauauanui a Mahi, desired to take control of Hawaiʻi Island (Kamakau 1992). Alapaʻinui, who had been living on Maui since the death of his father, returned to Hawaiʻi and waged war against the chiefs of Kona and Kohala. Alapaʻinui was eventually victorious and he took the chiefs of those districts captive, proclaiming Kona and Kohala his own. Kekaulike, the ruler of Maui, much preferred the former chiefs of Hawaiʻi Island, and wished to help them reclaim their lands. The Maui forces attacked Alapaʻinui, but were unable to defeat him. Although Alapaʻinui's forces were never beaten, the frequent attacks by Kekaulike did prevent him from taking the chiefs of Hilo and Kaʻū captive (Alapaʻinui did eventually gain control of these districts however). Alapaʻinui later fought and defeated the forces of Oʻahu on Molokaʻi, and after Kekaulike's death he fought Kauhi (his rival's oldest son) on Maui, where he was also victorious. Alapaʻinui ruled for many years, but at the end of his reign, after moving to Kikiakoʻi in Kawaihae, he became seriously ill. It was there at the *heiau* of Mailekini that he appointed his son Keaweʻōpala ruler of the island (Kamakau 1992).

During this time of warfare, and following the death of Keawe, Kamehameha was born in the North Kohala District in the *ahupuaʻa* of Kokoiki, near the *heiau* of Moʻokini (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992:66–68) places the birth event sometime between A.D. 1736 and 1758, most likely 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 Hālawa, North Kohala (Williams 1919).

It was in 1754 that Keaweʻōpala became the ruler of Hawaiʻi, but many of the chiefs who were deprived of their lands battled against him. Keaweʻōpala was soon defeated in South Kona by Kalaniʻōpuʻu, who then became the ruler of Hawaiʻi Island (Kamakau 1992). Kalani'ōpuʻu was a clever and able chief, and a famous athlete in all games of strength, but according to Kamakau (1992), he possessed one great fault: he loved war and had no regard for others' land rights. Although challenged by many rivals, Kalaniʻōpuʻu maintained his rule over Hawaiʻi Island for nearly thirty years.

About A.D. 1759, Kalaniʻōpuʻu conquered East Maui and defeated his wife's brother, the Maui king Kamehamehanui, by using Hāna's prominent Puʻu Kauʻiki as his fortress. He appointed one of his Hawaiʻi chiefs, Puna, as governor of Hāna and Kīpahulu. Following this victory, Keʻeaumoku, the son of Keawepoepoe who had originally supported Kalaniʻōpuʻu against Keaweʻōpala, rebelled against the Hawaiʻi chief. He set up a fort on a hill between Pololū and Honokāne Valleys in windward North Kohala, but Kalaniʻōpuʻu attacked him there and was victorious. Using ropes, Keʻeaumoku escaped to the sea and fled in a canoe to Maui where he lived under the protection of the Maui chiefs (Kamakau 1992).

In A.D. 1766 Kamehamehanui, the king of Maui, died following an illness and Kahekili became the new ruler of that island. Keʻeaumoku took Kamehamehanui's widow, Namahana, a cousin of Kamehameha I, as his wife, and their daughter, Kaʻahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Puʻu Kauʻiki, Hāna, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalaniʻōpuʻu and his Hāna forces raided and destroyed the neighboring district of Kaupō in Maui, 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 (Kamakau 1992). During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi (Kamakau 1992). Kalaniʻōpuʻu was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

History After Contact

The arrival of Western explorers in Hawaiʻi signified the end of the Precontact Period, and the beginning of the Historic Period. With the arrival of foreigners, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the late Proto-Historic Period/early Historic Period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first 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 (Kirch 1985; Kent 1983). 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 (Kirch 1985; Kent 1983). 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). Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces began to have a devastating impact on traditional life-ways in the Hawaiian Islands. This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

The Arrival of Captain James Cook and the End of Kalaniʻōpuʻu's Reign (1778-1782)

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in the Hawaiian Islands on January 18, 1778. The following January 17th [1779], on a return trip to Hawaiian waters, Cook anchored near Kaʻawaloa along the north shore of Kealakekua Bay in the South Kona District to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many of chiefs and commoners were gathered around the bay celebrating. According to John Ledyard, a British marine on board Cook's ship, upward of 15,000 inhabitants were present at the bay, and as many as 3,000 canoes came out to greet the ships (Jarves 1847:59). It has been suggested that Captain Cook was mistaken for the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992).

On January 24th, Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island, left his battle with Kahekili on Maui, and arrived at Kealakekua Bay. He landed at ʻAwili in Kaʻawaloa, where he stayed at the home of the chief Keaweaheulu in Hanamua (Kamakau 1992). Upon arriving at the village, Kalaniʻōpuʻu immediately forbade others from approaching Cook's ships, but on January 26th he visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawaiʻi, was present at this meeting (Jarves 1847).

On February 4th, Cook set sail from Kealakekua Bay, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua Bay to make repairs. With Cook's return many of the inhabitants of Kealakekua began to doubt that he was actually the physical manifestation of Lono (Kamakau 1992). On February 13th, several natives were discovered stealing nails from the British ships. They were fired upon by the crew, and a chief close to Kalaniʻōpuʻu named Palea was knocked down, and his canoe taken. That night one of Cook's boats was stolen, and the following morning Cook set ashore at Kaʻawaloa with six marines to ask Kalaniʻōpuʻu for its return. Kalaniʻōpuʻu, however, denied any knowledge of the theft; Cook decided to hold the chief captive until the boat was returned (Kamakau 1992). When Cook tried to seize Kalaniʻōpuʻu, however, a scuffle ensued and Cook was killed (along with four of his men and several natives) there on the shores of Kaʻawaloa, struck down by a metal dagger.

After Captain Cook fell, the British ships fired cannons into the crowd at the shore and several more natives were killed. Kalaniʻōpuʻu and his retinue retreated inland, bringing the body of Cook with them. Kamakau writes:

> . . . The bodies of Captain Cook and the four men who died with him were carried to Ka-lani-ʻopuʻu at Maaunaloia, and the chief sorrowed over the death of the captain. He dedicated the body of Captain Cook, that is, he offered it as a sacrifice to the god with a prayer to grant life to the chief (himself) and to his dominion. Then they stripped the flesh from the bones of Lono. The palms of the hands and the intestines were kept; the remains (*pela*) were consumed with fire. The bones Ka-lani-ʻopuʻu was kind enough to give to the strangers on board the ship, but some were saved by the kahunas and worshiped. (1992:103)

After the death of Captain Cook 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. Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. Kalaniʻōpuʻu first went to Hinakahua in Kapaʻau, North Kohala where he amused himself with "sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks" (Kamakau 1992:106). During his stay 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 Imakakoloʻa.

Imakakoloʻa was defeated in Puna by Kalaniʻōpuʻu's superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalaniʻōpuʻu "went to Ka-ʻu and stayed first at Punaluʻu, then at Waiohinu, then at Kamaʻoa in the southern part of Ka-ʻu, and erected a heiau called Pakini, or Halauwailua, near Kamaʻoa" (Kamakau 1992:108). Imakakoloʻa was eventually captured and brought to the *heiau*, where Kiwalaʻō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kiwalaʻō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloʻa and offered it up to the god, and the freeing of the tabu for the *heiau* was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawaiʻi. After usurping Kiwalao's authority with a sacrificial ritual in Kaʻū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalaniʻōpuʻu died in April of 1782 and was succeeded by his son Kiwalaʻō.

The Rule of Kamehameha I (1782-1819)

After Kalaniʻōpuʻu died, several chiefs were unhappy with Kiwalaʻō's division of the island's lands, and civil war broke out. Kiwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona in July of 1782. Supporters of Kiwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Mokuʻōhai with their lives and laid claim to the Hilo, Puna, and Kaʻū Districts. According to ʻIʻi (1963), nearly ten years of continuous warfare followed the death of Kiwalaʻō, as Kamehameha endeavored to unite the island of Hawaiʻi under one rule and conquer the islands of Maui and Oʻahu. Keōua became Kamehameha's main rival on the island of Hawaiʻi, and he proved difficult to defeat (Kamakau 1992). Keawemauhili would eventually give his support to Kamehameha, but Keōua never stopped resisting. Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Puʻukoholā at Kawaihae, which he dedicated to the war god Kūkaʻilimoku (Fornander 1996).

When the construction of Puʻukoholā Heiau was complete in the summer of 1791, Kamehameha sent two of his counselors, Keaweaheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Puʻukoholā Heiau by this ruse, but when he arrived at Kawaihae he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keōua gave Kamehameha undisputed control of Hawaiʻi Island by about the year 1792 (Greene 1993). Between 1792 and 1796 Kamehameha mostly resided at Kawaihae and worked the lands of the Lālāmilo-Waikōloa-Waimea region (Maly and Maly 2002). By 1796, Kamehameha had conquered all the island kingdoms except for Kauaʻi. 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).

In the twelve years following the death of Captain Cook, sixteen foreign ships (all British and American) called in Hawaiian waters (Restarick 1927). In 1790, two sister ships, the *Eleanora* and the *Fair American,* were trading in Hawaiian waters when a skiff was stolen from the *Eleanora* and one of its sailors was murdered. The crew of the *Eleanora* proceeded to slaughter more than 100 natives at Olowalu [Maui]. After leaving Maui, the *Eleanora* sailed to Hawaiʻi Island, where one of its crew, John Young, went ashore and was detained by Kamehameha's men. The other vessel, the *Fair American,* was captured by the forces of Kamehameha off the coast of North Kona, and in an act of retribution for the Olowalu massacre, they slaughtered all but one crew member, Isaac Davis. Guns and a cannon (later named "Lopaka") were recovered from the Fair American, and were kept by Kamehameha as part of his fleet (Kamakau 1992). Kamehameha made John Young and Isaac Davis his advisors.

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 during his 1793 and 1794 visits, giving them as gifts to Kamehameha I, who immediately made the cattle *kapu*, thus preventing them from being killed (Kamakau 1992). Five cows, one bull, two ewes, and a ram brought to the island by Vancouver in 1793 were set free to roam in the saddle area of Waimea between Mauna Kea, Mauna Loa, and Hualālai (Escott 2008).

During one of his visits Vancouver anchored at Kawaihae and a member of his crew, Archibald Menzies, a surgeon and naturalist, trekked inland towards Waimea. Menzies' journal records the journey and describes the land in the vicinity of the current project area:

> I travelled a few miles back…through the most barren, scorching country I have ever walked over, composed of scorious dregs and black porous rock, interspersed with dreary caverns and deep ravines…The herbs and grasses which the soil produced in the rainy seasons were now mostly in the shriveled state, thinly scattered and by no means sufficient to cover the surface from the sun's powerful heat, so that I met with few plants in flower in this excursion. (Menzies 1920:55)

Around the turn of the century, Kamehameha gave Waikōloa Nui Ahupuaʻa (excluding the coastal *ʻili* of ʻAnaehoʻomalu and Kalāhuipuaʻa) to Isaac Davis (Rosendahl 2000). Although the land gifted to Davis encompassed a large area, it lacked extensive resources, and was primarily a place for catching birds and gathering *pili* grass. When Davis died in 1810 without naming an heir, John Young took control of the land to protect it for Davis' children, who were at that time too young to take on the responsibility (Rosendahl 2000). Lālāmilo, or Waikōloa Iki, with its fertile upland agricultural complex, remained under the control of Kamehameha.

During the first part of the nineteenth century, Hawaiʻi's culture and economy continued to change drastically as capitalism and industry established a firm foothold in the islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine. Kamehameha, who resided on the Island of Oʻahu at this time, did manage to maintain some control over the trade of sandalwood on Hawaiʻi Island (Kuykendall and Day 1976; Kent 1983).

Upon returning to Kailua 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 added to the breakdown of the traditional subsistence system. Kamakau 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" (1992:204). Once Kamehemeha 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 1992:204). 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 and Handy 1991). While in Kailua, 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.

By the early nineteenth century the *kapu* cattle given to Kamehameha by Vancouver had multiplied to the extent that they were becoming a scourge for the native planters Waimea region. To protect the upland agricultural fields from the grazing cattle, sometime between 1813 and 1819, Kamehameha ordered that a wall be built from the northern boundary of Waikōloa Nui to near Puʻu Huluhulu (Barrere 1983). The wall was designed to keep wild cattle in Waikōloa Nui, and out of the more agriculturally productive areas on the Waimea side. This wall was called Kauliokamoa after the *konohiki* who oversaw its construction (Wolforth 2000).

The Death of Kamehameha I and the Abolition of the Kapu System (1819-1820)

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and 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 eliminate all of the regular *kapu* that maintained social order and the separation of men and women, 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 the responsibility of the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered:

> The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*ʻainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an

> innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-aliʻi, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

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 purification ceremonies Liholiho returned to Kamakahonu:

> 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-aliʻi 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 eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god *Kū-Kailimoku*, 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 Hawaiʻi to Kauaʻi, 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 ʻ*aumakua* worship, to continue (Oliver 1961; Kamakau 1992). Liholiho moved his court to Oʻahu, lessening the burden of resource procurement for the chiefly class on the residents of Hawaiʻi Island. With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

Kohala 1820-1848: A Land in Transition

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaiʻi. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *aliʻi*, 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 sandalwood trade wreaked havoc on the lives of the commoners, as they weakened from the heavy production, exposure, and famine just to fill the coffers of the *aliʻi*, who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). 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 went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar and cattle industries.

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 1969:399). Ellis notes that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. During his travels along the coast of North 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 writes:

> 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 2004:405-406)

Ellis also describes another of his travelling companion's journey 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. (Ellis 2004:412)

In 1822 John P. Parker, originally of Newton, Massachusetts, was one of the early foreigners granted permission to hunt bullock for the crown (Escott 2008). 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 (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).

The population of South Kohala continued to reside either near the shore or in the uplands of Waimea throughout the first half of the nineteenth century, but with the arrival of foreigners in Hawai‘i, the introduction of a western economy, and the rise of the sugar and cattle industries, life in Kohala began to change drastically. Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically; initially through deforestation from the collection of sandalwood, followed by the introduction of cattle to these lands (Rechtman and Prasad 2006). Foraging cattle wreaked havoc on the agricultural fields and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes. From the 1820s until the 1840s a sugar mill operated in the Waimea area. New crops, such as Irish potatoes, watermelons, cabbage, onions, tomatoes, mulberries, figs, and beans were also introduced in Historic times. 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). However, commercial ventures soon replaced traditional agricultural practices, and the Waimea landscape was substantially altered as a result of this post-contact change (Rechtman and Prasad 2006).

In 1830 the appointed governor of Hawai‘i Island, Kuakini, moved to 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). According to an 1830 Missionary Commission Report (Lyons 1875) another trail followed the boundary of Waikōloa and Lālāmilo *ahupua‘a* from Waimea to the coastal village of Puakō, passing by the current project area. Hawai‘i Registered Map Nos. 574 (prepared by Kaelemakule – no date; Figure 20), 1080 (prepared by C. J. Lyons and W.A. Wall in 1885; see Figure 19), and 2993, (prepared by Chas L. Murray in 1929; Figure 21), all show an "old trail" following the boundary between the two *ahupua‘a*. A September 10, 1836 article in the *Sandwich Island Gazette* describes the terrain traversed by the trail:

> . . . [the trail] consists of a gradual descent of about 10 miles to the seaside. It is entirely composed of an uneven rocky waste, covered with long grass. This barren tract is untenanted and uncultivated. Rain seldom falls here and, besides the grass, nothing is seen to vary the monotony until you approach the coast, when the eye is relieved by the yellow blossoms of the Nohu [*Tribulus cistoides*]. (*Sandwich Island Gazette* September 10, 1836)

In 1835 Lorenzo Lyons, a minister from Waimea, trekked along this trail to the village of Puakō, which he briefly described as follows:

> Puako is a village on the shore, very like Kawaihae, but larger. It has a small harbor in which native vessels anchor. Coconut groves give it a verdant aspect. No food grows in the place. The people make salt and catch fish. These they exchange for vegetables grown elsewhere. (Lyons in Doyle 1953:85)

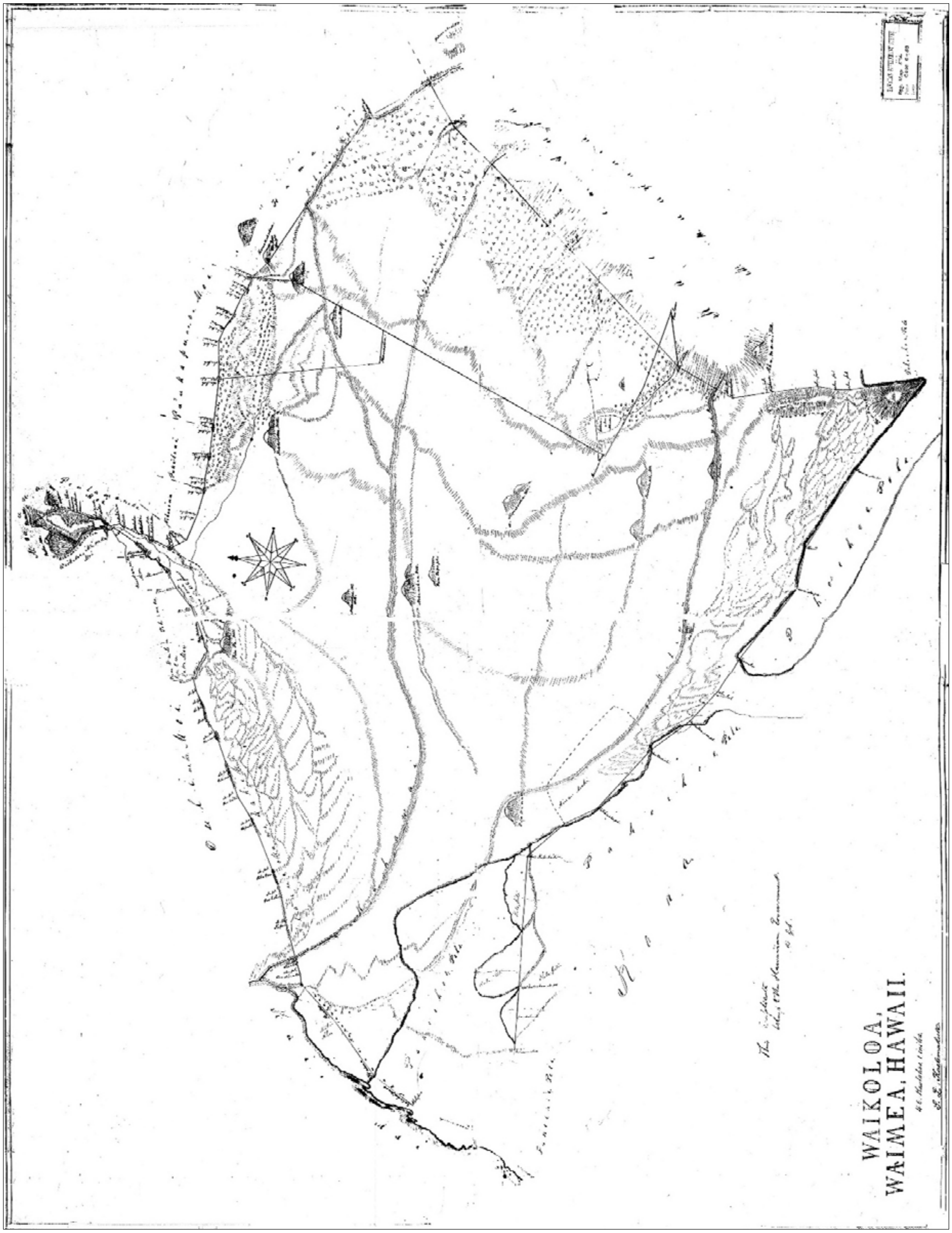

Figure 20. Registered map No. 574 showing an old trail along the Lālāmilo/Waikōloa *ahupua'a* boundary (prepared by Kaelemakule, n.d.).

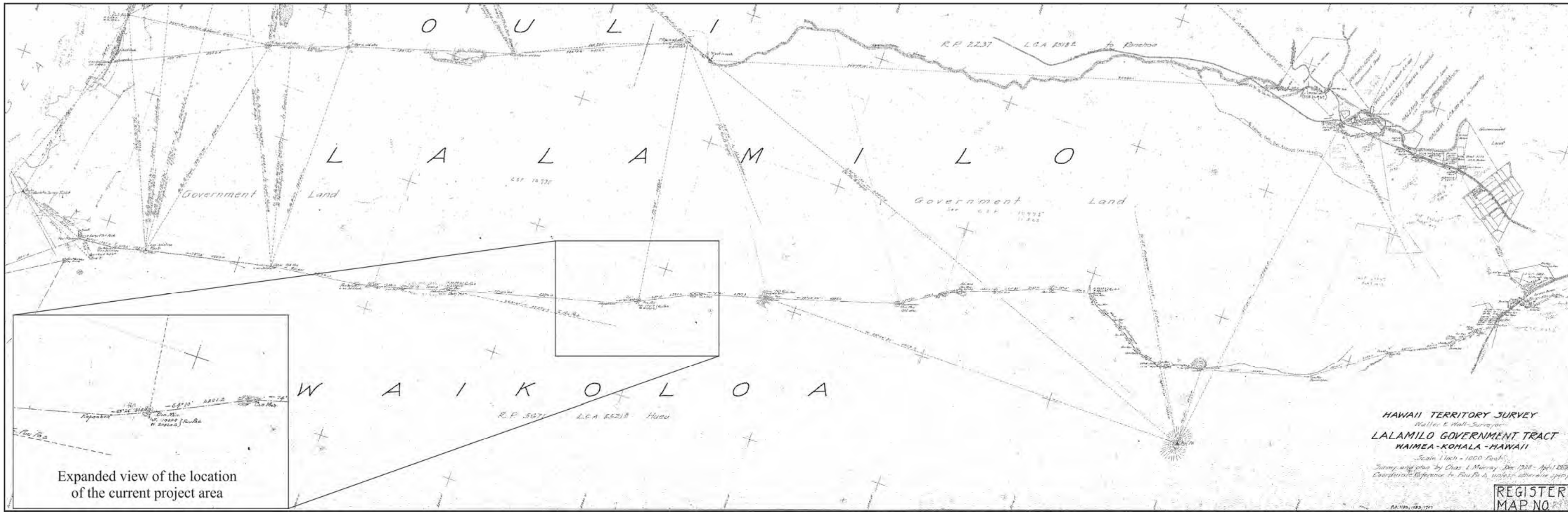

Figure 21. Registered Map No. 2993 showing an old trail running along the *ahupua'a* boundary of Lālāmilo and Waikōloa (prepared by Chas L. Murray in 1929).

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). In 1837 there were sixty foreigners in Waimea employed as mechanics and bullock hunters (Brundage 1971); and in his report to the American Board of Commissioners to Foreign Missions in 1840, Lorenzo Lyons stated "in my field are sixty or seventy foreigners, from seven or eight different nations. They are beef catchers, sugar manufacturers, shoe makers, merchants, masons, doctors, formers, and what not" (Doyle 1953:118). 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 lead to further efforts to tame, brand, fence, and herd privately owned cattle (Wilkes 1945). The decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, lead to a period of economic hardship and population decline in the Waimea area (Escott 2008).

By the mid-nineteenth century, leeward settlement had shifted to the windward side of Kohala as the leeward, agriculturally marginal areas were abandoned in favor of more productive and wetter sugarcane lands. 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. The wetter windward slopes of North Kohala and the Waimea plain were the focus of the shifting settlement pattern and they eventually became the population centers for the district. 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. Aliʻi 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. (1988:33)

Throughout the first half of the nineteenth century the native population of the district declined rapidly as native populations were decimated by disease and a depressed birth rate. Epidemics in 1848 and 1849 killed more than 10,000 people in twelve months throughout the Hawaiian Islands (Tomonari-Tuggle 1988). In 1848 in North Kohala, Rev. Bond reported that 100 people had died within a three week period, and in October of that year he reported that a measles epidemic had nearly every resident of the district in the hospital (Damon 1927). Following these epidemics, the population of the district had been reduced to nearly half of the reported population in 1835; the number of coastal residents soon dwindled and most of the coastal villages were left to a few solitary residents. An 1848 description of the town of Waimea cited in McEldowney (1983:432) stated that "it can scarcely be said that there is any native population at all." This statement seems to sum up the demographic changes that were taking place as the native population had been severely reduced by disease, displacement, and the ongoing changes in land tenure.

Legacy of the Great Māhele (1848-1865)

By the middle of the nineteenth century, the ever-growing population of Westerners forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership in the Hawaiian Islands, and the Great *Māhele* became the vehicle for determining ownership of native lands. During this period, land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki,* were defined. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands 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 (Chinen 1961:13).

During the *Māhele,* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. All three types of land were subject to the rights of the native tenants therein. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands. The boundary information was collected between ca. A.D. 1873 and 1885 and was usually given in Hawaiian, but transcribed in English.

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 (see Figure 18) 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 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 Waikoloa *ahupuaʻa* (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. 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.

Lālāmilo Ahupuaʻa was awarded to William C. Lunalilo as part of LCAw. 8559-B. Lunalilo, who became the first popularly elected Hawaiian King in 1874, died at age thirty-nine just twenty-five days after assuming the throne (Kelly 1983). Seventeen *kuleana* were claimed within Lālāmilo (Haun et al. 2003), including four at the coast (listed as being within Puakō) and thirteen in the uplands (listed as being within Waimea). The four *kuleana* at the coast were all house lots that were not awarded, while the thirteen inland *kuleana*, which were awarded, were for house lots and cultivation. None of the *kuleana* were in the vicinity of the current project area.

Waikōloa (Nui) Ahupuaʻa was awarded to George Davis Hūʻeu. Kamehameha I had originally given the land to George's father Isaac Davis. This award did not include the coastal areas of ʻAnaehoʻomalu and Kalāhuipuaʻa, which were retained by the crown; thus the Davis Hūʻeu award was primarily restricted to the non-agricultural *pili* lands south of the agriculturally productive Lālāmilo area and *mauka* of the rich coastal resource area. Although at least twenty-six claims were made for *kuleana* in Waikōloa, only nine small residential lots were awarded near the town of Waimea (Maly and Maly 2002).

In the decades following the *Māhele* of 1848, which are characterized by a growing detraction from traditional subsistence activities, 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 and sugar industries. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements (such as Puakō in the vicinity of the current project area) 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 proceedings of the Land Commission ushered in changes in the traditional Hawaiian land tenure system that enabled foreigners to purchase lands which had previously been unavailable to them. 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 that year, 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. A year later, in 1852, 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 (Bergin 2004). By the mid-1850's John Parker had turned most of the day to day operations of Parker Ranch over to his son, John Palmer Parker II.

By 1859, disputes regarding the boundary between the *ahupuaʻa* of Pāʻauhau (in the Hāmākua District) and Waikōloa had arisen between Hūʻeu and Parker. The boundary issue was quickly resolved, but the dispute lead Lot Kamehameha, Minister of the Interior, to recommended to W. S. Spencer, Interior Department Clerk, that boundary testimony for all *ahupuaʻa* be collected:

> From conversations with Surveyor Wilkes, I have come to the conclusion to recommend to H. Mj's. Government to have all Government Lands, especially in Hamakua and Waimea, correctly surveyed, if possible excepting those tracts of Lands already sold to private parties. My reasons for recommending this step are that the Boundaries can only be defined and explained from the evidence of very old people now living in these Districts, and if the Government hesitates or delays this evidence, there will be shortly be no guide or information to enable them to come to a decision, as to the correct Boundaries. The people being all old and not likely to remain long as living evidences, in this world. . . (Department of the Interior letter dated May 29, 1859; in Maly 2002:70)

Disputes over the boundaries of Waikōloa Nui Ahupuaʻa, belonging to G. D. Hūʻeu, and the neighboring Crown lands of Waimea also soon arose. Testimony regarding the boundaries of Waikōloa Nui were heard on August 8 and 9, 1865 at Waimea. Several individuals knowledgeable of the boundaries testified, including Mi 1st who swore:

> I live on Waikoloa – I am a kamaaina of the lands in dispute. The name of the large land is Waimea – I am a witness for George Davis and also for the Rex [King] – Waimea is a Kalana – which is the same as an island divided into districts – there are eight Okana in Waimea. In those Okana are those lands said to extend out (hele mawaho). These lands came in to the possession of Kamehameha I who said to Kupapaulu, go and look out to of the large lands running to the sea, for John Young and Isaac Davis. Kupapaulu went to Keawekuloa, the haku aina, who said if we give Waikoloa to the foreigners they will get Kalahuipua [Kalahuipuaa] and Anaiomalu [Anaehoomalu] (two lands at the beach) then your master will have no fish. So they kept the sea lands and gave Waikoloa to Isaac Davis. John Young asked my parents if it was a large land they said, the black aa was Napuu, and the good land Waimea.
>
> They kept all the valuable part of the lands, and gave the poor land outside to Isaac Davis. They kept Puukapu, Pukalani, Nohoaina, Kukuiula (above the church), and Paulama; and gave Waikoloa to Isaac Davis. The other Waikoloa [Waikōloa Iki, or Lālāmilo], this side of the stream dividing them, was the King’s. It comes down along the stream by Mr. Lyon’s, then along the ditch, then along the wall of Puuloa, to Ahuli on the King's land, to the round hill, Uleiokapihe, and is cut off here by Davis’ Waikoloa. - The wall was the boundary below, between Waikoloa of Isaac Davis and the land of the King, Kamehameha I. The latter built it by Kauliakamoa [Kauliokamoa]; to keep the cattle off from the King’s land. The boundary runs to Liuliu, and the pili was all South, on Davis’ land; then I know along an old road, Puupa, Waikoloa being South and Waimea North of the road, then to Kaniku. That is all I know.
>
> Cross. - My parents heard the command of Kamehameha I to Kupapaulu, and they told me, and also about John Young's asking about the land.
>
> I never heard that Puukapu, Nohoaina, Pukalani, and Paulama extended out to the pili. A road divided the land of the King and that of I. Davis.
>
> Waikoloa. - The wall was built to keep off the cattle, and to mark the land. The church is on the King’s land. When Kalama measured Waikoloa he took in the church, I heard. I went with Kalama some of the time. Kalama said leave the old boundary and make a straight boundary, so I left them, lest Davis’ land would go to the King. The boundary as I know it is from the English school house along a hollow, to the ditch near to Hoomaloo; thence to puu Makeokeo; thence to hills outside of Ahuli. The church is on Paulama which joins Waikoloa. (Boundary Commission, Volume A, No. 1 pg. 6)

Several named points along the boundary between Waikōloa and Lalāmilo are specified in 1865 Boundary Commission hearings. The points most proximate to the current project area include Puu Waewae, Kaala, Kapae, Pooholua, and Pohakau, Kapaakea, Palinui Puu Ananui, and Liuliu (Figure 22). Unfortunately no meanings for these names or legends associated with them are given. Other testimony indicates that Waikōloa Ahupuaʻa was a place for bird catching. Ehu, among others, testifies that, “Waikoloa was the land that had the birds” (Maly 1999:88).

Ranching other Historic Industries in the Lālāmilo-Waikōloa Area (1865-1942)

By the mid-1860s the Waimea Grazing and Agricultural Company, founded by Robert C. Janion and William H. Green in 1861, and joined by F. Spencer and Company soon thereafter, had acquired considerable strategic assets around Waimea in an attempt to monopolize the livestock industry in the region (Bergin 2004). From the outset, Spencer, Janion, and Green maintained an adversarial relationship with Parker Ranch, and land disputes and allegations cattle rustling were common occurrences between these two competing entities. During the early 1860s Parker successfully thwarted Janion’s men from harvesting unbranded cattle on his lands, but attacks by Frank Spencer contesting Parker’s claim to more than 17,800 acres in Kaʻohe and Kemole were more difficult to resolve, and were still ongoing when John Palmer Parker, the founder of Parker Ranch, died on August 20, 1868 (Bergin 2004). At the time Parker Ranch controlled about 47,000 acres of land in the region, including the Lālāmilo portion of the current project area. The ranch lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr. (Bergin 2004).

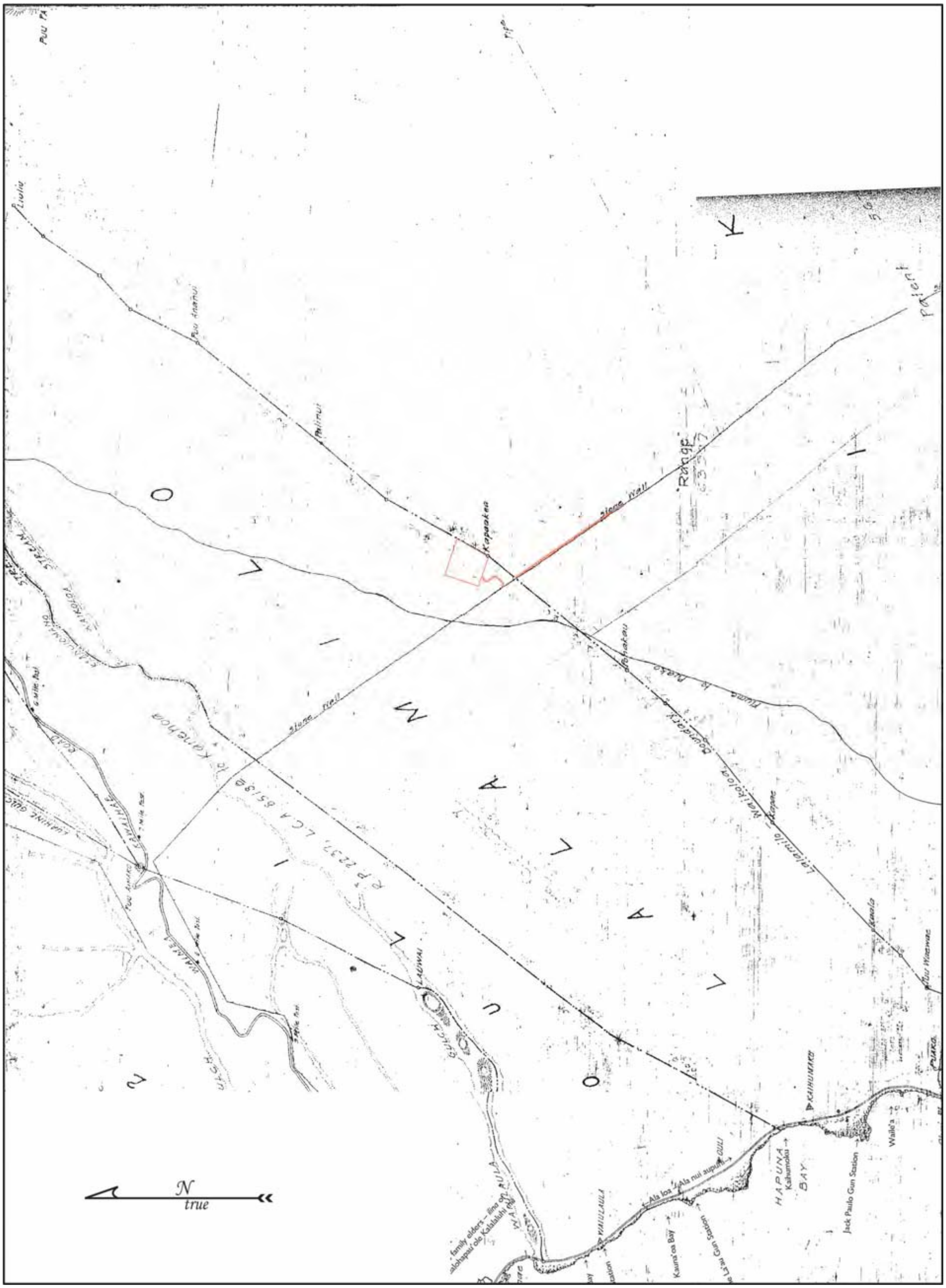

Figure 22. Portion of Hawai‘i Registered Map No. 2786 (prepared by Wright 1917 and annotated by Maly 1999) showing the current project area (outlined in red).

On July 2nd, 1868, G. D. Hūʻeu leased his remaining lands in Waikōloa Nui to the Waimea Grazing and Agricultural Company for a twenty year period (he had previously sold roughly 700 acres to Claude Jones on October 25th, 1866; Maly and Maly 2002). With the acquisition of this land, the Waimea Grazing and Agricultural Company became the largest ranching operation on the island (Escott 2008). Under the terms of the lease the Hūʻeu family was allowed to continue grazing their 1,000 head of cattle, 1,000 head of sheep, and 100 horses on the Waikōloa lands (Escott 2008).

Despite the growth of the ranching industry, Lorenzo Lyons estimated that by 1867 the population of Waimea was only four hundred people; during the 1870s the town of Waimea contained five stores and a hotel (Doyle 1945). An 1877 *Report of the Royal Commissioners on Development of Resources* documents the effects of cattle ranching on the environment of the Kohala-Waimea region, and the resultant out migration of the native population during this period:

> The forests on the Kohala mountains are dying rapidly. The land is mostly for grazing purposes, though on the mountain potatoes of fine quality can be raised in large quantities. In sheltered places, coffee would doubtless grow, but owning to the sparseness of the population and the superior attractions to other parts of the district, this part will hardly soon be settled. The once fertile and populous plain of Waimea looked sterile and desolate when visited by the Commission - a painful contrast to Kohala loko on the other side of the mountain.
>
> The complaint of the people is well founded. The water they use is fouled in many places by cattle, horses and other animals, and as the stream is sluggish it has no chance to free itself of impurities, and the water used by the people in their houses must be a cause of disease and death, especially to the children . . . It is little wonder that with his crops trodden out by the sheep or cattle of his stronger neighbors, his family sickened perhaps to death by the polluted waters, that the small holder should yield to despair, and abandoning his homestead seek employment in some other district, usually without making another home . . .
>
> The plains of Pukapu and Waimea·are subject to high winds, aggravated by the loss of the sheltering forests of former days. The soil however is very good in many places for sugar cane and other products. To develop its best resources, efforts must be made to restore the forests and husband the supply of water at their sources to furnish a supply for agricultural purposes. At present the lands are used almost exclusively for grazing purposes. Although the proprietors and lessors are probably not averse to the establishment of agricultural enterprises, it is to be feared that the denudation of the neighboring mountains and plains of the forests will render the climatic conditions unfavorable to success.
>
> It would seem that a wise appreciation of the best interests of this district, even of the grazing interests themselves, would lead to the decrease of the immense herds which threaten not only Waimea but even Hamakua with almost irreparable disaster. It is to be feared that they will in time render a large part of the land of little value even for grazing purposes. Owing to the increasing frequency and severity of droughts and consequent failure of springs. Some thousands of cattle are said to have died this last winter from want of water, and the works erected in Waimea for the purpose of trying out cattle have been idle for months for want of water.
>
> The commission do not propose here to discuss fully the vexed Questions of the causes of the diminution of the forests, but in view of the fact that they are diminishing and the streams and springs diminishing a corresponding rations, also that with the cattle running upon the lands as at present, any effort to restore them must be futile and any hopes of their recuperation vain, the Government, if it would wish to preserve that part of the island of Hawaii from serious injury, must take some steps for reclaiming the forests.
>
> In this connection we would say that it is unfortunate that large tracts of Crown and Government lands have been lately leased on long terms for grazing purposes, without conditions as to their protection from permanent injury, at rates much lower than their value even as preserves for Government purposes or public protection. The commission deem (sic) this a matter of grave importance, challenging the earnest attention of the Government, and involving the prosperity of two important districts (in Maly and Maly 2002:58-59).

By the late-1870s, largely due to persistent drought conditions within its grazing lands, the Waimea Grazing and Agricultural Company went out of business, and its herd was purchased by Parker Ranch (Parker Ranch would also eventually acquire the lease of Waikōloa Ahupuaʻa; Bergin 2004). Francis Spencer formed Puʻuloa Sheep and Stock Company, and continued to raise sheep in Waikōloa and neighboring lands. In October of 1876 Spencer sold his interest in the sheep ranch to George W. Macfarlane; included in this transaction were the Waikoloa Nui lands lease from G. D. Hūʻeu (Maly and Maly 2002). George Bowser, the editor of *The Hawaiian Kingdom Statistical and Commercial Directory and Tourists Guide*, visited Waimea in 1880 and stayed at Spencer's house. Browser writes:

> . . . Waimea has always been a place of some considerable importance, and there are around it several pretty homesteads, notably the residences of Mr. F. Spencer and the Reverend Lyons. From Mr. Spencer's veranda there is a striking view of Maunakea, the summit of which was at this time of the year still in its winter robe of snow. The snow never leaves this mountain top entirely, but the position of the snow-line varies considerably with the season of the year, and also from one year to another, according to the weather which characterizes them. The country all round is chiefly suitable for grazing, and, besides innumerable wild cattle, descended, no doubt, from those which Vancouver gave to Kamehameha I, there are some 20,000 head depastured in the neighborhood, the property of Mr. Parker, who has, besides, some large droves of horses, probably numbering a thousand head in all. Mr. Spencer has turned his attention chiefly to sheep farming, and occupies a large tract of country with his flock of 15,000 sheep and 15,000 goats. Waimea itself, although of immemorial age, and once populous, is now only a scattered village, with but two stores and a boarding and lodging house and coffee saloon. (Bowser 1880:540)

Upon leaving Waimea George Browser set out for Puakō, travelling along a trail that passed by the vicinity of the current project area. Browser provides the following description of the journey and the coastal village:

> . . . I made my start from the house of Mr. Frank spencer, leaving the Kohala district, I must say, with much regret. Fifteen miles of a miserably rough and stony road brought me to Puako, a small village on the sea-coast, not far from the boundary between the Kohala and Kona districts. There was nothing to be seen on the way after I had got well away from Waimea except clinkers; no vegetation, except where the cactus has secured a scanty foothold . . .
>
> At Puako there is some grief for the eye, in the shape of a grove of cocoa-palms, which are growing quite close to the water's edge. These had been planted right amongst the lava, and where they got their sustenance from I could not imagine. They are not of any great height, running from twenty to sixty feet. There are about a dozen native huts in the place. These buildings are from twenty to forty feet long and about fifteen feet high to the ridge of the roof. They only contain a single room each, and are covered with several layers of matting. (Bowser 1880:546)

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 Waikoloa that had formerly belonged to the Waimea Agricultural and Grazing Company. A sketch map prepared J. S. Emerson in 1882 during the Hawaiian Government Survey of South Kohala (State Survey Division, Book 251:109; reproduced by Escott 2008; Figure 23), shows the Parker Ranch grazing lands at that time and the network of trails that ran through them. By the mid-1880s Sam Parker's poor business dealings had lead 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 Parker Ranch was under the direction of Alfred W. Carter, 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 Nui 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 Keʻamuku 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 Humuʻulu, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

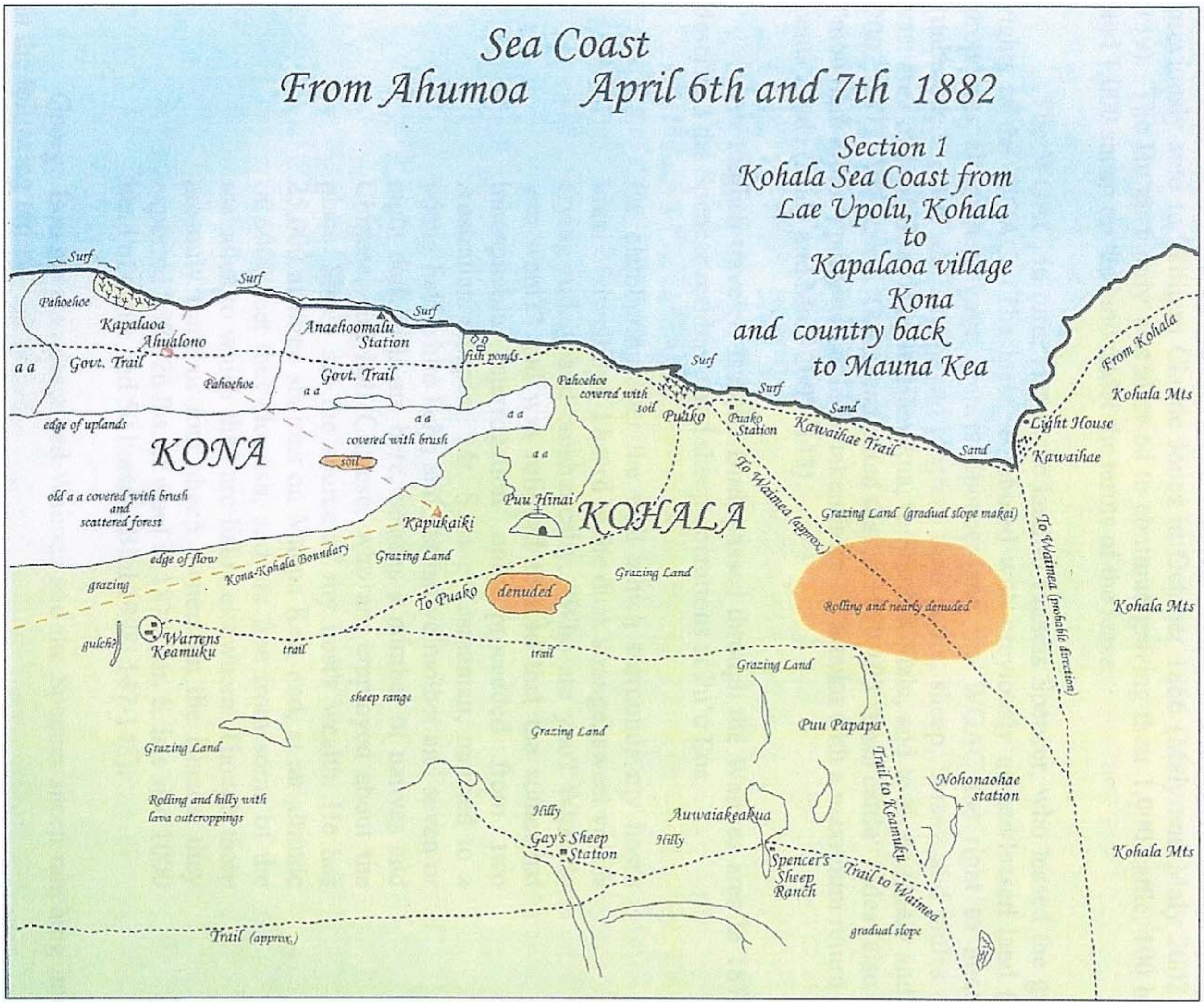

Figure 23. J. S. Emerson's sketch map of the South Kohala Sea Coast (from Escott 2008:43)

A few years prior A. W. Carter first being appointed Thelma Parker's guardian and trustee, Mr. Wilmot I. Vredenberg, a British national, during an 1895 hunting trip to South Kohala made a chance discovery of sugarcane growing wild in the Puakō area that ushered in a brief sugar industry in the coastal lands of Lālāmilo. Vredenberg immediately took the sugarcane to Robert Hind and his son John who had founded the Hāwī Mill and Plantation Company in North Kohala in ca. 1880 (Puakō Historical Society 2000). John Hind described this chance encounter, which would soon lead to the establishment of the short-lived Puakō Sugar Plantation (ca. 1895-1913):

> Mr. W. I. Vredenberg one Sunday came to Hawi in a state of considerable excitement, with four or five sticks of fine looking cane strapped to his saddle, which, as he put it, he discovered at Puako the day before while on a shooting trip. This cane was grown without irrigation, and he enthusiastically announced there were large areas of as good land as that on which these sticks were grown.... Conditions appeared extremely favorable.... Soil was analyzed... a well was sunk (about ten feet) water analyzed and found to contain no more salt water than other plantations, using well water. An experimental plot was planted, which for growth exceeded anything I had ever seen. (Hind n.d.:46-47)

The Hinds, excited by the prospects of a new plantation, soon entered into negotiations with the Parker Ranch for land at Puakō. Parker Ranch at that time used the lands around the bay, which they had purchased from Lunalilo, as a winter range, and they occasionally shipped cattle from there (Puakō Historical Society 2000). The Hinds were able to trade their rights to a piece of land in Hilo at Waipunalei for a swath of Parker Ranch land at Puakō, and they leased additional acreage from the Territory of Hawaiʻi (Maly 1999). These lands (between 1,500-1,800 acres) briefly became the Puakō Sugar Plantation.

Norman G. Campion, a marine engineer, was hired to design the Puakō sugar mill and oversee its construction on a four acre property along the shore (Grant No. 4856). A wharf was constructed first to facilitate the shipment of materials for mill construction. Then, as John Hind writes, "a fine up to date little mill with all the appurtenances which go with a modern plantation was installed [ca. 1905], on an ideal site, a hundred or so yards from the landing" (Hind ms.:50 in Maly 1999:122). The mill area housed crushing machinery, mixers, vats, and all the other mechanical necessities for the mill, along with dormitories and a camp for over three hundred workers, a company store, two schoolhouses, an office building, various storehouse and warehouse facilities, and a shed for honey processing machinery (Puakō Historical Society 2000). A rail line connected the mill operations with field operations. Other improvements to the plantation included the construction of an approximately eight-mile long wooden flume that carried water from Waikōloa Stream near Waimea to the coastal lands of the plantation (Maly 1999). Hawaiʻi Registered Map No. 2786 (prepared by Wright in 1917; see Figure 22) shows some of the Puakō plantation infrastructure and the route of the flume across the current project area. A map prepared by the Territory of Hawaiʻi for a Parker Ranch pasture lease in Lālāmilo Ahupuaʻa in 1928 (C.S.F. 4947) shows the flume originating at Keanuiomano Stream (to the north of Waikōloa Stream) and then continuing across Lālāmilo and Waikōloa *ahupuaʻa* (northwest of the current project area) to the coast near Puakō Bay (Figure 24).

Vredenberg, who had originally found the wild sugarcane at Puakō, was hired by the Hinds to manage the plantation (Puakō Historical Society 2000). In the beginning, Puakō Sugar Plantation was plagued by periods of heavy rain and floods, called freshets and semi-typhoons by John Hind (n.d), who lamented the destruction caused by the former, but came to welcome the latter, which "were of certain value, and over a series of years proved an asset" (Hind n.d.:48). The first sugar crop planted by the plantation (in ca. 1901) was decimated by a flood waters when several intermittently flowing streams overflowed their drainages (Puakō Historical Society 2000).

In 1901, soon after the establishment of the Puakō Sugar Plantation, the Inter-Island Telegraph Co. moved its wireless telegraphy station from Lāʻau Point, Molokaʻi to Puakō to establish a direct line of communication with the stations at Barber's Point, Oʻahu and Lahaina, Maui (U. S. House of Representatives 1917). In 1903, the Territorial Legislature of Hawaiʻi granted a subsidy of $1,000 per month to the Inter-Island Telegraph Co. that stipulated, among other conditions, that a telegraph line between Puakō and the city of Hilo be built, enabling the residents of Hilo to quickly and securely transmit messages to Puakō, which could then be relayed to wireless stations on the other islands. Apparently the Inter-Island Telegraph Co. was not quick to build the telegraph line to Puakō, as illustrated in a commentary published in the August 30, 1904 edition of *The Hawaiian Star*:

> "We are now constantly hearing complaints of the wireless telegraph system. There is no fault found with the actual transmission of the messages across the water but merely with that part of the system where the telephone has to be used to carry the messages from the sender to the wireless station—Puako. Mistakes are thus frequently made in the wording. The transmission of a telegraphic message by telephone always arouses considerable curiosity along the line, and it is no exaggeration to say that every earcup is down and thus interfering with the efficiency of the instrument, and also making it difficult for the centrals to hear. This of course eliminates all privacy and every message becomes common property. Now according to the terms of the bill entitling the I. I. Wireless Telegraph Co. to a subsidy of $1000 per month from the government, it was made conditional that they should lay a land telegraph line from the wireless station (which is now at Puako) to Hilo. So far there is none laid. Instead of fulfilling theirs the company is drawing the subsidy and the public is left with the defective system. We know for a fact that in important messages where secrecy is necessary the telegrams have had to be carried by special messengers to the wireless office. The time is more than half gone and the public should see that the company carry out their in this respect, otherwise all the money will have been drawn by the company and the service still remain without its special telegraph "land line," which is therefore not in accordance with the governor's motto—economy." (*The Hawaiian Star*, Tuesday August 30, 1904 page 5)

By October of 1904 it was reported that "the necessary wire for the construction of the additional fifteen miles of telegraph line from Waimea to Puako, the wireless station, will arrive by the Kiuau, which will complete the telegraph line to Hilo" (*The Weekly Hilo Tribune*, Tuesday, October 18, 1904, page 5), and by February of 1905, F. J. Cross, the manager of the Inter-Island Telegraph Co. stated that "we have created and have been maintaining the wire telegraph line from Puako, Hawaii, to Hilo as required by the law under which we are paid by the Territory" (*Hilo Tribune*, 14 February 1905, pg. 6). Use of the Puakō telegraph line was apparently short-lived, as by 1911 the wireless station at Puakō had closed and been replaced by a new, more powerful station at Kawaihae (Department of the Interior 1912).

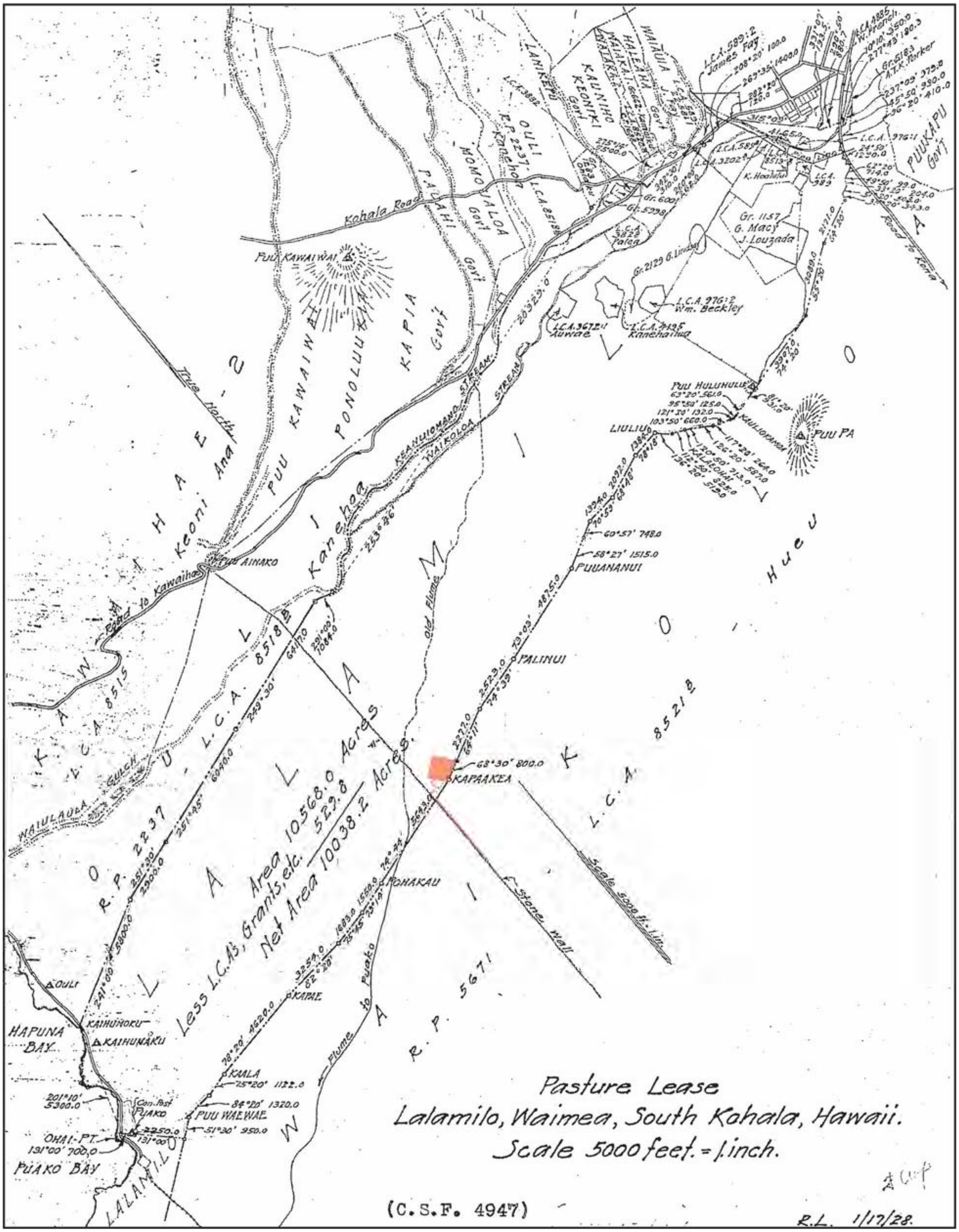

Figure 24. 1928 map (C.S.F. 4947 compiled by E.W. Hockley) showing the Parker Ranch lease of Lālāmilo and the route of the flume to Puakō (with the current project area in red).

With establishment of the Puakō Sugar Plantation and other associated industries at Puakō, and the resulting influx of population (workers and their families) that followed, the need arose for better transportation routes linking the isolated community of Puakō with the neighboring communities of Kawaihae and Waimea. The September 12, 1905 edition of the *Weekly Hilo Tribune* reported that:

> Wilmot Vredenberg, manager of the Puako Sugar Co., asked that an appropriation of $300 to $400 per month for the construction of a road between Kawaihae and Puako. He said that he had no "pull," and that during the five years that the Puako Plantation had been in existence, the Government has not expended $20 for clearing the trails of algeroba trees and rocks. (*The Weekly Hilo Tribune*, Tuesday, September 12, 1905, pg. 3)

By 1909, J. C. Searle had become the manager of the plantation. The March 25, 1909 *Evening Bulletin Industrial Edition* contains an article entitled "A History of the Progress of the Sugar Industry of Hawaii Since the Reciprocity Treaty of 1876," which contains a short description of the Puakō Plantation Company, briefly describing its history, lands, and mill:

> Puako plantation is situated on the leeward side of the Island of Hawaii, five miles from Kawaihae. The plantation consists of between 500 and 600 acres. Three hundred acres of this is good cane land located upon a low flat near the sea, the soil having been washed down from the mountains by freshets. The land was obtained by John Hind and his associates from the Parker Ranch in 1898, the first cane being planted by W. L. Vredenberg in 1899.
>
> Finding that owing to the small rainfall at Puako (and the surrounding country) was not enough to counteract the salt in the well water, arrangements were made with the Parker Ranch to take the Waiaka water of Waimea and a nine mile three board flume was built from the Waiaka Glulch to Puako Plantation.
>
> Four gasoline engines pump 2,500,000 gallons of water every ten hours for irrigation purposes.
>
> The plantation employs sixty-five men, all of whom work by the day. Like other plantations Puako is short of labor. The 1908 crop was about 403 tons and the 1909 crop is estimated at 800 tons.
>
> The mill buildings was [sic] erected in 1901. The six-roller Cora mill which was manufactured by Fulton Iron works of St. Louis, was erected in the same year. The mill has run very satisfactorily ever since and has not needed overhauling. Its principle features are the Lillie effect, Deming system of clarification, mud presses, etc. Room has been left for a new three-roller mill should it be needed. The cane carrier is supplied with revolving knives and bagasse is fed automatically to the furnaces.
>
> Two fast gasoline launches are maintained for carrying mail, passengers and freight between Kiholo, Puako and Kawaihae, connecting with the island steamers Mauna Kea and Mauna Loa, besides being available for trips to Kona and Kohala. (pg. 29)

According to John Hind (n.d.), while the floods that plagued the plantation's early years were an annoyance, the often strong, on-shore winds that dried the moisture from the soil, deposited salt in the fields, and broke the cane stalks during the following years were the real hindrance to growing sugarcane at Puakō. It was the winds and lack of water that eventually led to the closure of the plantation, after only a brief period of operation, in ca. 1913. Hind describes the difficulties faced by the plantation during its brief existence as follows:

> . . . the high winds proved disastrous. During the first year or two we only had a few severe visitations, but later, while we might be exempt for several months, and everything flourishing, we would have a continuation of storms, which at times would threaten to put us off the map. And I may say in passing, were it not for these heavy wind storms, and conditions could continue as they were during the first few months of our operations there, Puako would be worth $35,000.00 to $50,000.00 a year. I have seen the property more than once, look good for either of these amounts and after a three days blow, look like thirty cents. The principle cause of this sudden deterioration being the thorough drying out of the soil, leaving the salt, which could not be washed out in time, by subsequent irritations. We found a good rain was of very great benefit, and finally as a forlorn hope, after keeping tab, on the Waimea stream for over eighteen months, put in an eight mile flume, but strange as it may seem, the water failed just before the flume was finished. Mr. Carter the Manager of the Parker Ranch [c. 1903] attributed the failure to the unprecedented dry weather in the mountains, but as the stream, never after that, continued to flow with any degree of regularity, it would appear the shrinkage of forest area in the mountains was having its effect. Puako, as a sugar proposition, I was satisfied, was hopeless, so finally was closed down [by ca. 1913], and parts gradually sold off at what they would bring. . . (Hind n.d.:48-50)

A letter in the January, 1913 edition of the *American Sugar Industry*, however, reported that by May 22 of the previous year:

> One small sugar plantation has gone out of business as such. Puako Plantation, on Hawaii, is now part of the Hind stock ranch, and the land formerly occupied by sugar cane is now planted in sorghum for fodder for Hind's cattle. The mill has been dismantled, the sugar-making machinery going to Hawi mill while the engines are being retained for irrigation purposes. (Vol. XV No.1:49)

Robert Hind, and his son John, continued to use the Puakō lands for various economic pursuits even after the failure of the Puakō Sugar Plantation. According to Maly (1999) the Hinds extend their ranching interests in the area to include a *kiawe* feed lot and cattle shipping operation, and they also made honey and charcoal on their lease lands. The Hind's lease was located *makai* of the Parker Ranch grazing lands in Waikōloa and Lālāmilo *ahupua'a*. Thelma Parker, who had come of age to inherit the Parker Ranch holdings in 1912, reworked the legal arrangement with A. W. Carter, making the trustee of her properties for the foreseeable future (Bergin 2004). Thelma, who had married Henry Gaillard Smart, gave birth to the next Parker Ranch heir, Richard Palmer Kaleiokū Smart, on May 21, 1913. Soon after the birth (in 1914 and 1915 respectively) both Thelma and Henry Smart passed away, leaving baby Richard parentless (Bergin 2004).

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 Waikoloa 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 is 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 Waikoloa Stream had been tapped by a number of ditches or '*auwai*, and that the inhabitants of the area relied heavily on the water from Waikoloa Stream for the continued traditional existence. The firsthand accounts provided in the testimonies of the residents of the lands describe the Waikoloa 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.

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. By the time Carter acquired the Kohala Ranch Co., made up of the 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).

As a result of Carter's land acquisitions during the early to middle 1900s, the current project area became part of a much larger, consolidated Parker Ranch that operated throughout the Hāmākua, North and South Kohala Districts. New land use patterns within this expanded ranch property, quite different from the land use patterns just a half century earlier, dictated the need for improved routes of travel between different locations; as a result much of the old trail network of the South Kohala District was abandoned or replaced. While the Precontact trail between Puakō and Waimea followed the Lālāmilo/Waikōloa boundary, maps made as early as 1901 show the trail from Puakō to Waimea extending through the center of Lālāmilo Ahupua'a (see Figure 17). The 1923 U.S.G.S. Pu'u Hīnai quadrangle shows Puakō as a small village during this period with a few roads and houses along the coast, a coastal trail extending north to Kawaihae and south to Kīholo Bay, and a trail extending inland to Waimea, passing north of the current project area (Figure 25). By the 1940, the population of Waimea, at the center of Parker Ranch, had also expanded, and the lands in and around the town were divided into numerous house lots indicative of the new land tenure system.

Beginning in 1941, just months prior to the bombing of Pearl Harbor, with World War II already underway in Europe and Asia, the U.S. Army established an infantry headquarters in the Pu'ukapu area of Waimea (Bergin 2006). After the United States formally entered the war, the Army presence in Waimea expanded to include the U.S. Navy and Marines, and become one of the largest multi-force, U.S. military camps 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 housing approximately 20,000 soldiers. This cantonment would eventually come to be called Camp Tarawa. During World War II, and shortly thereafter, the lands surrounding the camp (including the current project area) were used as a firing range and as a training area for the U.S. Marines (Brundage 1971).

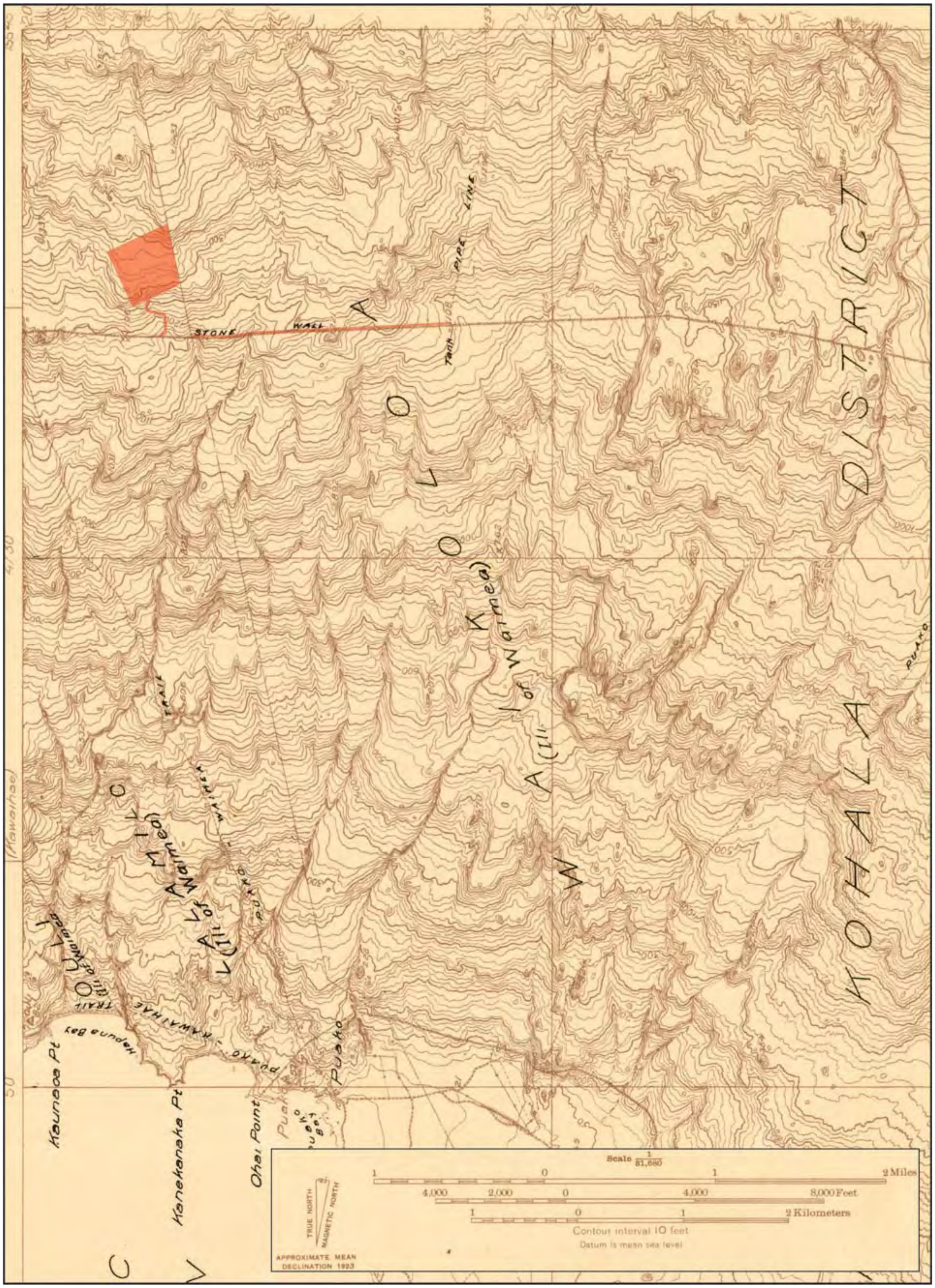

Figure 25. Portion of the 1923 U.S.G.S. Pu‘u Hinai quadrangle showing the current project area (in red).

The Waikoloa Maneuver Area and the Lālāmilo Firing Range (1943-1953)

In December of 1943, nearly 123,000 acres of land in the Waimea-Waikōloa area were leased by the U. S. War Department for use as a troop training area (Escott 2008). With this lease the current project area became part of the U.S. Navy's 91,000-acre Waikōloa Maneuver Area, which included the 9,141 acre Lālāmilo Firing Range, and extended from the coast to the Pohakuloa Training Area, and from the Waimea-Kawaihae Road to south of the Waikoloa Road. Much of the area was acquired through a license agreement with Richard Smart of Parker Ranch for the nominal fee of one dollar (Haun et al. 2010). According to Escott:

> . . . The military utilized portions of this property for troop maneuvers and weapons practice, while other areas served as artillery, aerial bombing and naval gun fire ranges. Troop exercises were conducted using 30 caliber rifles, 50 caliber machine guns, hand grenades, bazookas, flame throwers, and mortars. Larger ordnance and explosive (OE) or unexploded ordnance (UXO) items used included 37 millimeter (mm), 75 mm, 105 mm, and 155 mm high explosive (HE) shells, 4.2 inch mortar rounds, and barrage rockets. From 1943 through 1945 nearly the entire Waikoloa Maneuver Area was in constant use, as the Marine infantry reviewed every phase of training from individual fighting to combat team exercises. Intensive live-fire training was conducted in grassy areas, cane fields, and around the cinder hills of Puʻu Pa and Puʻu Holoholoku. (2008:47)

The 2nd Marine Division was the first to train at Waikōloa, for five months, in preparation for the invasion of Saipan and Tinian. The 5th Marine Division replaced the 2nd Division in August 1944, and used the Waikōloa Maneuver Area to prepare for the assault on Iwo Jima. While training, the marines resided at a military camp established just outside of Waimea Town. Initially called Camp Waimea, the camp was later renamed Camp Tarawa in honor of the first successful invasion of the Pacific War. Camp Tarawa was the largest U.S. Marine training facility in the Pacific, covering an area of approximately 467 acres, and between 1943 and 1945 as many as 50,000 men passed through the camp on their way to the Pacific Theater (Escott 2008). According to Nees and Williams (2000), in addition to the 2nd and 5th Marine Divisions, the 31st Naval Construction Battalion, the 471st Army Amphibian Truck Company, the 726th Signal Aircraft Warning Company, the 11th Amphibian Tractor Battalion, the 5th Joint Assault Signal Company, and the 6th Marine War Dog Platoon also passed through Camp Tarawa.

The last of the Marines of the 5th Division departed Camp Tarwa in June of 1946, and the Waikōloa Maneuver Area, with the exception of the 9,141 acre Lālāmilo Firing Range, was returned to the Parker Ranch in September of 1946 (Haun et al. 2010). The Lālāmilo Firing Range, through a permit granted by the Territory of Hawaiʻi, was retained by the U.S. Marines as a training area and camp site until 1953 (Escott 2008). When the use permit was cancelled in December of that year, the lands once again reverted to leased cattle pasture administered by the Territory of Hawaiʻi. Clean-up of unexploded ordnance (UXO) within the Waikōloa Maneuver Area is still ongoing.

Use of the Project Area Lands during the Late Historic and Modern Periods (1954-present)

Following World War II, the lands of Waikōloa (in ca. 1946) and Lālāmilo (in ca. 1953) in the vicinity of the current project area were once again used as cattle pasture. Parker Ranch retained fee simple ownership of Waikōloa, but the lease of Lālāmilo reverted back to the Territory of Hawaiʻi, and then in 1959 to the State of Hawaiʻi, and was eventually assigned to Palekoki Ranch. The use of the project area lands for military training exercises during World War II opened new access routes to inland and coastal locations that were previously unavailable, but that could now be traveled by motorized vehicle (Maly 1999). The 1956 U.S.G.S. Puʻu Hīnai quadrangle (unlike the 1923 quadrangle; see Figure 25) shows the Puakō-Waimea trail extending inland from Puakō Bay through Waikōloa Ahupuaʻa to a north/south fork in the road (Figure 26); the northern fork, labeled Puakō-Waimea Trail, extends northeast into Lālāmilo Ahupuaʻa, passing the northwest of the current project area on its way to Waimea; the southern fork continues east into the uplands of Waikōloa Ahupuaʻa. It is likely that this road was built by the U. S. military during World War II to access lands within the Waikōloa Maneuver Area and then used as the road to Waimea once the Waikōloa lands were returned to Parker Ranch and the Territory of Hawaiʻi at the conclusion of the war.

Since the 1950s modern development, concentrated along the coast and around the Villages of Waimea and Waikōloa, has been slowly encroaching on the project area lands. In 1949-50 the coastal lands of Lālāmilo were divided into the Puakō Beach Lots and a nice road was built to Kawaihae, bringing many new residents to the area (Maly 1999). During the 1970s the current alignment of Queen Kaʻahumanu Highway (Highway 19), extending from Kailua to Kawaihae, was constructed across the coastal sections of the *ahupuaʻa*, Waikōloa Road was built to connect the new lower highway with the upper highway (Highway 190), and the Village of Waikōloa was established at inland elevations to the south of the project area. With the construction of the new highways and the shifting of residential patterns, the older coastal roads and *mauka*/*makai* travel routes largely fell into disuse (the Puakō-Waimea trail is not shown on the 1982 U.S.G.S. Puʻu Hīnai quadrangle).

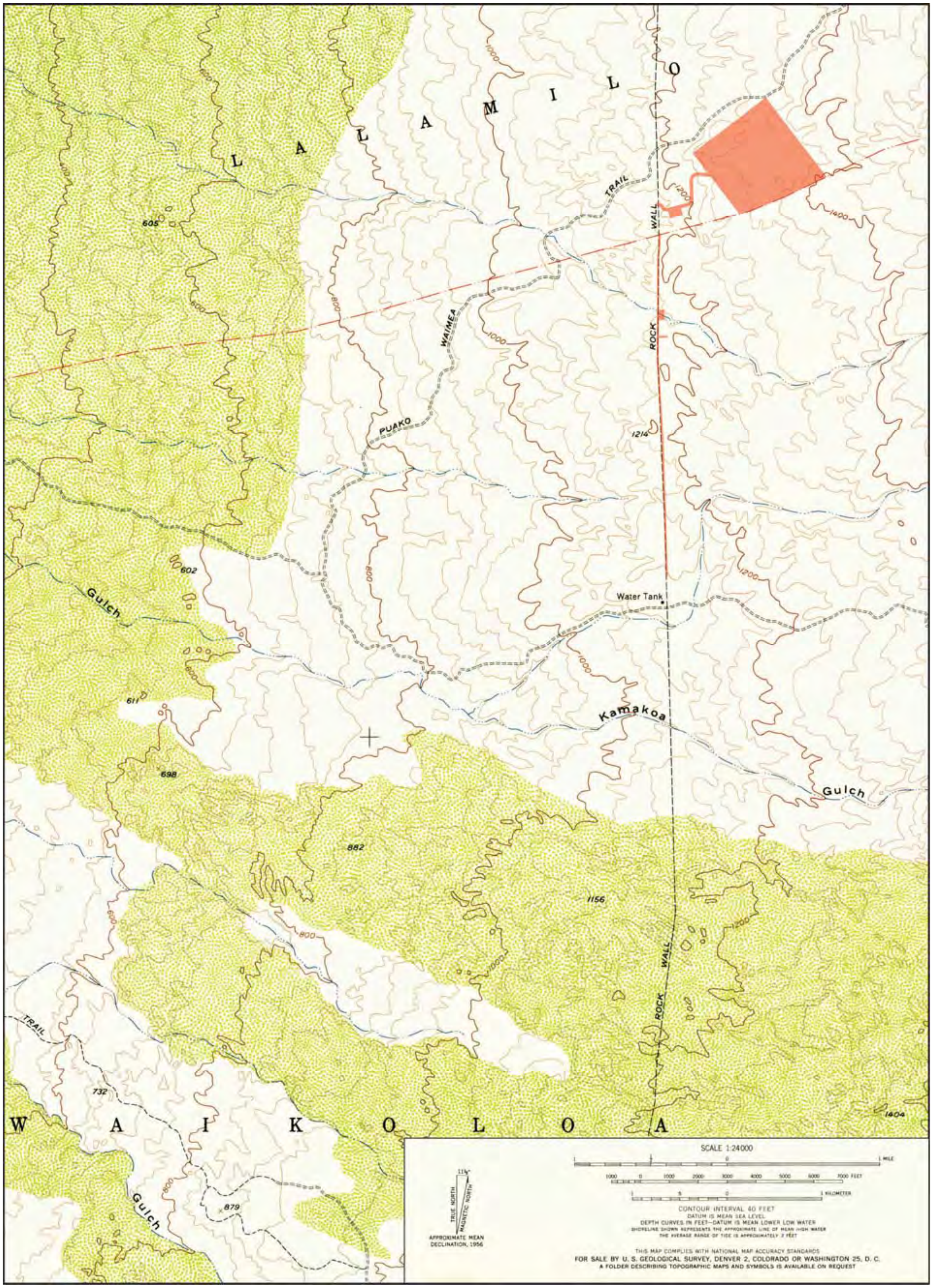

Figure 26. Portion of the 1956 U.S.G.S. Puʻu Hinai quadrangle showing the current project area (outlined in red).

During the 1980s large resort properties were developed along the coast of Lālāmilo and neighboring lands. The resort developments required water, which necessitated the drilling of wells and the development of a modern water distribution system. Several wells were drilled in the vicinity of the current project area around this time (see Figure 3), and in 1985 the first Lālāmilo Wind Farm was erected as a power source for some of those wells. The wind farm (Figure 27), which was acquired by Hawaii Electric Light Company in 1987, continued to operate for almost twenty-five years, before being removed from the current project area in 2010.

Figure 27. October 17, 2009 aerial view (from Google Earth) of the first Lālāmilo Wind Farm.

PREVIOUS ARCHAEOLOGICAL STUDIES

There have been numerous archaeological studies conducted in the *ahupua'a* of Waikōloa and Lālāmilo in the vicinity of the current project area (Figure 28 and Table 1). Previous studies in these *ahupua'a* have largely concentrated on (1) the resort developments in the coastal areas of Lālāmilo and Waikōloa *ahupua'a*, (2) the intermediate zone of Waikōloa Ahupuaʻa between Queen Kaʻahumanu Highway and Waikōloa Village, and (3) the uplands of Lālāmilo Ahupuaʻa in the vicinity of Waimea Town. A few studies, mostly of small well sites and access corridors (Clark and Rechtman 2005; Rechtman 2003, 2005, 2008a, 2008b, 2008c; Rosendahl 1992a, 1992b) and of the route of the proposed Waimea-Kawaihae Road corridor (Barrera and Kelly 1974; Clark and Kirch 1983), have been conducted within the intermediate *pili* lands of Waikōloa and Lālāmilo *ahupua'a* at more proximate elevations to the current project area; three previous studies (Soehren 1984; Rosendahl 1992a, 1992b; Rechtman 2005) have included portions of the current project area.

Table 1. Previous archaeological-historical investigations in the vicinity of the current project area.

Year	*Author*	*Ahupua'a*	*Type of Study*	*Elevation**
1971	Ching	Waikōloa, Lālāmilo	Survey	140-200
1972	Rosendahl	Waikōloa, Lālāmilo	Salvage	142-200
1972	Bevacqua	Waikōloa	Survey	500-850
1974	Barrera and Kelly	Lālāmilo, Waikōloa	Reconnaissance Survey	10-2600
1978	Yent and Griffen	Lālāmilo	Reconnaissance	0-320
1979	Ching	Lālāmilo	Reconnaissance	2280-2480
1979	Kirch	Lālāmilo, Waikōloa, Kalāhuipuaʻa	Investigations	0-200
1981	Clark	Lālāmilo	Intensive Survey	2280-2480
1983	Clark and Kirch	Lālāmilo, Waikōloa	Investigations	10-2600
1984	Soehren	Lālāmilo	Reconnaissance	1280-1360
1987	Clark	Lālāmilo	Survey	2280-2480
1987	Kennedy	Waikōloa	Reconnaissance	200-490
1990	Burgett and Rosendahl	Lālāmilo	Inventory Survey	0-320
1991	Jensen and Burgett	Waikōloa	Inventory Survey	480-570
1991	Yent	Lālāmilo	Survey	0-320
1992a, b	Rosendahl	Waikōloa	Inventory Survey	1130-1240
1992	Shilz and Shun	Waikōloa	Inventory Survey	150-540
1992	Burgett et al.	Lālāmilo	Survey	
1992	Dunn and Rosendahl	Lālāmilo	Inventory Survey	
1993	Barrera	Lālāmilo	Inventory Survey	2440-2500
1994	Jensen	Lālāmilo	Inventory Survey	0-320
1994	Spear and Chaffee	Makapala to Lālāmilo	Inventory Survey	310-360
2000	Rosendahl	Waikōloa	Inventory Survey	100-190
2002	Moore et al.	Waikōloa	Inventory Survey	200-490
2003	Haun et al.	Lālāmilo	Inventory Survey	2100-2490
2003	Rechtman	Waikōloa	Assessment	1090-1160
2004	Sinoto and Dashiell	Waikōloa	Inventory Survey	550-1200
2005	Clark and Rechtman	Waikōloa	Inventory Survey	1150-1200
2005	Rechtman	Waikōloa	Survey	1130-1240
2006	Rechtman	Waikōloa	Survey	1260-1320
2008a	Rechtman	Lālāmilo	Survey	1180-1240
2008b	Rechtman	Waikōloa	Survey	1260-1320
2008c	Rechtman	Waikōloa	Survey	1200-1270
2010	Rieth and Morrison	Kawaihae, ʻŌuli, Lālāmilo, Waikōloa	Inventory Survey	0-2460
2011	Clark and Rechtman	Waikōloa	Inventory Survey	170-540
2014	Clark et at.	Waikōloa	Inventory Survey	200-530

Feet above mean annual sea level

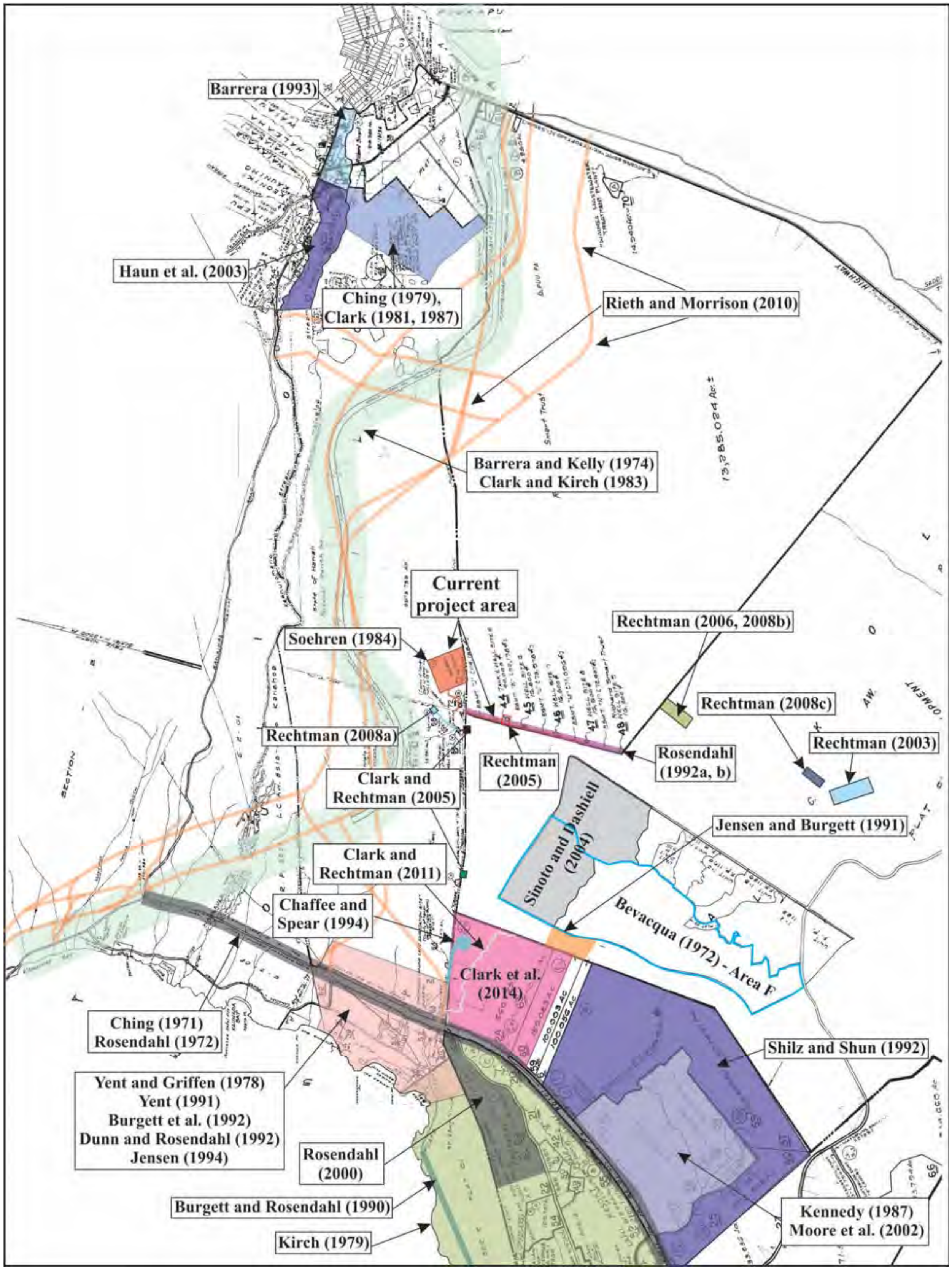

Figure 28. Previous archaeological studies conducted in the vicinity of the current project area.

Archaeological Studies of the Coastal Areas of Lālāmilo and Waikōloa Ahupuaʻa

Collectively, investigations conducted in the coastal portions of Lālāmilo and Waikōloa *ahupuaʻa* (Burgett and Rosendahl 1990; Ching 1971; Jensen 1994; Kirch 1979; Rosendahl 1972; 2000; Yent 1991; Yent and Griffen 1978) have identified a wide range of Precontact and Historic archaeological site types including caves (lava tubes), petroglyphs, cairns, trails, rock and cave shelters, refuge caves, burial caves, burial monuments, a *hōlua* slide, and a large number of features associated with both temporary and permanent habitation such as house platforms, overhangs, terraces, modified outcrops, paved areas, U-shape enclosures, sinkholes, walls, and rubble excavation areas. Coastal and inland (*mauka*/*makai*) trail networks have also been documented during these studies. The trails were used for coastal travel between *ahupuaʻa*, and also for commodities exchange between the coastal areas and the upland agricultural fields and resource areas.

In 1979, the B. P. Bishop Museum published a report entitled *Marine Exploitation in Prehistoric Hawaiʻi* (Kirch 1979) that presented the findings of several phases of archaeological investigation within a roughly 3,841 acre area between Queen Kaʻahumanu Highway and the coast, within the *ahupuaʻa* of Waikōloa, Lālāmilo, and Kalāhuipuaʻa (see Figure 28). Four hundred and forty-nine archaeological features were identified within the study area including petroglyphs, fish ponds, trails, C-shaped structures, U-shaped structures, L-shaped structures, shelter caves, burial caves, storage caves, modified sinks, abrader manufacturing areas, *papamū*, walls, circular structures, enclosures, platforms, midden deposits, paved areas, pits, cairns, and a Historic cemetery (Kirch 1979). More than half of the identified features were situated near the ocean within the land divisions of Lālāmilo and Kalāhuipuaʻa, and were associated with Precontact coastal habitation and resource procurement. The remaining features (n=207) were situated at more inland elevations within Waikōloa Ahupuaʻa, which does not extend to the coast, but were also primarily associated with coastal habitation and resource procurement. Only a few features, consisting of crude constructions related primarily to short-term habitation an *mauka/makai* travel, were reported near Queen Kaʻahumanu Highway at the north end of the area along the Waikōloa/Lālāmilo boundary (Kirch 1979).

Burgett and Rosendahl (1990) conducted an archaeological inventory survey of a 1,000 foot long by 100 foot wide corridor for the proposed location of the Puako Road Extension Corridor near the coast in Lālāmilo Ahupuaʻa within the Kirch (1979) study area (see Figure 28). The primary focus of the survey was to identify the presence and/or absence of any highly significant archaeological sites and features that might prevent the development of the proposed roadway and waterline. As a result of the archaeological investigations performed by Burgett and Rosendahl (1990), twenty-four sites (SIHP Sites 14513 to 14536) containing fifty-one features of various function and integrity were identified within or immediately adjacent to the corridor. All of the documented sites, with the exception of a single petroglyph panel and a *pāhoehoe* excavation/wall of indeterminate function, were deemed to be associated with habitation/temporary habitation. Many of the habitation site complexes that were encountered were comprised of features such as caves, cairns, petroglyphs, terraces, overhangs, pavings, and in one case, a walled sink.

Rosendahl (2000) later conducted an archaeological inventory survey of a roughly 450-acre portion of the Kirch (1979) study area (TMK: (3) 6-8-01:022) located in Waikōloa Ahupuaʻa along the Lālāmilo boundary at elevations ranging from 30 to 230 feet above sea level (see Figure 28). Rosendahl identified thirty archaeological features that he grouped into fourteen sites (SIHP Sites 21974-21987). Most of the identified sites were situated at the northeastern end of the study area nearest to Queen Kaʻahumanu Highway and Puakō Bay. Twenty-one of the recorded features dated to the Historic Period and nine were interpreted as Precontact Period constructions. Most of the Historic Period features, including a network of corrals formed by metal poles, wooden cattle feeders and wooden stanchions, a water pumping facility and a concrete flume, two concrete slabs, a cattle loading chute, a large, bermed enclosure, three collapsed wooden structures, a trash pile, and two metal boxes, were assigned to a single Historic/Modern ranch complex. The remaining Historic Period features were recorded as single feature sites, including three core-filled walls, four stone clearing mounds, and a cart path. The cart path consisted of two parallel alignments of cobbles with a leveled surface between extending in an ENE/WSW direction parallel to the Waikōloa/Lālāmilo boundary. Rosendahl (2000) indicates that this cart path appeared to have provided access from Puakō Bay to an undetermined *mauka* location. The Precontact Period sites recorded by Rosendahl (2000) included three overhang shelters, an enclosure and C-shape, an isolated enclosure (SIHP Site 21980), two surface midden scatters, and a modified outcrop.

Along the eastern edge of the Kirch (1979) and Rosendahl (2000) study areas, Ching (1971) and Rosendahl (1972) examined a corridor for the construction of a Kailua-Kawaihae road corridor (Queen Kaʻahumanu Highway) between Lālāmilo Ahupuaʻa and Hamanamana Ahupuaʻa (in the district of North Kona; see Figure 28). Ching (1971) conducted a surface survey of the entire corridor, which was followed by archaeological salvage excavations at selected locations within the final alignment of highway conducted by Rosendahl (1972). Within the Waikōloa and Lālāmilo portions of the road corridor Ching (1971) and Rosendahl (1972) identified numerous, diverse archaeological feature types, including C-shapes, U-shapes, L-shapes, linear shelters, rectangular shelters, cave shelters, dwelling caves, enclosures, mounds, fire pits, petroglyphs, hunting blinds, *ahu* (cairn), trails, terraces, walls, platforms, and areas of surface midden that were interpreted as having been used for habitation, agriculture, burial, transportation, and recreational purposes during the both the Precontact and Historic Periods. These features were briefly described by Ching (1971) and placed on a map of the overall survey area. Rosendahl's (1972) study focused primarily on defining the nature of the Precontact residential occupation within the corridor and the interrelationship of the features and the various resource zones. Rosendahl suggests that the primary focus of Precontact occupation within the corridor (and by association the barren inland zone) involved the use of temporary shelters by people travelling between the coastal and upland zones, the temporary and extended use of residential sites by people engaged in the collection of coastal resources, and the storage of gear for recurrently used and possessions. Limited dating of materials recovered from the sites suggested primary use from ca. A.D. 1500 through the Historic Period.

North of the Kirch (1979) and Rosendahl (2000) project areas, the Ching (1971) and Rosendahl (1972) survey corridor extends through a 750-acre parcel in coastal Lālāmilo Ahupua'a that was the subject of a phased archaeological study (Burgett et al. 1992; Dunn and Rosendahl 1992; Jensen 1994) conducted by Paul H. Rosendahl, Inc. (PHRI) for the expansion of the Hapuna Beach State Recreation Area (see Figure 8). This area was the subject of previous archaeological investigations conducted by Yent and Griffin (1978), and Yent (1991). The PHRI project was undertaken in three phases beginning with Phase I – survey and initial site identification (Burgett et al. 1992), followed by Phase II – completion of inventory-level fieldwork at sites that required additional evaluation and documentation (Dunn and Rosendahl 1992), and culminating in Phase III – analysis of all recovered cultural materials, including site and feature distributions, as well as description and analysis of recovered cultural material and ecofactual remains (Jensen 1994).

Within the project area, as a result of these studies, 164 sites containing 425 features were identified. The identified feature types included C-shaped, U-shaped, D-shaped and L-shaped alignments, cairns, walls, cleared areas, enclosures, depressions, foundations, hearths, midden scatters, modified outcrops, mounds, overhangs, parallel walls, paved areas, pylons, ramps, remnant terraces, rubble concentrations, trails, and upright stones. Jensen (1994) proposes a range of functional interpretations for these formal feature types, including agriculture, fence line, habitation, hunting blind, indeterminate, marker, military, park maintenance, possible agriculture, possible ceremonial, possible marker, possible military, possible post support, possible temporary habitation, recreation, temporary habitation, trail marker, transportation, and water transportation. In some cases more than one functional interpretation was assigned to a single feature. The predominant functional activities represented by these collective features was temporary habitation, agriculture, habitation, and transportation. Habitation sites were clustered near the shore at Hapuna Bay within the project area, but temporary habitation and agricultural, and by association trail sites, extended into the area *mauka* of Queen Ka'ahumanu Highway along the Waikōloa/Lālāmilo boundary. Jensen relates that, "clearly, exploitation of the area's marine resources, coupled with agricultural activity within gulch areas, while operating from both permanently occupied feature complexes as well as temporarily occupied sites, represent important activities for Native Hawaiian occupants of the region," he notes however, "that a variety of non-subsistence-related, non-indigenous, post-1940's activities are also represented among the project area's cultural resource base" (1994:23).

Archaeological Studies of the Intermediate Zone of Waikōloa Ahupua'a between Queen Ka'ahumanu Highway and Waikōloa Village

Extensive archaeological survey of the intermediate zone of Waikōloa Ahupua'a between Queen Ka'ahumanu Highway and Waikōloa Village has occurred. Previous studies conducted in this area have generally included large land areas that contain few archaeological sites (Bevacqua 1972; Chaffee and Spear 1994; Clark and Rechtman 2011; Clark et al. 2014; Kennedy 1987; Moore et al. 2002; Schilz and Shun 1992; Sinoto and Dashiell 2004). The findings of the previous studies agree that the dry, intermediate inland areas of Waikōloa *ahupua'a* were not extensively utilized during Precontact times for habitation related purposes, but were an area where small scale resource procurement was conducted on a limited basis.

Kennedy (1987) conducted an archaeological reconnaissance survey of TMKs: (3) 6-8-001:036, 038, and 039, encompassing roughly 1,000 acres within Waikōloa Ahupua'a that extend inland from Queen Ka'ahumanu Highway (see Figure 28). As a result of the Kennedy study only one site, consisting of a shallow rock shelter, an *ahu*, and a low wall, was identified. Kennedy (1987) noted the presence of a single *'opihi* shell at the site and modern debris, but given the reconnaissance nature of the survey, did not investigate further. Moore et al. (2002) later conducted an archaeological inventory survey of this same project area (see Figure 28), identifying ten archaeological sites containing a total of thirteen features (SIHP Sites 22509-22518). The recorded sites included the rock shelter previously recorded by Kennedy (1987), seven C-shaped walls with associated *ahu*, four independent *ahu* (three of which were grouped together), and a stone covered hearth. With the exception of the individual *ahu*, which were interpreted as demarcating Historic pasturelands, the recorded sites were thought to have been "utilized for temporary habitation during the pre-Contact Period with the utilization of some sites potentially extending into the early post-Contact Period" (Moore et al. 2002:i). A radiocarbon sample obtained from the rock shelter previously recorded by Kennedy (1987) returned a date of A.D. 1480 for initial utilization of the site.

Schilz and Shun (1992) conducted an archaeological survey and evaluation of approximately 3,000 acres extending inland from Queen Kaʻahumanu Highway in Waikōloa Ahupuaʻa (TMKs: (3) 6-8-01:025, and 036 to 042) that encompassed the area earlier surveyed by Kennedy (1987) and later by More et al. (2002) (see Figure 28). The 1,000 acre area previously surveyed during by Kennedy (1987) was not re-examined, but within the 2,000 acre area surrounding it Schilz and Shun (1992) identified only a single archaeological site consisting of a lava tube containing human skeletal remains (SIHP Site 15033). Besides this site, Schilz and Shun (1992) noted twelve additional features in the overall survey area (cairns, wall shelters, rock mounds, and C-shapes) that were interpreted as modern and were not assigned SIHP site numbers. Regarding the C-shapes, of which they found four, Schilz and Shun noted that the rough enclosures appeared to be "hunters' blinds with no deposits of any kind" (1992:21).

To the north of the Shilz and Shun (1992) study area Clark et al. (2014) conducted an archaeological inventory survey of roughly 810 acre area (TMKs: (3) 6-8-01:024 and 060) in Waikōloa Ahupuaʻa that extends inland from Queen Kaʻahumanu Highway along the Lālāmilo boundary (see Figure 28). Archaeological inventory surveys of two corridors across this property had previously been conducted by Chaffee and Spear (1994) and Clark and Rechtman (2011). Chaffee and Spear (1994) identified two archaeological sites (SIHP Sites 19777 and 19778) within the Clark et al. (2014) study area, both surface scatters of shell midden. The shell scatters were interpreted as rest stops (Precontact temporary habitation areas) utilized by travelers along a trail route that once followed the Lālāmilo/Waikōloa boundary between the coastal settlement zone and the inland agricultural zone. No trial route or surface architecture was identified near either site, and a shovel probe excavated at Site 19777 revealed the absence of any subsurface cultural deposit. The marine shell fragments from the surface of both sites were collected. Clark and Rechtman (2011) identified five archaeological sites (SIHP Sites 28682 to 28686) within the Clark et al. survey area. The recorded sites included a portion of the old Puakō Sugar Plantation's wooden flume from Waikōloa Stream, two rock piles that seemed to mark the former route of a World War II-era communications line, a Historic dike constructed for flood-control purposes, a circular enclosure containing a rock pile that may have been a Historic hunting blind or skeet shooting area, and a C-shaped enclosure that may have been the location of a Precontact shelter. All of these previously recorded sites, along with a portion of Site 21976, a Historic cart path, previously recorded by Rosendahl (2000), were incorporated into the findings of the Clark et al. (2014) study.

Three of the sites recorded Clark and Rechtman (2011) – Sites 28682, 28683, and 28684, the old Puakō flume, the World War II-era communications line, and a Historic dike/ditch complex – were expanded by Clark et al. (2014) to include additional features newly identified within the larger project area. Site 21976, originally recorded by Rosendahl (2000) as a Historic cart road, was reinterpreted as a bulldozed roadway created during the early to mid-twentieth century. Sites newly identified by Clark et al. (2014) (Sites 30071 to 30083) included two C-shaped enclosures interpreted as Precontact Period shelters, three Precontact Period habitation complexes, two modified outcrops interpreted as Precontact Period shelters, a rock pile and modified outcrop that appear to have functioned as a Historic survey station, a short wall interpreted as a Precontact Period shelter, a surface scatter of marine shell, a rock pile with an associated trail segment that may have been a rest area along an old trail route, a complex of features used for Historic Period habitation and agricultural purposes, and a complex of eighty-nine twentieth century hunting blinds built by bird hunters. The Precontact Period sites, mostly indicative of short-term or recurrent habitation, were concentrated in the northern portion of the project area near the Lālāmilo boundary. Clark et al. (2014) suggest, like Chaffee and Spear (1994) before them, the presence of these site types in that area is evidence of the route of an old trail that once extended along *ahupuaʻa* boundary.

East of the Clark et al. (2014) study area in Waikōloa Ahupuaʻa, Jensen and Burgett (1991) conducted an archaeological inventory survey of an approximately 80 acre portion of TMK: (3) 6-8-002:019 (see Figure 28). As a result of that survey, five archaeological sites (SIHP Sites 15066-15070), containing a total of twenty-two features, were recorded. The features included three boulder alignments (possible check dams) within a gulch, terraces on the northwestern bank of the gulch, a wall, and seventeen hunting blinds. Jensen and Burgett (1991) interpreted the boulder alignments and terraces within the drainage channel as potential Precontact Period features, suggesting that intermittent water flow may have been channeled and stored to provide water for agricultural pursuits along the gulch edges. The low wall, which extended along a meandering course across a flat area between two knolls, was described as being similar to a wall excavated by Rosendahl (1972) in the lower portion of Waikōloa Ahupuaʻa, and was also interpreted as having a possible agricultural function. The seventeen hunting blinds consisted of crudely constructed stacked stone structures that were interpreted as modern features.

Bevacqua (1972) conducted an archaeological survey of portions of Waikōloa Ahupuaʻa in order to determine the nature and distributions of archaeological sites within areas that were slated for development at that time. Seven large areas dispersed throughout the *ahupuaʻa* were examined (Areas A-G), the most proximate being Area F, located to the east of the Jensen and Burgett (1991) study area within the Waikōloa Village development area (see Figure 28). Bevacqua (1972) recorded total of twenty-two sites within the seven survey areas. Five sites (Sites 17-21) were identified in Area F including a circular stone enclosure, an isolated C-shaped shelter, two cairns, and a complex consisting of four C-shaped shelters, a rectangular enclosure, four walls, and a cairn. Sinoto and Dashiell (2004) conducted an archaeological inventory survey of TMK: (3) 6-8-02:022 encompassing roughly 860 acres within the Waikōloa Village development area (see Figure 28), a portion of which was previously surveyed by Bevacqua (1972). Sinoto and Dashiell (2004) reported no archaeological findings as a result of their study.

Archaeological Studies of the Intermediate Zone of Waikōloa and Lālāmilo Ahupuaʻa in the Vicinity of the Current Project Area

Previous archeological studies conducted within the intermediate *pili* lands of Waikōloa and Lālāmilo *ahupuaʻa* at proximate elevations to the current project area (see Figure 28) have typically included small well parcels and access corridors (Clark and Rechtman 2005; Rechtman 2003, 2005, 2008a, 2008b, 2008c; Rosendahl 1992a, 1992b). The two notable exceptions are the proposed Waimea-Kawaihae Road corridor that passes to the north of the current project area through the center of Lālāmilo Ahupuaʻa, extending from the coast in the *ahupuaʻa* of Kawaihae to the Town of Waimea; this corridor has been subject to extensive archaeological study (Barrera and Kelly 1974; Clark and Kirch 1983); and the more recent study of the Kawaihae Road Bypass Corridors (Rieth and Morrison 2010). Three previous archaeological studies, one of the old Lālāmilo Wind Farm (Soehren 1984) and two of the Parker wells (Rosendahl 1992a, 1992b; Rechtman 2005) have included portions of the current project area. Although few in number, the most common feature types reported at proximate elevations to the current project area are C-shaped shelters and cairns, along with Historic military and ranching features.

Within the current project area Soehren (1984) conducted an archaeological reconnaissance survey of an approximately 80 acre area (Lot A of the Lālāmilo survey area) for the construction of the first Lālāmilo Wind Farm (see Figure 28). In northwestern corner the survey area Soehren (1984) identified evidence of World War II era and possibly nineteenth century ranching use, in the form of surface debris and a stacked stone alignment; to the east of this he noted the presence of a cairn and an associated marine shell scatter; and to the west he mentioned a stone wall cattle fence that was to be breached by the wind farm access road. The reconnaissance report prepared by Soehren, which did not include a feature location map, is reproduced in its entirety below:

> The area examined contains approximately 80 acres and lies between 1280 and 1360 feet above sea level, 4.5 miles inland from Puako Bay along the southern boundary of Lalamilo. The new Waimea-Kawaihae highway will pass about one-half mile to the north. This region is in the Vegetation Zone IV as described by McEldowney, (1983:410): “mixed grass and shrub communities (10 to 90 cm.) containing naturalized introduced species and some native shrubs adapted to grazing…” In aboriginal times, before cattle were introduced, these lands were marginal to the Hawaiian economy, serving primarily as a reservoir of natural products such as pili grass and birds.
>
> Evidence of human presence at the site is accordingly scarce. The presence of military personnel, presumably during World War II, is indicated by a few weathered boards, rusted food cans and field telephone wire on a prominent knoll at the western edge of the site. Some field stones have been roughly stacked into an alignment one fathom long, two stones high. The knoll is located at the northwestern end of line “A” and is identified by the spot elevation 1308.0 on the topographic map of the site. A scattering of broken cowry shells on the eastern slope of the knoll probably derived from the “field rations” of native Hawaiian cowboys during the nineteenth century. The knoll commands a good view in all directions and would be ideal when watching or searching for cattle.
>
> A similar scattering of broken cowry shells was found about 500 feet east on another slight knoll, identified by the spot elevation 1326.5 and windmill site B13. On top of the knoll is a roughly made stone cairn about three feet in diameter and 1.5 feet high.
>
> No other archaeological or historic features were observed in the project area and those found warrant no further consideration.
>
> Access to the wind farm site is proposed along an existing ranch jeep trail which roughly parallels the wire fence marking the boundary between Lalamilo and Waikoloa. A cattle guard will probably

> be installed where the road crosses the stone wall cattle fence at about 1150 feet elevation. This well-maintained fence is a prominent landmark which extends for several miles north-south across the lands of Ouli, Lalamilo and much of Waikoloa.
>
> While it might be regarded as an historic feature, an additional breach should not adversely affect its significance. The access road was not examined during this survey but it is unlikely to contain undisturbed archaeological features of significance. (Soehren 1984:1-2)

Rosendahl (1992a) conducted an archaeological inventory survey of a roughly 2,800 meter long by 40 meter wide corridor across a portion of TMK: (3) 6-8-01:001 (see Figure 28) that included Easements J, K, L, and M of the current Waikōloa survey area (where Parker wells No. 1, 2, 3, and 4 are currently located). Rosendahl, indicating that the "area had been extensively disturbed historically", did not identify any significant cultural resources within the corridor, although he did note the presence of a cattle wall along with "bulldozer berms, and recent trash" (Rosendahl 1992a:5). Don Hibbard of DLNR-SHPD, citing an earlier correspondence that indicated that the proposed wells were "adjacent to a long historic boundary wall (Site No. 9012) that divides Waikoloa and has been determined to be significant under criterion 'a' or for its association with events important to broad patterns in Hawaii's history" (Hibbard Letter dated July 1, 1991 on file at SHPD), did not concur with Rosendahl's findings. In response to the letter, Rosendahl (1992b) conducted additional historical research on the well sites, and as a result construction was allowed to proceed on two of the proposed well (Parker wells No. 1 and 2) and the paved roadway along the *mauka* edge of the Site 9012 wall (Hibbard Letter dated August 26, 1994 on file at SHPD).

Rechtman (2005) later inspected an area within the Rosendahl (1992a) survey corridor for the proposed development of Parker well No. 3 and the stub road leading to it (part of Easement J of the current Waikōloa survey area). Rechtman (2005) also reporting no findings, and requested that DLNR-SHPD issue a written determination of "no historic properties affected" for the well site. Several other archaeological studies conducted at well sites near the current project area (Rechtman 2003, 2005, 2008a, 2008b, and 2008c; see Figure 28) have also reported no findings. At the most proximate of these well sites (Lālāmilo Well E), however, Rechtman indicates that:

> . . . three small enclosures were noted outside the corridor near the existing Well D. Based on the presence of broken glass, bullets and bullet shell casings, the enclosures appear to be U.S. Military WW II era training related features. All three features are located along the upper edge of a south facing slope, spaced four to fifteen meters west (outside) of the survey area. They were likely constructed by U.S. marines in the 1940s as defensive positions during training exercises. (2008a:3)

Clark and Rechtman (2005) conducted an archaeological inventory survey of two locations (4.4 acres) for the construction of two water tanks situated within Waikōloa Ahupuaʻa along the boundary with Lālāmilo Ahupuaʻa (see Figure 28). Both of the survey areas, one at 610 feet above sea level and another at 1,103 feet above sea level, were situated on TMK: (3) 6-8-02:019 to the west of the current project area. As a result of the study, a single archaeological site (SIHP Site 24396), consisting of two features, was recorded at the proposed location of the lower water tank. Site 24396 consisted of a C-shaped enclosure (Feature A) and a small rock pile (Feature B) situated approximately fifty-five meters apart on gently west sloping, grassy terrain. Subsurface testing at Feature A revealed no cultural material. Based on the formal attributes of the C-shape, Clark and Rechtman (2005) suggest that it may have functioned as a Precontact temporary habitation feature constructed by individuals utilizing the local resources or simply passing through the area on a trail. Feature B was interpreted as a cairn that may have marked a former boundary or trail route. Several metal fragments (shrapnel) and a number of cartridge casings left by U.S. soldiers who used the area for training maneuvers during World War II were also noted on ground surface in the vicinity of Site 24396.

The Mudlane-Waimea-Kawaihae Road Corridor, which passes to the east of the current project area, was the subject of an archaeological survey conducted by Barrera and Kelly (1974), subsequent feature excavations and historic studies conducted by Clark and Kirch (1983) (see Figure 28). As result of the Barrera and Kelly (1974) fieldwork 4,561 archaeological features were identified, with the majority situated along the coastal margin of Kawaihae and in the uplands of Lālāmilo. Archaeological investigations in Section 2 of the proposed road, a roughly 600 meter wide corridor extending from an elevation of 145 meters above sea level in ʻŌuli Ahupuaʻa to 620 meters above sea level in Lālāmilo Ahupuaʻa and passing the current project area, revealed the presence of sixty-four sites containing 381 features (Clark and Kirch 1983:138-179). Three main categories of features were identified at these sites including cairns, shelters, and alignments. Clark and Kirch (1983) indicate that the majority of structures in Section 2 appeared to have been built as defensive positions and wind shelters during World War II. Only a very few sites were located in the middle zone of Section 2 at elevations proximate to the current project area; subsurface testing of features within this zone revealed that all were likely of modern or military origins. Except for one rock wall at 1,200 feet above sea level (SIHP Site 9012), none of the archaeological features were still in use. Survey of areas outside of the road corridor indicated that Hawaiian occupation of the middle zone may have been limited to the banks of Waikoloa Stream and along Wai‘ula‘ula Gulch. Most of the features in Section 2 were concentrated in the upland zone nearest the more agriculturally productive soils. Radiocarbon dates indicated that Hawaiian use of the upland area may have begun as early as A.D. 1600 and lasted until ca. 1800-1850.

Rieth and Morrison (2010) conducted an archaeological inventory survey of a roughly 1,548 acre area of potential road corridors extending from Māmalahoa Highway near Waimea Town to Highways 19 and 270, traversing Waikōloa, Lālāmilo, ‘Ōuli, and Kawaihae *ahupua‘a* (see Figure 28). In the general vicinity (at the same elevation) of the current study area they identified nine sites, eight of which were described as single mounds of undetermined age and function and the ninth was the prominent stone wall (Site 9012) that extends north/south through the greater area. Like the earlier Clark and Kirch (1983) study, Rieth and Morrison (2010) indicated that the mid-elevation area of Lālāmilo has a relatively low density of archaeological resources.

Archaeological Studies of the Uplands of Lālāmilo Ahupua‘a in the Vicinity of Waimea Town

In the uplands of Lālāmilo Ahupua‘a near the Town of Waimea at elevations ranging from roughly 750 and 900 meters (2,460 to 2,950 feet) above sea level previously conducted archaeological studies (Barrera 1993; Barrera and Kelly 1974; Ching 1979; Clark 1981, 1987; Clark and Kirch 1983; Haun et al. 2003, 2010) have documented an agricultural complex with an extensive network of fields fed by a system of irrigation ditches running from the Waikoloa and Kahakohau Streams. The field complex is characterized by spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along (Waikoloa Stream) at the eastern margins of the system. Here more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Kirch surmises that the fields were perhaps intermittently irrigated, and that “simple furrows” were utilized to “direct water across the sloping field surfaces,” as “the capacity of the ditches was insufficient to have kept all fields constantly watered, and some method of rotation must have been practiced” (1985:231). In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke*, *mamaki*, plantains, bananas, sugarcane, coconuts, and *hala* (Haun et al. 2003). Although most of the archaeological studies of these fields have concentrated on the Lālāmilo section of the system, archaeological survey of the Mudlane-Waimea-Kawaihae Road Corridor by Barrera and Kelly (1974) and subsequent feature excavations and historic studies by Clark and Kirch (1983) demonstrate that the field system also extends into the uplands of Waikōloa Ahupua‘a.

Ching (1979) conducted an archaeological reconnaissance survey of a 295 acre property for the proposed development of the Lālāmilo Agricultural Park, situated to the northeast of the current project area (see Figure 28). The property was also the subject of later archaeological investigations by Clark (1981 and 1987). As a result of the fieldwork conducted by Ching (1979) and Clark (1981, 1987), a total of 284 archaeological sites and 2,125 features were identified and recorded. The majority of features encountered during these investigations were agricultural in nature (n=1,739). Habitation (permanent and temporary) features were the next most prevalent, and twenty-seven burial features were also identified. Twenty eight of the features in the project area related to Historic period ranching activities. Barrera (1993) conducted an archaeological inventory survey of a 50 acre parcel located adjacent to the Ching 1979 and Clark (1981, 1987) study area (see Figure 28). As a result of the survey, Barrera (1993) recorded a single archaeological site containing thirty-three agricultural features.

Most recently, Haun et al. (2003) conducted an archaeological inventory survey of a roughly 266-acre Department of Hawaiian Home Lands (DHHL) parcel located to the northeast of the current project area in Lālāmilo Ahupua’a (see Figure 28). As a result of the survey, seventy-six archaeological sites containing 819 features were identified and recorded. The sites were interpreted as primarily Precontact in age, with only six possibly dating to the Historic Period. Formal feature types encountered during fieldwork included terraces, mounds, enclosures, field boundaries, stone walls, irrigation ditches, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, concrete piers, and a small amount of isolated objects (Haun et al. 2003). Terraces were the most predominant of the identified features, followed by mounds. Feature functions varied considerably, however, Haun et al. (2003) noted that features relating to agriculture were the most common in the project area, followed closely by features pertaining to permanent habitation. In addition, a total of eighteen burials were identified within the project area, seven of them present in an existing Historic cemetery. The remaining eleven burials were identified during subsurface excavations at features that were determined to have a high potential for yielding human remains. Further work was not recommended for seven of the sites encountered during the study, as they were deemed to have been adequately documented. However, Haun et al. (2003) suggest that data recovery might be an appropriate mitigation measure for the remainder of the sites, excluding the burials and a portion of an agricultural complex (Site 22632) which were recommended to be preserved in place.

3. PROJECT AREA EXPECTATIONS

Given the review of the previous archaeological research, historical documentary research, and settlement patterns for the South Kohala District presented above, a set of archaeological expectations for the current study area are offered. The location and the specific history of the project area land use, the results of the background research, and a review of archaeological work previously conducted in the general vicinity of the current study area, which is located in a dry intermediate zone of Lālāmilo and Waikōloa *ahupuaʻa* between the more intensively utilized coastal and upland resource/habitation areas, suggests that archaeological features will be related primarily to the collection of specific resources (such as *pili* grass and birds) and travel between the coastal and upland areas during the Precontact to early Historic Periods, and ranching and military use during the later Historic Period.

Based on radiocarbon results, Rosendahl (1972) has suggested that widespread use of the coastal lands in the vicinity of the project area may have occurred as early as ca. A.D. 1500 and Clark and Kirch (1983) have suggested that the upland areas were intensively utilized as early as A.D. 1600. Very little archaeological evidence for the initial use of the intermediate lands between these two areas has thus far been discovered, but an old trail from Puakō to Waimea is known to have followed the Waikōloa/Lālāmilo *ahupuaʻa* boundary. Previous archaeological studies conducted adjacent to this boundary have not documented physical evidence of the actual trail route, but Chaffee and Spear (1994) and Clark et al. (2014) have reported marine shell scatters and temporary habitation features near the *ahupuaʻa* boundary *makai* of the current project area that suggest its former presence. Temporary shelters typically take the form of small C-shaped enclosures used for overnight stays or for respite from the elements. Clark and Kirch (1983) who documented several potential shelters at proximate elevations the current project area within the Mudlane-Waimea-Kawaihae Road Corridor, indicate that subsurface testing revealed that all were of modern military origins and were likely built as defensive positions and wind shelters during World War II.

Soehren (1984), who conducted an archaeological reconnaissance survey of an approximately 80 acre parcel included in the current project area (Lot A of the Lālāmilo survey area), identified evidence of World War II era and possibly nineteenth century ranching use, in the form of surface debris and a stacked stone alignment in the northwestern corner of Lot A. He also noted the presence of a cairn and an associated marine shell scatter, and mentioned a stone wall cattle fence that was to be breached by the wind farm access road. Since the Soehren (1984) study, however, a large portion of the 80 acres has undergone mechanical disturbance for the construction of the first Lālāmilo Wind Farm. Rosendahl (1992a) conducted an archaeological inventory survey of Easements J, K, L, and M of the current Waikōloa survey area and noted the presence of the same cattle wall, but did not record any archaeological sites, indicating that the “area had been extensively disturbed historically” (Rosendahl 1992a:5). The area surveyed by Rosendahl (1992a) has since been developed with a paved road and Parker wells No. 1, 2, 3, and 4. The cattle wall noted by Soehren (1984) and Rosendahl (1992a, 1992b) was originally recorded by Clark and Kirch (1983) as SIHP Site 9012. It was built during the reign of Kamehameha I in response to the growing number of free ranging cattle in the area, and was designed to keep the cattle in the coastal portion of the study *ahupuaʻa*, away from the agricultural fields on the Waimea side (Rosendahl 1992b). The wall was referred to as the “Pā of Kauliokamoa” after the *konohiki* who oversaw its building (Wolforth 2000:4).

It is expected, given the results of previous archaeological studies conducted within the current project area combined with the extent of previous development that has occurred, that archaeological sites will be few in number and, with the exception of the aforementioned rock wall (SIHP Site 9012), will be limited to the undisturbed portions of Lot A of the Lālāmilo survey area. Archaeological features in this area are expected to be related to the Historic military and possible ranching use of the general project lands (Soehren 1984), evidence of a former trail route or boundary markers could also be found in undisturbed areas next to the fence along the southern edge of Lot A adjacent to the Waikōloa Ahupuaʻa boundary. Easement J of the Lālāmilo survey area is known to have been nearly completely graded in the past and is not expected to contain archaeological features. Nor are any sites expected in the area previously surveyed by Roasendahl (1992a) along the *mauka* edge of the existing paved road within the Waikōloa survey area. The Site 9012 rock wall still functions as a cattle barrier and has been previously recommended for preservation by DLNR-SHPD; only a small portion of this wall, situated at the western end of Easement J of the Lālāmilo survey area, where a gate was erected across the former Lālāmilo Wind Farm access road is expected to be within the current project area.

4. FIELDWORK

Surface survey and site recording for Lālāmilo Wind Farm Repowering Project was conducted on March 19 and 20, 2014, by Ashton K. Dircks Ah Sam, B.A., Owen F. Moore, M.A., Genevieve L. Glennon, B.A., and Matthew R. Clark, B.A., under the direction of Robert B. Rechtman, Ph.D.

METHODS

Fieldwork included a visual inspection of the surface of the Lālāmilo and Waikōloa survey areas, and detailed site recordation. Within the Lālāmilo survey area fieldworkers walked northwest/southeast transects across Lot A (78.081 acres), beginning in the southeastern corner, spaced at twenty meter intervals; and along both edges of the existing access road within Easement J (1.957 acres) to a distance of 10 meters beyond the graded roadway. Within the Waikōloa survey area fieldworkers walked the eastern (*mauka*) edge of the existing paved roadway within Easements J, K, L, and M to a distance of ten meters spaced at five meter intervals. The entire study area was easily accessible, and the ground surface visibility was excellent. The survey area, the archaeological features, and any significant landforms were plotted on a scaled map of the project area using a Garmin HCx handheld GPS device (set to the UTM NAD 83 datum). Temporary site numbers were assigned to the encountered archaeological features in sequential order as they were recorded (T-1, T-2, T-3, etc.). Isolated or stand-alone features were assigned their own temporary site numbers, as were groups of features that appeared interrelated based on proximity, form, and presumed age. The features of multi-component temporary sites were assigned alphabetical feature designations (A, B, C, etc.). Each temporary site identified within the project area was marked with a metal site tag containing the temporary site number, the date the site was recorded, and the recorder's initials. After being cleared of vegetation the temporary sites and features were mapped in detail (using a measuring tape and compass), photographed (both with and without a meter stick and north arrow for scale and orientation), and described using standardized site record forms. No subsurface testing was conducted during the current study.

FINDINGS

As a result of the archaeological inventory survey of the Lālāmilo Wind Farm Repowering Project three Historic Period archaeological sites were identified and recorded (Table 2). The sites include a portion of a rock wall, the wall of Kauliokamoa (SIHP Site 9012), that extends across the *ahupua'a* of Lālāmilo and Waikōloa and is said to have been constructed at the command of Kamehameha I, a complex of stone features with associated debris that indicates use as a World War II era military encampment (SIHP Site 30109), and a complex of five cairns marking the boundary between Lālāmilo and Waikōloa *ahupua'a* (SIHP Site 30110). Sites 30109 and 30110 are located within Lot A of the Lālāmilo survey area, Site 30109 is in the northwest corner and Site 30110 along the southeast boundary, and Site 9012 is present at the western end of Easement J of the Lālāmilo survey area (Figure 29). Site 9012 also extends along the western edge of Easements J, K, L, and M for the entire length of the Waikōloa survey area, but the wall is located *makai* of the existing paved road, and is not within the area examined for the current study. The *mauka* edge of the paved road within the Waikōloa survey area has been completely disturbed by bulldozing to a distance of more than six meters (20 feet), and no archaeological resources of any kind were observed (confirming the findings of the earlier studies conducted by Rosendahl 1992a and Rechtman 2005). Several fragments of marine shell were identified along the edges of the existing access road within the Easement J portion of the Lālāmilo survey area, but these fragments appear to be washing down the steep slope from Site 30109, which itself contains a fairly substantial surface scatter of marine shell.

Table 2. Archaeological sites recorded during the current inventory survey.

*SIHP #**	*Site Type*	*Site Function*	*Age*	*Features*
9012	Rock wall	Ranching	Historic	1
30109	Complex	World War II military encampment	Historic	9
30110	Cairn complex	Boundary marker	Historic	5

***SIHP site numbers are preceded by the state, island, and U.S.G.S. quad prefix 50-10-11.**

The three archaeological sites identified within the Lālāmilo Wind Farm Repowering Project Area (SIHP Sites 50-10-11-9012, 30109, and 30110) are described in detail below. Their locations relative to one another, the project area, parcel, and *ahupua'a* boundaries are shown in Figure 29.

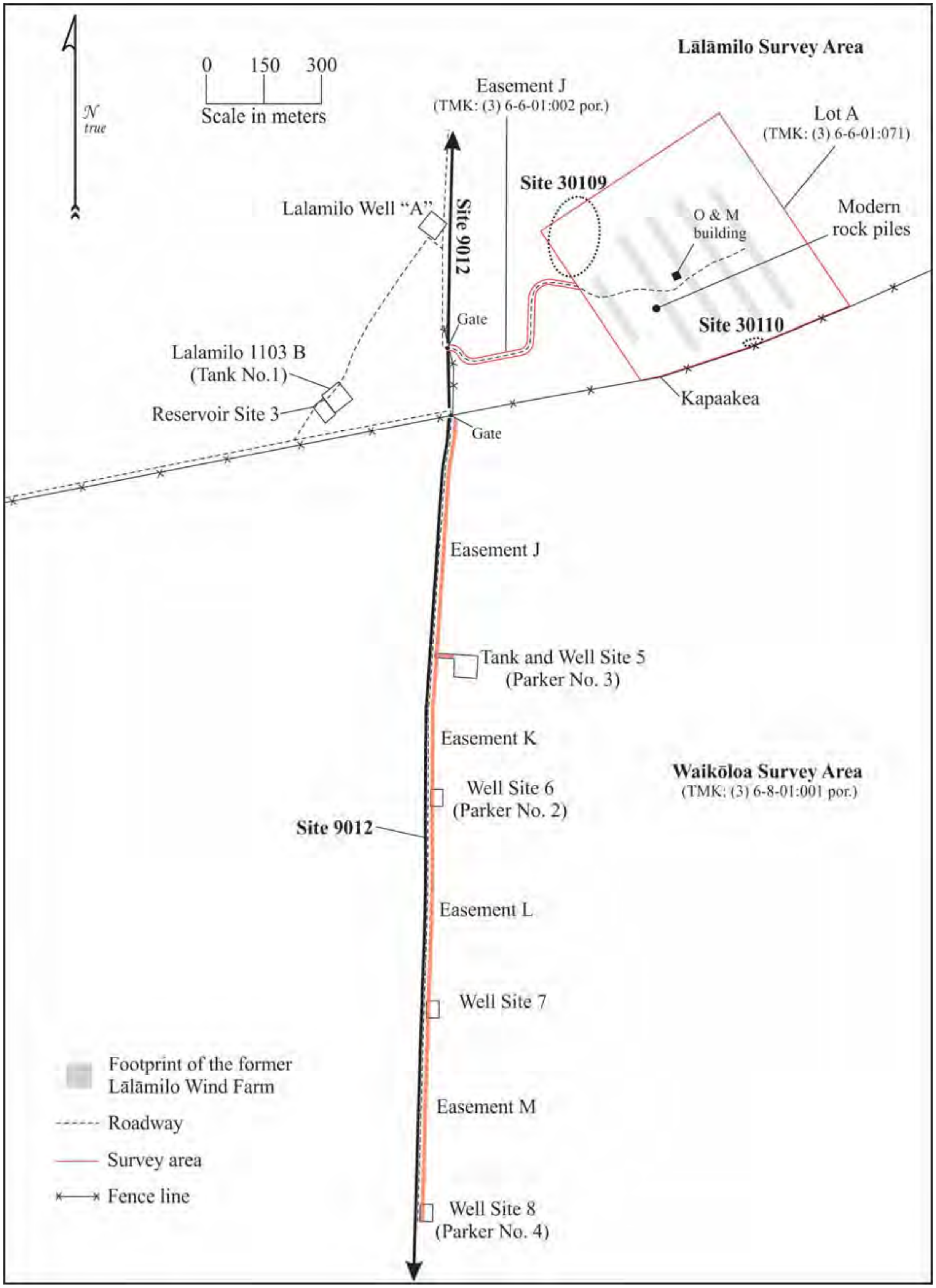

Figure 29. Project area plan view.

Site 30109 was first identified by Soehren (1984) as the World War II era debris, marine shell, and stacked stone alignment “located at the northwestern end of line ‘A’ and is identified by the spot elevation 1308.0” (1984:1). A scattering of marine shell and cairn described by Soehren as being “500 feet east [of Site 30109] on another slight knoll, identified by the spot elevation 1326.5 and windmill site B13” (1984:1), was not relocated and is presumed to have been destroyed during the construction of the original wind farm (the location described by Soehren has been bulldozed flat). Soehren (1984) did not identify Site 30110, nor did he mention two small rock piles located in the southwestern portion of Lot A, adjacent to a bulldozed swath of land where “Line B” of the former wind farm once stood. These two rock piles (recorded as Site T-3, but determined to be modern constructions, and therefore not assigned an SIHP site number), are spaced 20 meters apart from each other within an area that has been impacted by mechanical clearing (see Figure 29). The southern rock pile, constructed of roughly twelve small to large loosely piled cobbles, measures 1.6 meters by 1.2 meters by 32 to 41 centimeters tall (Figure 30). The northern rock pile, constructed of roughly ten small to large loosely piled cobbles, measures 1.5 meters by 1.2 meters by up to 50 centimeters tall (Figure 31). The rocks used in the construction of both of the rock piles exhibit signs of mechanical scarring, and the ground surface in their vicinity is littered with modern wind farm debris, indicating that both piles are likely modern constructions related to wind farm activities that were not present at the time of the Soehren (1984) study.

Figure 30. Southernmost of the two modern rock piles identified within Lot A of the Lālāmilo survey area, view to the north.

SIHP Site 9012

Site 9012 is a Historic Period rock wall that extends through the Lālāmilo survey area at the western end of Easement J (Figure 32). The wall also extends along the western edge of Easements J, K, L, and M for the entire 2.1 kilometer length of the Waikōloa survey area (see Figure 29), but is located *makai* of the existing paved road, and is not within the area examined for the current study (Figure 33). Site 9012, which was first assigned its SIHP designation by Welch (1983), extends across both Lālāmilo and Waikōloa *ahupuaʻa* for several miles at elevations ranging from 1,100 to 1,200 feet above sea level, and is oriented roughly north/south. An approximately 15 meter long section of Site 9012, where a gate in the wall provides access to the existing road within Easement J of the Lālāmilo survey area, is present within the current project area. A gravel road follows the western edge of the wall, and a wire fence line crosses it within the project area (Figure 34). The sections of the wall, on either side of the gate, are mostly intact, but do exhibit some areas of collapse. At intact sections the wall averages 0.6 to 1 meters wide and has heights varying from 1 to 1.2 meters (Figure 35 and Figure 36).

Figure 31. Northernmost of the two modern rock piles identified within Lot A of the Lālāmilo survey area, view to the northwest.

Figure 32. SIHP Site 9012, wall extending across the easement J portion of the Lālāmilo survey area, view to the south.

Figure 33. SIHP Site 9012, wall along the *makai* edge of the existing road within Easement L of the Waikōloa survey area, view to the north.

Figure 34. SIHP Site 9012, wall within Easement J of the Lālāmilo survey area to the north, view to the north.

Figure 35. SIHP Site 9012, top surface of wall, view to the north.

Figure 36. SIHP Site 9012, intact western edge of the wall, view to the east.

Boundary testimony for Waikōloa Nui Ahupuaʻa recorded in 1865, indicates that this wall was built during the reign of Kamehameha I in response to the growing number of free ranging cattle in the area. The wall was designed to keep the cattle in the coastal portion of Waikōloa/Lālāmilo/ʻŌuli *ahupuaʻa*, and away from the agricultural area on the Waimea side (Clark and Kirch 1983). It was referred to as the "Pā of Kauliokamoa" after the *konohiki* who oversaw its building (Wolforth 2000:4). According to McEldowney (1983), the wall location also corresponds to the boundary between the vegetative and climatic regimes associated with the barren *pili* lands and the more fertile *kula* lands. The wall has been previously determined significant under Criterion A for its association with events important to broad patterns in Hawaiʻi's history and recommended for preservation (SIHP DOC NO: 9408RC51).

SIHP Site 30109

Site 30109 is a World War II military encampment consisting of nine features (Features A-I) located in the northwest corner of the wind farm survey area, north of the access road (see Figure 29). The site measures roughly 150 meters long by 100 meters wide and the features are situated on two ridges and within a crescent shaped basin. The ground surface at Site 30109 is comprised of mostly exposed soil with scattered cobbles and few areas of exposed bedrock. The features at the site consist of an L-shaped alignment (Feature A), a rectangular-shaped cobble collection (Feature B), two C-shaped alignments (Features C and D), a filled-pit (Feature E), a cleared-level surface (Feature F), a collapsed wall segment (Feature G), a modified ridge top (Feature H), and a marine shell scatter (Feature I). Five of these features (Features A-E) are situated in a depression, blocked from the prevailing northeast trade winds and out of site when viewed from the east by a crescent-shaped ridge that has Features F-H on it. A second ridge to the north of the first (on the opposite side of a natural drainage) has a water-worn cobble on it with a nearby marine shell scatter (Feature I). On this second ridge, there are no associated features except rock pile marking the north boundary of Lot A. The site area is scattered with marine shell and rusted metal cans (C-ration-type of ration issued to combat soldiers during WW II from 1938 until 1958) along with communication field-wire extending in a northeast/southwest direction along the north edge of Feature H that continues to nearby Features A and G. Marine shell fragments are scattered across the surface of Site 30109 along with a coral fragments, water-worn cobbles, and a single volcanic glass flake. Detailed descriptions of Features A-I of Site 30109 follow below, and the locations of the features relative to one another and the boundary of Lot A are shown in Figure 37.

Feature A

Feature A is an L-shaped alignment located in the central portion of Site 30109, approximately 12 meters northwest of Feature C and 7 meters east of Feature B (see Figure 37). It is situated at the base of a southwest facing ridge. Feature A measures 6.5 meters long by 4 meters wide and is constructed of loosely piled small and medium cobbles and a single bedrock boulder on a soil cut in the slope. The alignment wall averages 1.1 meters in width and has upslope heights ranging from 7 to 31 centimeters tall and down-slope heights varying from 40 to 68 centimeters tall. Against the upslope edge of the alignment is a 1 meter wide level area of soil and cobbles which is present the length of the feature (Figure 38). The level area to the west of the feature measures 4.2 meters long by 2.7 meters wide. The surface in this area consists of a few collapsed cobbles on a soil and small cobble surface. Cultural material observed at Feature A consists of a single marine shell (*Cypraea* sp.) fragment, two coral chunks, communication wire, and a rusted can.

Feature B

Feature B is a rectangular-shaped cobble collection located in the central portion of Site 30109 at the base of a southwest facing ridge slope, approximately 7 meters west of Feature A (see Figure 37). The feature measures 1.63 meters long by 1.13 meters wide. It is constructed of small to large cobbles on its edges which enclose a level area of small to large pebbles mixed with soil (Figure 39). The feature has a maximum down-slope height of up to 35 centimeters and a maximum upslope height of up to 37 centimeters. On the level surface are seven rusted can fragments. Cultural material observed near Feature B includes communication wire, rusted metal cans, and a 1943 U.S. half-dollar that was found 4.1 meters to the southeast (Figure 40). It is likely that the enclosed portion of the feature was formerly slightly depressed from the surrounding ground surface and was later filled with soil and cobbles to create the current level surface. The dense collection of rusted metal cans indicate that this feature may have formerly functioned as a hearth.

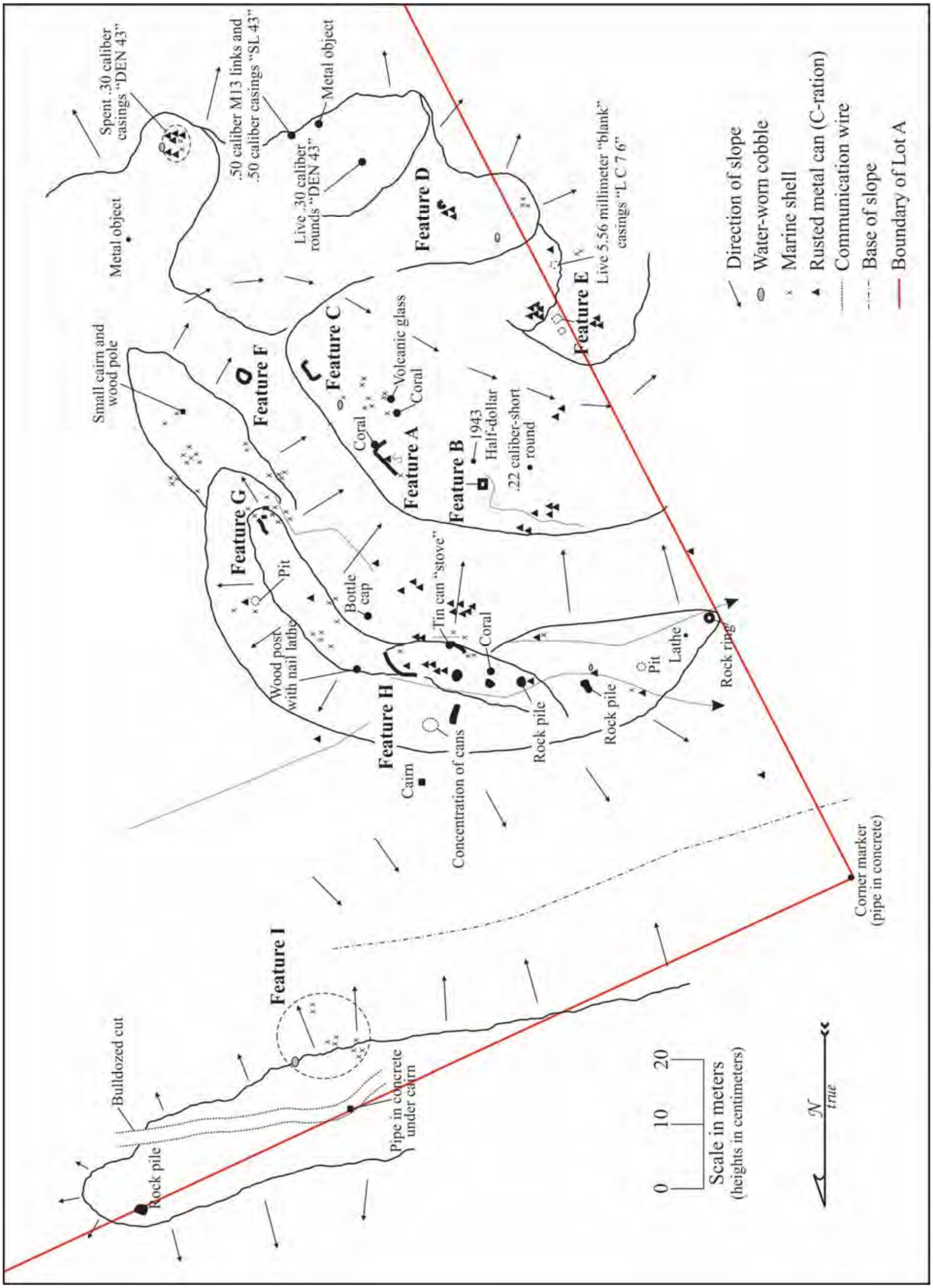

Figure 37. SIHP Site 30109 plan view.

Figure 38. SIHP Site 30109 Feature A, L-shaped alignment, view to the southeast.

Figure 39. SIHP Site 30109 Feature B, rectangular-shaped cobble collection, view to the northeast.

Figure 40. SIHP Site 30109 Feature B, 1943 U.S. Half-dollar found on the ground surface near Feature B.

Feature C

Feature C is a C-shaped alignment located in the central portion of Site 30109, approximately 12 meters southeast of Feature A and 5 meters southwest (down-slope) of Feature F (see Figure 37). Feature C is also situated at the base of the southwest facing ridge. The alignment measures 2.9 meters long by 2.4 meters wide and is constructed of loosely piled small to large cobbles and a few small boulders (Figure 41). It is mostly jumbled with collapse occurring down slope to the southwest (following the underlying ground surface). Feature C has a maximum upslope height of 37 centimeters and down-slope height standing up to 52 centimeters tall. The area immediately to the southwest of the alignment is relatively clear of rock material and consists of mostly exposed soil with gravels and small cobbles. There was no cultural material observed immediately adjacent to Feature C. A single water-worn cobble and a marine shell fragment were observed on the ground surface five meters northeast of the feature.

Feature D

Feature D is a small C-shaped construction located in the southern portion of Site 30109, approximately 17 meters southwest of Feature C and 13 meters southeast of Feature E (see Figure 37). The feature is situated on a gentle southwest facing slope of mostly soil with a few scattered cobbles. It measures 1.4 meters long by 1.3 meters wide and opens to the southwest. Feature D is constructed of loosely piled small to large cobbles that partially enclose a 0.6 meter by 0.53 meter area of exposed soil (Figure 42). It has an interior height of up to 22 centimeters tall and exterior height of up to 25 centimeters tall. Cultural material observed at Feature D includes a single fragment of metal shrapnel on the cobbles at its northwest end, and three metal can fragments on the ground surface immediately to the northwest.

Figure 41. SIHP Site 30109 Feature C, C-shaped alignment, view to the northeast.

Figure 42. SIHP Site 30109 Feature D, C-shaped construction, view to the northeast.

Feature E

Feature E is a potentially filled-pit located in the southwest portion of Site 30109, approximately 13 meters northwest of Feature D and 14 meters southwest of Feature B (see Figure 37). The former pit is situated on a gentle southwest facing slope of soil and scattered cobbles. Feature E is roughly square shaped, measuring 1.85 meters along each edge. The feature is currently only a slight depression (15 centimeters deep) in the ground, but appears to have been filled in as the soil and rock material within it does not match the surrounding ground surface (Figure 43). Located one meter to the northwest of Feature E is a second potential filled-pit. This second possible feature is less defined than the first, and it is difficult to determine if it ever was a pit, or simply part of the natural landscape. Like the other nearby feature, this area is mostly soil filled except it has a few scattered cobbles on the surface. Rusted metal cans and shrapnel fragments are scattered on the ground surface surrounding Feature E. A collection of 5.56 mm (L C 76) crimped live "blank" rounds were scattered within a 50 centimeter area 4 meters south of the feature.

Figure 43. SIHP Site 30109 Feature E, potential filled-pit, view to the northeast.

Feature F

Feature F is a cleared-level surface located in the eastern portion of Site 30109, 5 meters northeast (upslope) of Feature C and 12 meters south of Feature G (see Figure 37). It is situated on a moderate southwest facing slope of soil, scattered cobbles, with a few areas of exposed bedrock. Feature F is roughly rectangular in shape, measuring 4.3 meters long by 3 meters wide. It consists of a level cleared area of soil and a few scattered cobbles which sits 10 to 25 centimeters below the surrounding ground surface (Figure 44). Small to large cobbles have been loosely placed along the edges of the level surface. No cultural material was observed at Feature F except a concentration (twelve fragments) of shrapnel in the southeast corner of the level surface. A small cairn and wooden pole are located 6 meters upslope from Feature F on a level surface at the top the ridge and marine shell fragments were observed in the general vicinity of the feature.

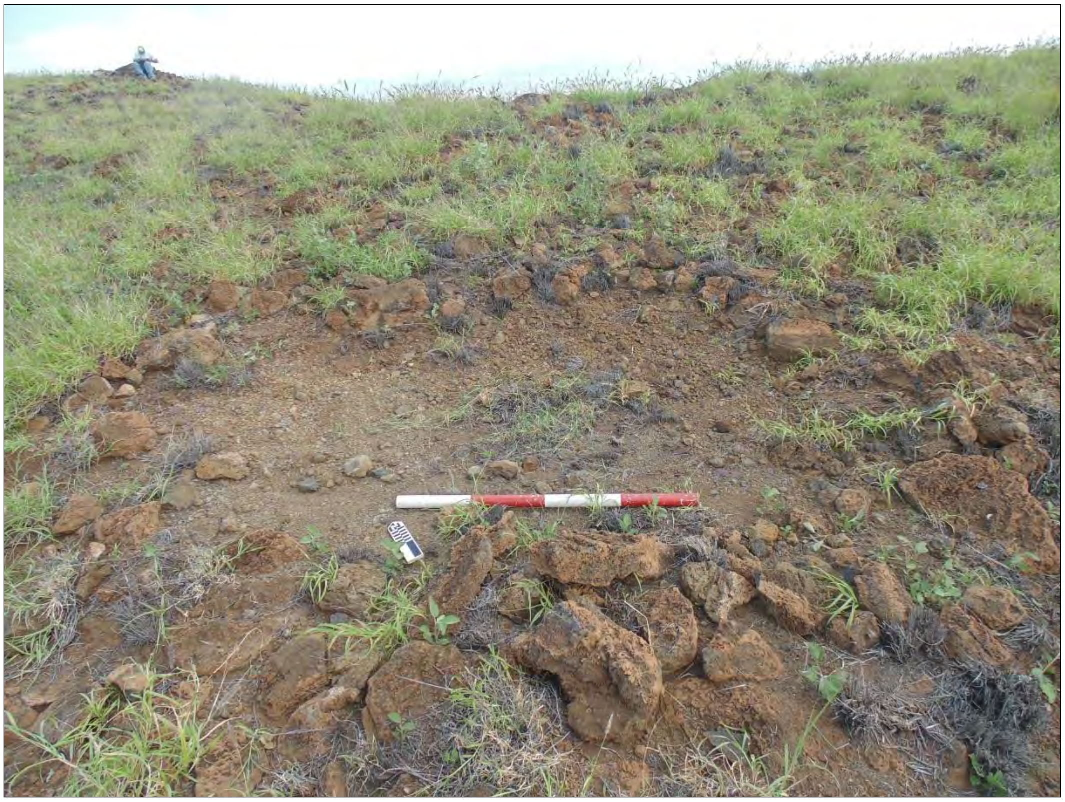

Figure 44. SIHP Site 30109 Feature F, cleared-level surface, view to the north.

Feature G

Feature G is a collapsed wall segment located in the northeast portion of Site 30109, 12 meters north of Feature F and 15 meters southeast of Feature H (see Figure 37). The wall is situated on a moderate southeast slope near the top the prominent ridge formation at Site 30109. Feature G measures 5 meters long by 2.7 meters wide and is constructed of loosely piled small and large cobbles (Figure 45). The feature is mostly intact along its west facing edge, while the east facing edge slopes toward the northeast following the underlying contour. The west facing edge has heights varying from 27 to 53 centimeters tall. At the southern end of the wall is an area of approximately 20 scattered cobbles, which stands 19 to 24 centimeters tall. It appears that these cobbles may have been formerly stacked as part of the wall. The area to the west of the wall is mostly level with small gravels, soil, and a few scattered cobbles. Cultural material observed at Feature G consists of three marine shell (*Cypraea* sp.) fragments at the base of the wall's west edge.

Feature H

Feature H is a modified ridge top located in the north-central portion of Site 30109, roughly 15 meters northwest of Feature G and 13 meters north (upslope) of Feature B (see Figure 37). Feature H is situated at the top (highest point) of the east/west running ridge with excellent views of all directions from the feature (Figure 45). The modified area measures 15 meters long by 14 meters wide. Modifications to the ridge top consist of roughly five rock piles that vary in size and shape (Figure 46). Exposed bedrock forms the north edge of the feature while rock piles along the east, west, and south edge's define the limits of the modified area (Figure 47). The level area defined by the rock piles consists of mostly soil mixed with small gravel and cobbles. Cultural material within the level area consists of communication wire, milled lumber (see Figure 48), rusted metal cans, a metal can "stove" (Figure 49), a coral chunk, a plastic lighter, and marine shell (*Cypraea* sp.).

Additionally, along the ridge's north facing slope is a linear rock pile (Figure 50) and cobble filled depression (Figure 51), which are likely associated with the features at the top of the ridge. The cobble filled depression sits 20 centimeters below the surrounding ground surface has a dense concentration of rusted metal cans scattered throughout.

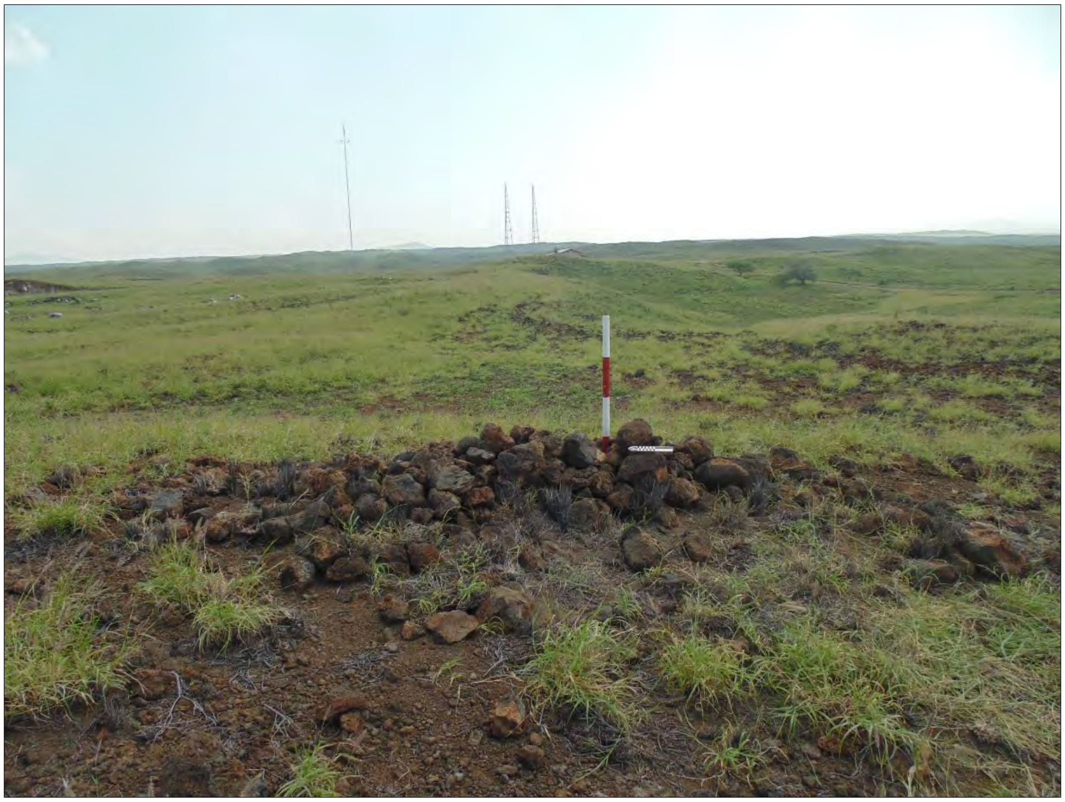

Figure 45. SIHP Site 30109 Feature G, collapsed wall segment, view to the east.

Figure 46. SIHP Site 30109 Feature H, modified ridge top, view to the west.

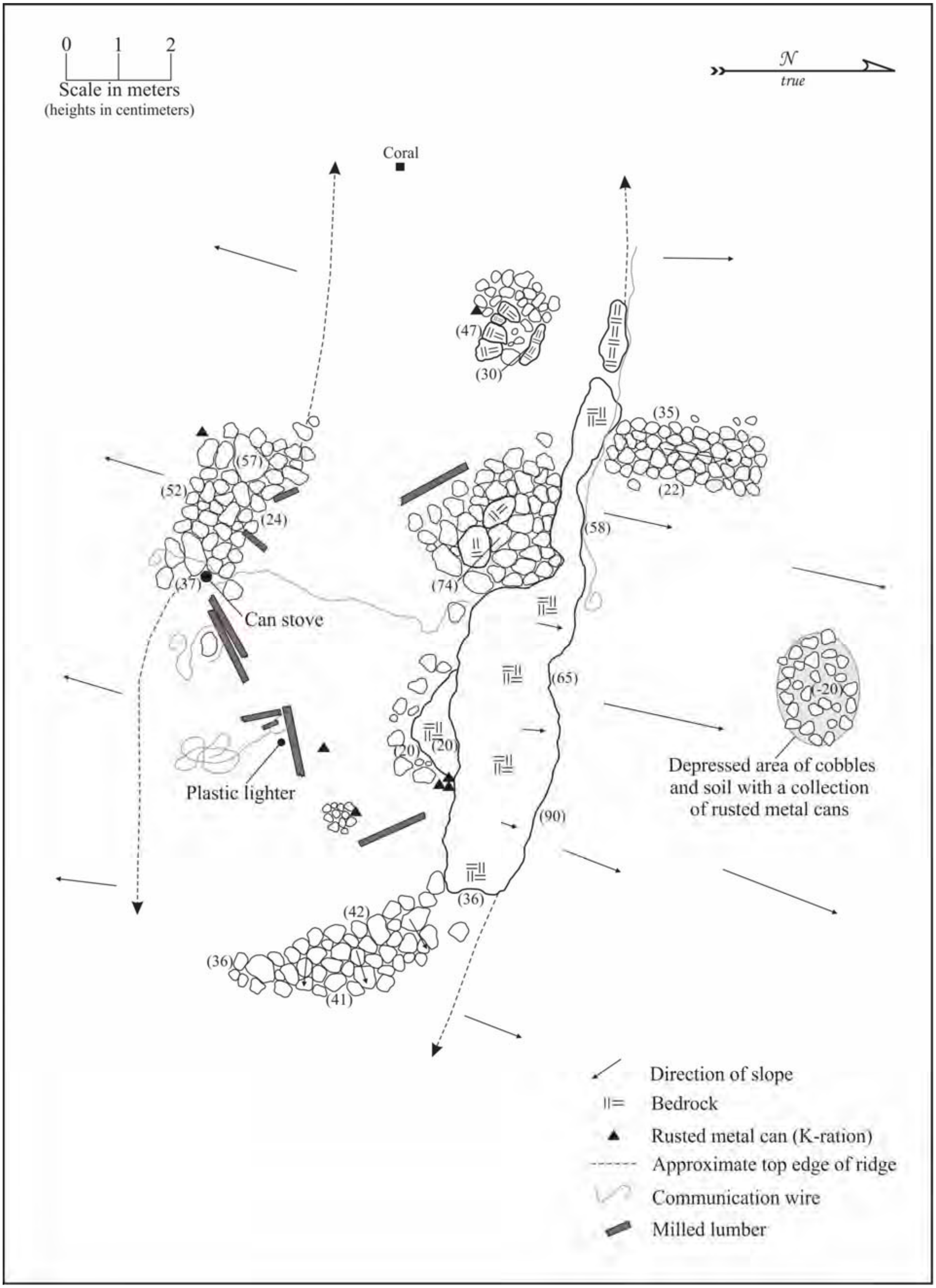

Figure 47. SIHP Site 30109 Feature H plan view.

Figure 48. SIHP Site 30109 Feature H, level area defined by rock piles at the top of the ridge, view to the east.

Figure 49. SIHP Site 30109 Feature H, communication wire and milled lumber, overview.

Figure 50. SIHP Site 30109 Feature H, metal can “stove” in-situ, overview.

Figure 51. SIHP Site 30109 Feature H, linear rock pile along the ridge’s northern slope, view to the south.

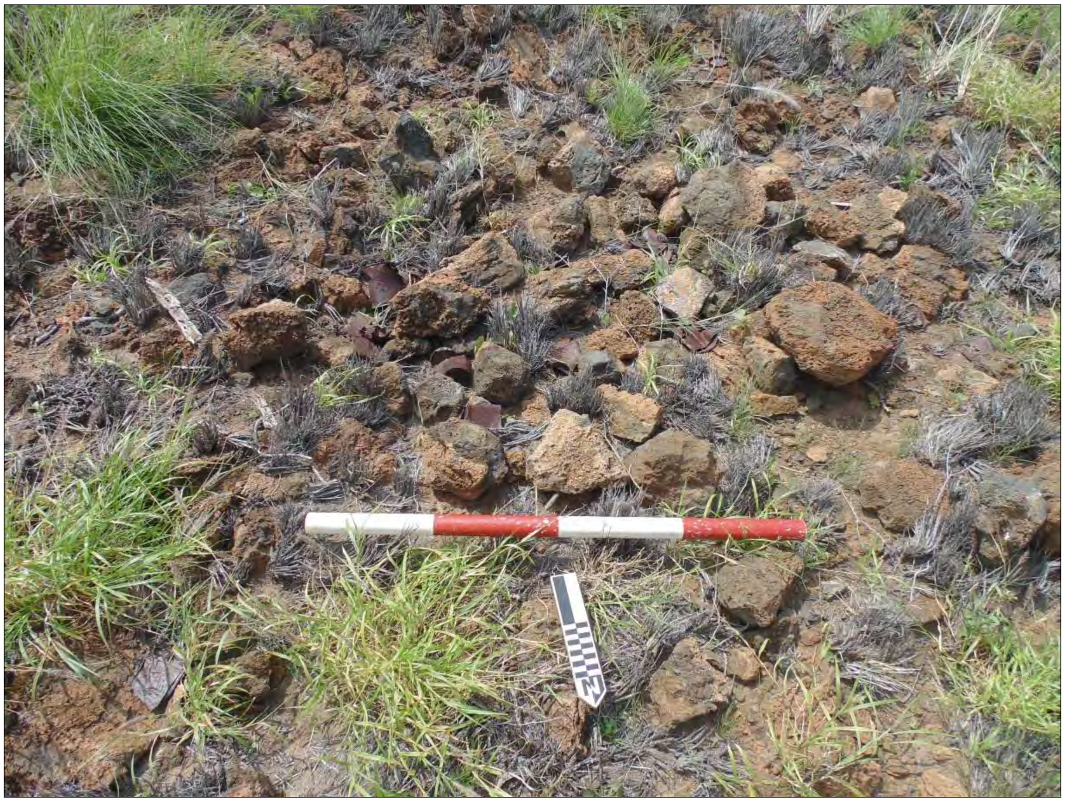

Figure 52. SIHP Site 30109 Feature H, cobble filled depression with rusted metal cans, view to the south.

Feature I

Feature I is a marine shell scatter and water-worn cobble on a ridge to the north of Feature H, on the opposite side of a natural drainage (see Figure 37). The marine shell scatter is situated at the top and along the south facing ridge slope. The marine shell is scattered within a 3 meter long by 2.5 meter wide area and consists primarily of *Cypraea* sp. shell fragments. A single water-worn cobble was observed at the east end of the marine shell scatter (Figure 52). A bulldozer cut road runs in an east/west direction on the top of the ridge, approximately 3 meters north of Feature I. Along the north edge of this road is a pipe set-in concrete beneath a cairn, 5 meters from the marine shell scatter. Near this pipe is a coil of modern metal wire. Roughly 30 meters northeast of the water-worn cobble, at the top edge of the ridge, is an isolated rock pile marking the northern boundary of the project area.

Discussion of Artifacts and Site Function

Historic Era artifacts observed at Site 30109 include concentrations of munitions on the ground surface along the southwest edge of the site (see Figure 37). The location of the ammunition concentrations (Figure 53) appear to correspond to defensive firing positions on the edges of the former encampment (Figure 54). At these firing positions there are 4 types of small munitions (spent .30 caliber M1 cartridges marked “DEN 43”, spent .50 caliber BMG cartridges marked “SL 43”, unfired 5.56 mm blank rounds marked “L C 7 6”, and a single .22 caliber short cartridge). In addition to the munitions, a few .50-caliber M13 links (Figure 55), rusted metal cans (mostly C-rations; Figure 56), various metal objects (Figure 57 and Figure 58), communications wire, a metal can stove (see Figure 49), milled lumber, and a 1943 U.S. Half-dollar (see Figure 40) were observed at Site 30109. Headstamp dates on two types ammunitions (“D E N 43” and “S L 43”) (Figure 59 and Figure 60) indicate that they are military rounds produced in 1943, while a third type of ammunition (“L C 7 6”) (Figure 61) has a headstamp indicating that it was produced in 1976.

It appears that most of the metal cans at Site 30109 are World War II era C-rations. In the late 1930s the U.S. military began standardizing a system of rations that are easily carried and provide a well-balanced diet for combat soldier’s to carry and eat in the field. During the late 1930s to the 1940s the military developed five types of rations (A-ration, B-ration, C-ration, K-ration, and D-ration). The A-ration, consisted of fresh food products prepared at a mess hall. The B-ration was the same as the A-ration with the substitution of canned and dehydrated foods where refrigeration was not available. Field rations used by combat troops in the field during World War II consisted of, Type C (complete pre-cooked, ready-to-eat canned individual meal), Type D (designed as a short duration individual "assault" ration for paratroopers and other specialized light infantry forces), and Type K (designed as a short duration individual "assault" ration for paratroopers and other specialized light infantry forces) are individual combat rations intended to provide food for soldiers for up to five days. The C-ration was used as the military's primary "combat" ration until 1958. A C-ration consisted of 3 cans containing a meat and vegetable component, and 3 cans, containing crackers, sugar, and soluble coffee; it furnished 2974 calories, 114 grams of protein, and an adequate supply of vitamins and minerals (http://www.foxco-2ndbn-9thmarines.com/c-rations.htm).

Figure 53. SIHP Site 30109 Feature I, water-worn cobble along the north edge of the feature, overview with 20 centimeter scale.

According to the *Department of the Army Field Manual No. 24-20*, "Field-Wire Techniques," from May of 1956, the communication field-wire observed at Site 30109 is (Wire Type WD-1/TT), commonly used by the U.S. military during World War II (also earlier and later) to establish field-wire communications systems in order to provide tactical units with telephone, teletypewriter, and facsimile services (1956:4). Aerial construction is the recommended method for installing this type of communications system because it is the easiest to maintain or change, and provides better quality circuits than surface construction, but it can also be laid out across the ground surface to disguise the wire route and to provide quicker communication capability.

Based on the predominance of World War II era artifacts at Site 30109 it appears that the encampment was occupied by the U.S. military for training purposes at some point after 1943, but likely before 1946. It is likely that Feature H, which occupies the most prominent point on the ridgeline, may have been a command center as it has views in all directions and most of the communication wire. Features A, C, F, and G appear to be the location of former camp/tent areas. Feature B may be a filled fire hearth. Feature D is of uncertain function, but may have been associated with defensive firing positions established along the ridgeline at the southwestern edge of the site, where a number of ammunition concentrations were noted. Feature E appears to be a former latrine pit that was later filled in. A 1943 U.S. Half-dollar found near Feature B and the dates on the ammunition headstamp's indicate that the military's occupation of Site 30109 certainly occurred after 1943. The marine shell observed at the site could have supplemented the C-rations eaten by the soldiers. It is more likely, however, when the presence of coral, volcanic glass, and water-worn cobbles are also considered, that Site 30109 had an earlier component. As suggested by Soehren (1984), the site could have been occupied prior to World War II by "Hawaiian cowboys," or even earlier, by the builders of the nearby Site 9012 wall during the reign of Kamehameha I (in ca. 1913-1915).

Figure 54. SIHP Site 30109 munitions scatter along the southwest edge of the site.

Figure 55. SIHP Site 30109, general area of munitions scatter and defensive firing positions, view to the northeast.

Figure 56. SIHP Site 30109, .50 caliber ammunition clip, overview.


Figure 57. SIHP Site 30109, example of the rusted metal cans (C-rations), overview.

Figure 58. SIHP Site 30109, metal object, overview.

Figure 59. SIHP Site 30109, metal object on the ground surface near the south edge of the site, overview.

Figure 60. SIHP Site 30109, .30-caliber M1 bullet cartridge with headstamp “D E N 43,” overview.

Figure 61. SIHP Site 30109, .50-caliber M13 bullet cartridge with headstamp “S L 43,” overview.

Figure 62. SIHP Site 30109, .30-caliber blank bullet cartridges with headstamp “L C 7 6,” overview.

SIHP Site 30110

Site 30110 is a complex of five cairns (Features A-E) located in the northeast portion of Lot A of the Lālāmilo survey area, adjacent to the fence that marks Lālāmilo/Waikōloa *ahupuaʻa* boundary (see Figure 29). The cairns, which occur next to a concrete monument marking a change in direction in the Waikōloa/Lālāmilo boundary, are situated at the top of a southwest sloping landform near its southern edge to the north of the fenceline. Site 30110 measures 40 meters long by 7 meters wide and is constructed on a level surface of scattered cobbles and soil with a few areas of exposed bedrock (Figure 62). Vegetation at Site 30110 is limited to buffel grass (*Cenchrus ciliaris*), fountain grass (*Pennisetum setaceum*), and *ʻilima* (*Sida fallax*). Detailed descriptions of Features A-E of Site 30110 are presented below.

Feature A

Feature A is a cairn located at the southwest end of Site 30110 (see Figure 62). The cairn measures 1.6 meters long by 1.4 meters wide. It is constructed of approximately 50 large cobbles (Figure 63). The concrete monument at Site 30110 is located on the ground surface adjacent to the rock pile’s southwest edge (Figure 64).

Feature B

Feature B is a cairn located in the southwest portion of Site 30110, approximately 11 meters northeast of Feature A (see Figure 62). The cairn consists of a single course collection of 8 large cobbles. It measures 1.6 meters long by 1.35 meters wide with a maximum height of 25 centimeters tall (Figure 65).

Feature C

Feature C is a cairn located in the central portion of Site 30110, approximately 6 meters northeast of Feature B (see Figure 62). It measures 2.6 meters long by 2.25 meters wide and is constructed of approximately 80 small cobbles and a few large cobbles loosely piled together (Figure 66). The cairn has a maximum height along its upslope edge of 22 centimeters and a down-slope height standing up to 37 centimeters tall.

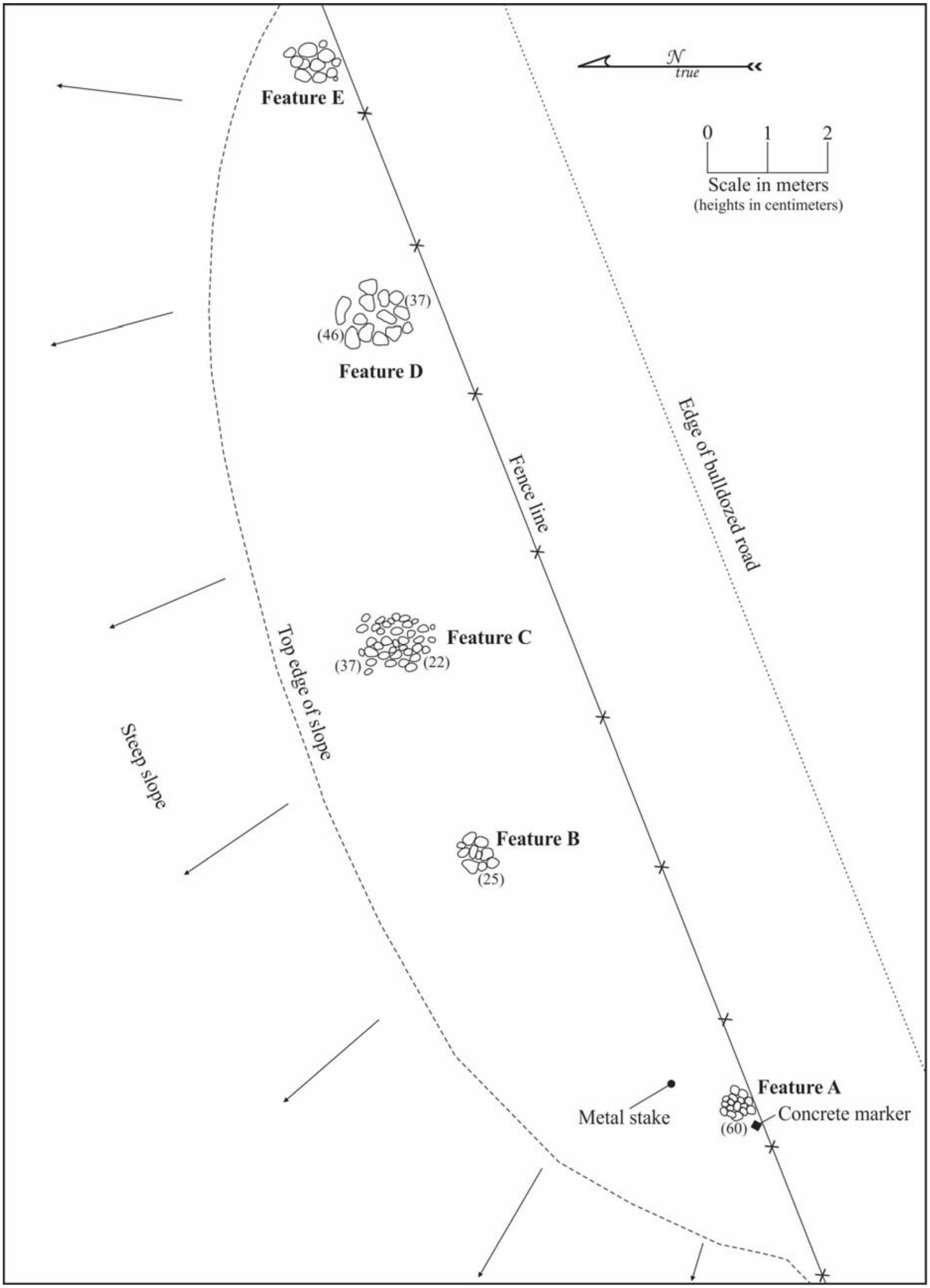

Figure 63. SIHP Site 30110 plan view.

Figure 64. SIHP Site 30110 Feature A, view to the southeast.

Figure 65. SIHP Site 30110 Feature A, concrete monument next to fence line, view to the southwest.

Figure 66. SIHP Site 30110 Feature B, view to the southeast.

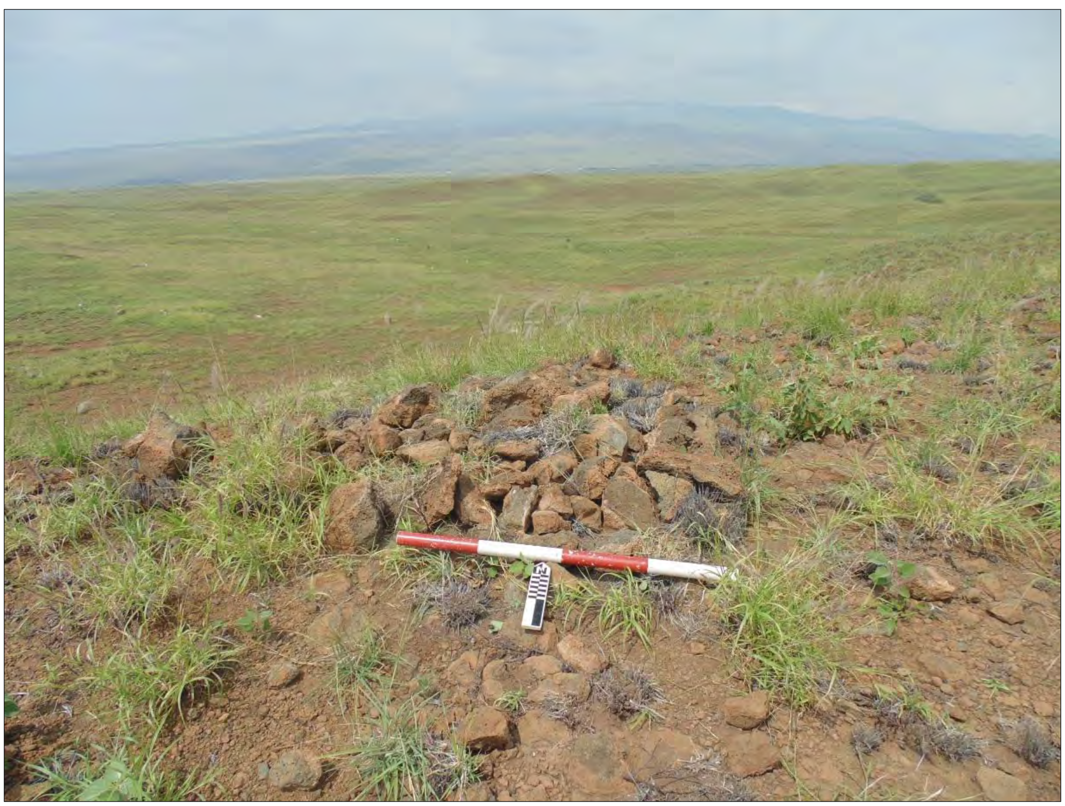

Figure 67. SIHP Site 30110 Feature C, view to the north.

Feature D

Feature D is a cairn located in the eastern portion of Site 30110, approximately 9 meters east of Feature C (see Figure 62). It measures 2.7 meters long by 2.35 meters wide and is constructed of approximately 50 piled large cobbles and small boulders (Figure 67). This rock pile has a maximum height along its upslope edge of 37 centimeters and along its down-slope edge it stands up to 46 centimeters tall. Some of the cobbles exhibt mechanical scarring, as if moved to this location after being impacted by a bulldozer.

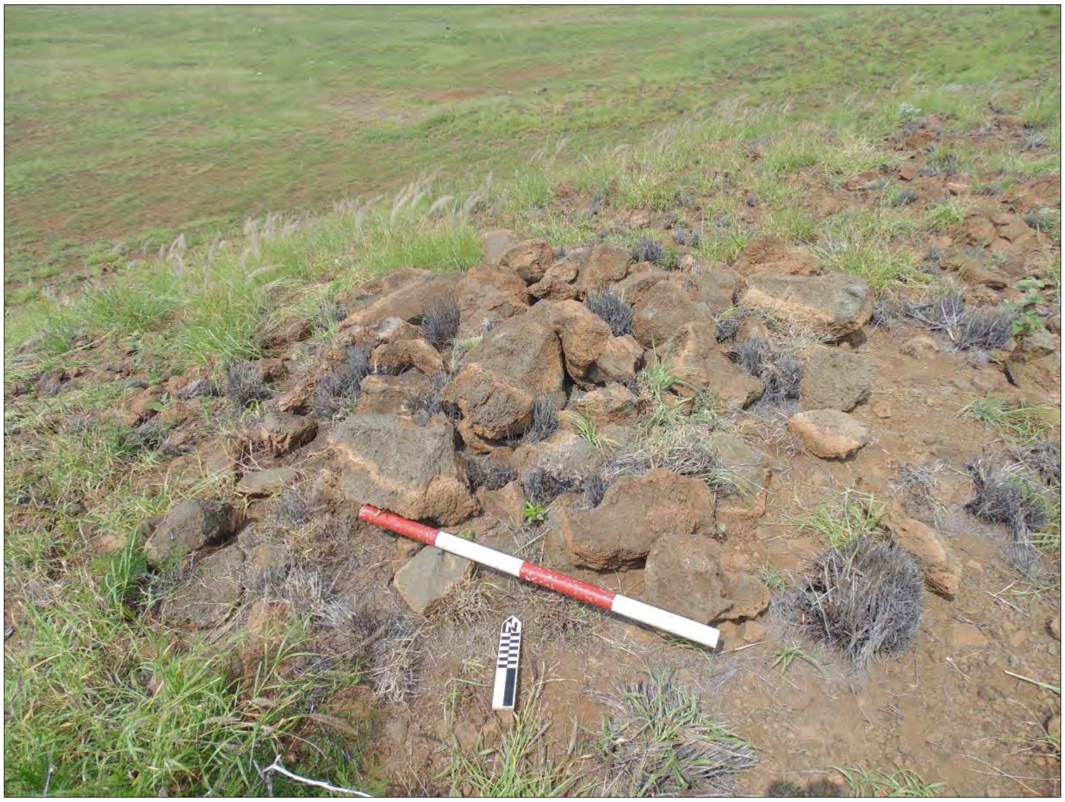

Figure 68. SIHP Site 30110 Feature D, view to the north.

Feature E

Feature E is a cairn located at the northeast end of Site 30110, approximately 7 meters northeast of Feature D (see Figure 62). It measures 2 meters long by 1.7 meters wide and is constructed of roughly 20 medium and large cobbles against a large bedrock boulder adjacent to the fence line (Figure 68). Feature E has a maximum height of up to 50 centimeters tall. Mechanical scarring is also present on some of the cobbles used in the construction of Feature E.

Based on the location of Site 30110, on top of a hill along the Lālāmilo/Waikōloa *ahupuaʻa* boundary at a point where it changes direction, it is likely that the cairns were constructed as boundary markers. Hawaiʻi Registered Map No. 2993 prepared by Chas L. Murray in 1929 (see Figure 21) indicates the presence of a concrete monument along the boundary of Lālāmilo and Waikōloa *ahupuaʻa* at the location of Site 30110, which is likely the same concrete monument that is situated adjacent to Feature A (see Figure 65). Given that the concrete monument is a low construction, the cairns of Site 30110 were likely constructed as more prominent visual markers of the Waikōloa/Lālāmilo boundary that would be evident from some distance away. These cairns are most likely Historic or Modern constructions, and probably post-date the placement of the concrete monument indicated on the 1929 map. Rocks at Features D and E exhibit signs of mechanical scarring and are likely the most recent cairns, built after the bulldozed road adjacent to the south edge of the fence line and at the base of the steep slope to the north of Site 30110 were constructed. A second concrete monument marking the Waikōloa/Lālāmilo boundary is shown on the 1929 map to the west of Site 30110 at a location "Kapaakea" where there is another turn in the *ahupuaʻa* boundary. This monument was also identified in the field, and is identical to the one at Feature A (Figure 70).

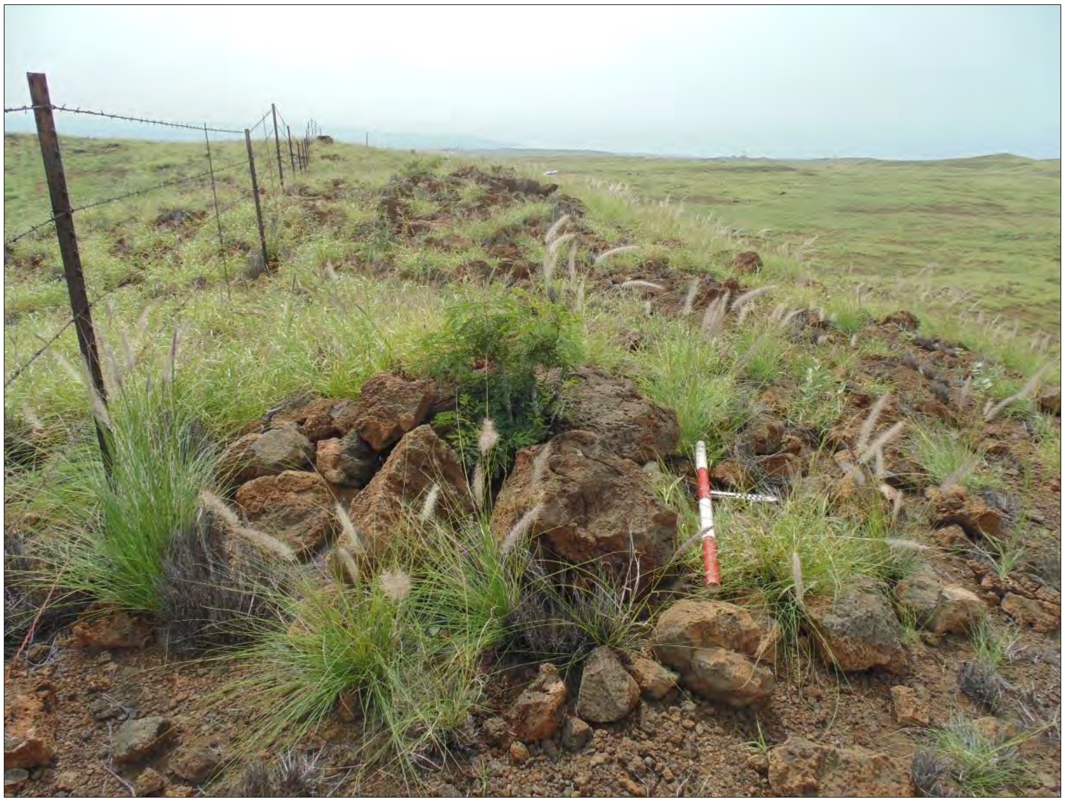

Figure 69. SIHP Site 30110 Feature E, view to the west.

Figure 70. Concrete monument at “Kapaakea” along the boundary between Waikōloa and Lālāmilo *ahupua‘a*, view to the southwest.

5. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The recorded archaeological sites are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawaiʻi Administrative Rules 13§13-284-6. This significance evaluation should be considered preliminary until DLNR-SHPD provides concurrence. 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 treatments for the three recorded sites are presented in Table 3 and discussed below.

Table 3. Site significance and treatment recommendations.

SIHP Site #	***Site Type***	***Temporal Affiliation***	***Significance***	***Recommended Treatment***
9012	Kauliokamoa's wall	Historic	A, B, D	Preservation
30109	World War II military encampment	Historic	A, D	No further work
30110	Boundary marker	Historic/Modern	D	No further work

Site 9012 is an early nineteenth century dry-stacked rock wall that was purportedly built during the reign of Kamehameha I (at his direction) to keep the growing population of "*kapu*" cattle out of the fertile agricultural areas of Lālāmilo. As such this site is associated with both significant events and persons important in Hawaiian history, and is evaluated as significant under Criterion A and B. This site is also considered significant under Criterion D for its research value. The current proposed project will have no effect on this site as the wall has an existing gated breach at access Easement J, and the continued preservation of this site is the recommended treatment.

Site 30109 is a WWII-era military encampment associated with training activities conducted within the greater Camp Tarawa Waikoloa Maneuver Area. This site reflects activities that when considered in their totality were important locally, nationally, and ultimately globally; and as such this site is considered significant under Criterion A. It is also considered significant under Criterion D for its historical research value. Although this site will not likely be directly impacted by the proposed wind farm construction activities, it may be indirectly impacted by increased use of the area; however, the thorough documentation of this site during the current study has mitigated such potential impacts and no further work is the recommended treatment.

Site 30110 is a series of Historic/Modern boundary markers that are considered significant under Criterion D. This site has been fully and comprehensively documented as a result of the current study and no further work is the recommended treatment.

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APPENDIX D

CULTURAL IMPACTS ASSESSMENT

Cultural Impact Assessment for the Proposed Lālāmilo Wind Farm Repowering Project

TMKs: (3) 6-6-01:002 (por.), 071, and (3) 6-8-01:001 (por.)

Lālāmilo and Waikōloa *ahupua'a*
South Kohala District
Island of Hawai'i

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June 2014

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ASM Project Number 21850

Cultural Impact Assessment for the Proposed Lālāmilo Wind Farm Repowering Project

TMKs: (3) 6-6-01:002 (por.), 071, and (3) 6-8-01:001 (por.)

Lālāmilo and Waikōloa *ahupua'a*
South Kohala District
Island of Hawai'i

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1. INTRODUCTION

At the request of Lālāmilo Wind Company, LLC, ASM Affiliates, Inc. conducted a cultural impact assessment for the Lālāmilo Wind Farm Repowering Project in the *ahupua'a* of Lālāmilo and Waikōloa, South Kohala District, Island of Hawai'i (Figure 1). The proposed redevelopment of the Lālāmilo Wind Farm will occur on parcels and easements in Lālāmilo Ahupua'a (TMKs: (3) 6-6-01:002 por. and 071; Figure 2) that are owned by the State of Hawai'i and were originally created for an earlier wind farm which operated between 1985 and 2010, but has since been removed. Construction of the new wind energy generation system will supply electricity to four existing County of Hawai'i, Department of Water Supply (DWS) wells in Lālāmilo Ahupua'a (Lālāmilo wells A, B, C, and D) that were formerly connected to the Lālāmilo Wind Farm, and four existing Parker Ranch wells (Parker wells No. 1, 2, 3, and 4) in Waikōloa Ahupua'a (Figure 3). Connecting the existing Parker wells to the new wind farm equipment will require the installation of new power lines within an access easement across TMK: (3) 6-8-01:001 (por.), owned by the Richard P. Smart Trust. The proposed Lālāmilo Wind Farm Repowering Project will also utilize an existing facility that is located on TMK: (3) 6-6-01:076 (see Figure 2), but the use of this facility will only involve the pulling of cable through existing underground conduits and the overhead connecting of power lines on existing infrastructure.

A recent archaeological inventory survey (Clark et al. 2014) conducted for the Lālāmilo Wind Farm Repowering Project resulted in the documentation of three archaeological sites, a rock wall (SIHP Site 9012), a World War II military encampment (SIHP Site 30109), and a complex of cairns marking the boundary between Lālāmilo and Waikōloa *ahupua'a* (SIHP Site 30110). Site 9012 is an early nineteenth century dry-stacked rock wall that was purportedly built during the reign of Kamehameha I (at his direction) to keep the growing population of "*kapu*" cattle out of the fertile agricultural areas of Lālāmilo. As such this site is associated with both significant events and persons important in Hawaiian history, and was evaluated as significant under state historic property significance Criteria A and B. This site is also considered significant under Criterion D for its research value. The current proposed project will have no effect on this site, and it will continued to be preserved. Site 30109 is a WWII-era military encampment associated with training activities conducted within the greater Camp Tarawa Waikoloa Maneuver Area. This site reflects activities that when considered in their totality were important locally, nationally, and ultimately globally; and as such this site was considered significant under Criterion A for these association. It is also considered significant under Criterion D for its historical research value. Although this site will not likely be directly impacted by the proposed wind farm construction activities, it may be indirectly impacted by increased use of the area; however, the thorough documentation of the site during the inventory study mitigated such potential impacts and no further work was the recommended treatment. Site 30110 is a series of Historic/Modern boundary markers that are considered significant under Criterion D. This site was fully and comprehensively documented as a result of the inventory survey study and no further work was the recommended treatment.

In support of an Environmental Assessment conducted in compliance with HRS Chapter 343, the current study was prepared pursuant to Act 50, approved by the Governor on April 26, 2000; and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai'i, on November 19, 1997. Below is a description of the project area and the proposed development activities, a detailed culture-historical background, and a presentation of prior studies; all of which combine to provide a physical and cultural setting and context for the current study. A summary of consultation is provided, followed by a discussion of potential cultural impacts along with the appropriate mitigation actions and strategies.

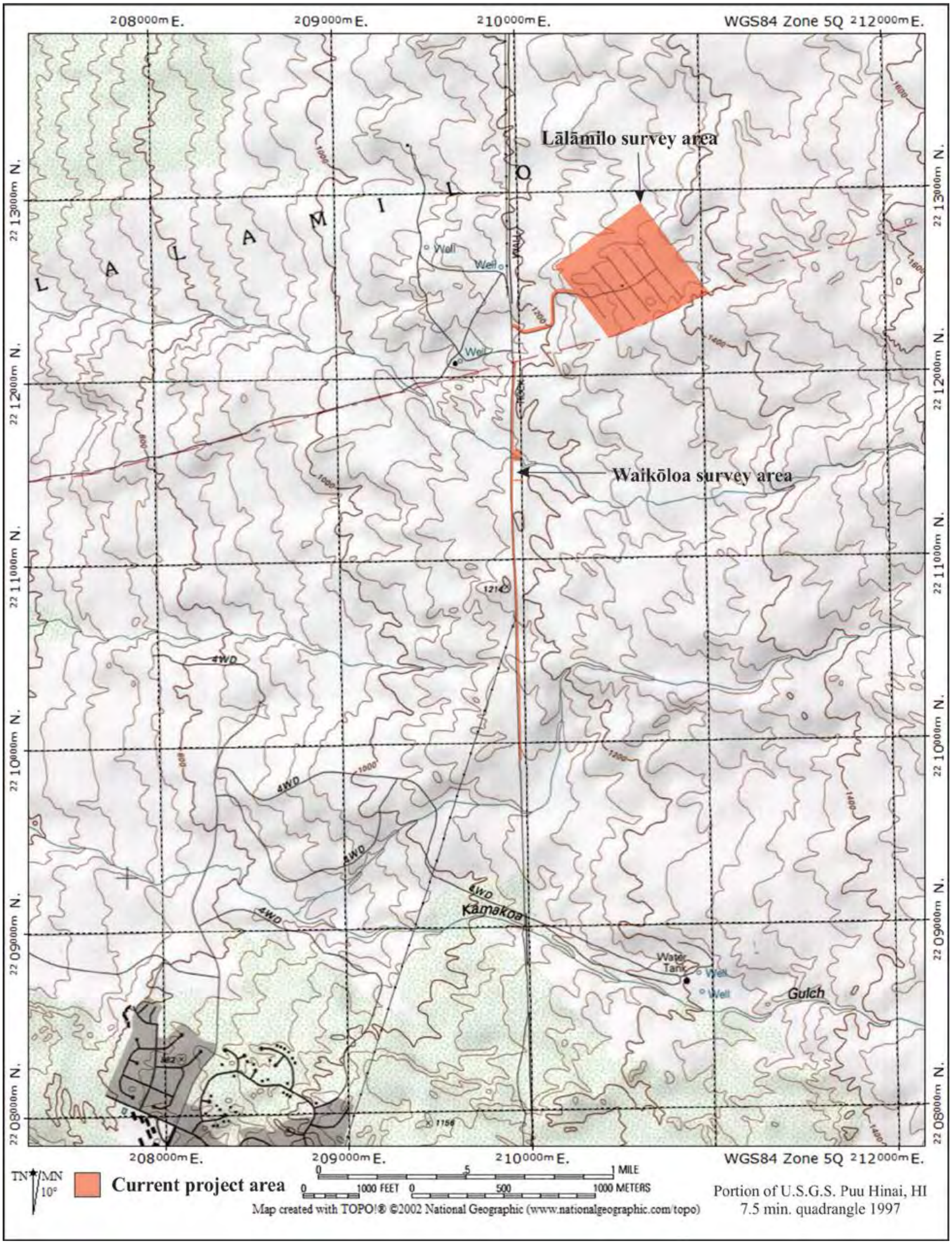

Figure 1. Project area location map.

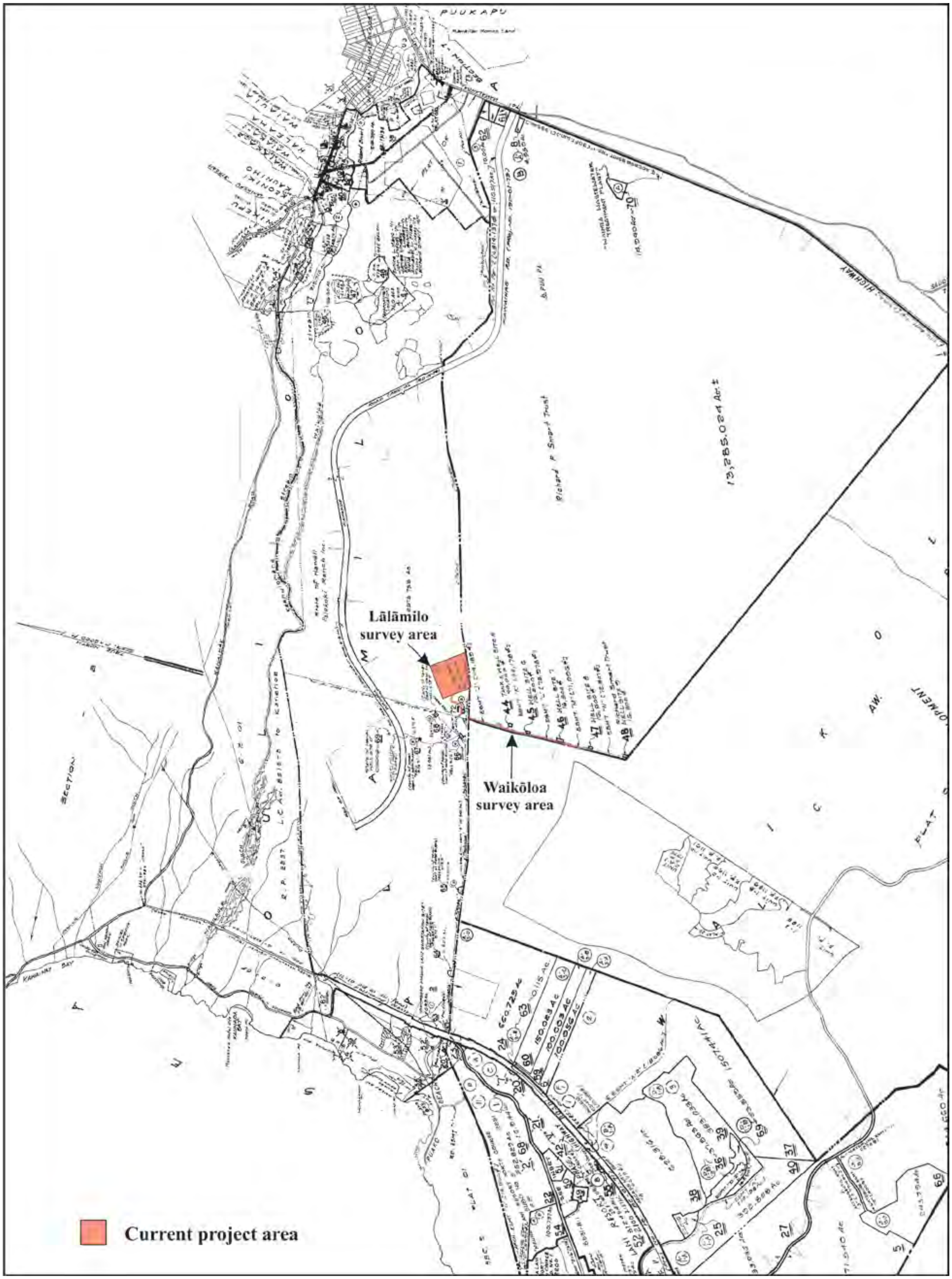

Figure 2. Portions of Tax Map Keys (TMKs): (3) 6-6-01 and 6-8-01 showing the location of the current project area.

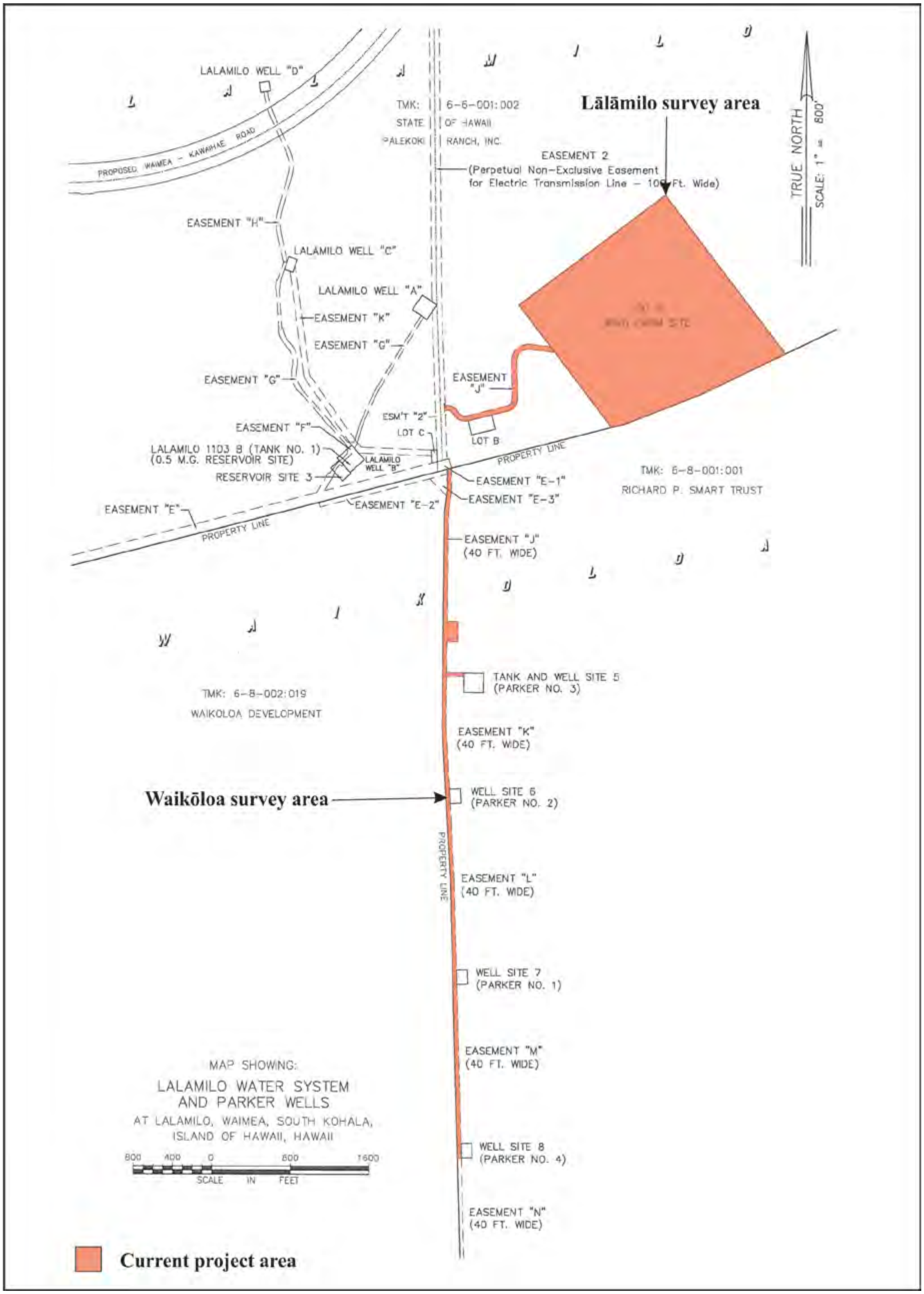

Figure 3. Map of the Lālāmilo Water System and Parker Wells (revised April 30, 2012) showing the current project area.

2. PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The current project area consists of approximately 87.5 acres located at elevations ranging from roughly 354 to 427 meters (1,160 to 1,400 feet) above sea level in the *ahupuaʻa* of Lālāmilo and Waikōloa, South Kohala District, Island of Hawaiʻi (see Figure 1). The project area is situated on Mauna Kea (hm) lava flows that are 250 to 65 thousand years old (Wolfe and Morris 1996). Soils that have developed on these lava flows are classified as belonging to the Hapuna-Waikui-Lalamilo complex, which is typically comprised of 35 percent Hapuna and similar soils, 35 percent Waikui and similar soils, 20 percent Lalamilo and similar soils, and 10 percent minor components (USDA 2013). Mean annual rainfall within the project area ranges from 250 to 280 millimeters, with most of the rain falling during the wettest winter months of December and January, and very little rainfall occurring during the driest summer months of June, July, and August (Giambelluca et al. 2013). This area often experiences strong easterly/northeasterly trade winds that blow down the mountains at speeds of 20-30 miles per hour during the nighttime. Daytime sea breezes, which blow on-shore, are often of similar strength (Juvik and Juvik 1998). As a result of the arid conditions, strong winds, periodic wildfires, and nearly two centuries of use as cattle pasture, vegetation within the project area is relatively sparse. Introduced grasses, including buffelgrass (*Pennisetum ciliare*) and fountain grass (*Pennisetum setaceum*), along with various other introduced weeds, blanket most of the project area, but a few native species, including *ʻUhaloa* (*Waltheria indica*), *ʻAkia* (*Wikstroemia pulcherrima*), and *Pāʻū o Hiʻiaka* (*Jacquemontia ovalifolia*), were also observed. Trees are relatively scarce within the project area, but a few scattered *kiawe* (*Prosopis pallida*) are present, along with a single pine tree planted next to the former Lālāmilo Wind Farm parking lot.

The project area includes 80 acres within Lālāmilo Ahupuaʻa (the 78.081-acre Lot A [TMK: (3) 6-6-01:071] and a 1.947-acre easement [Easement J] across TMK: (3) 6-6-01:002) for the construction of the wind farm and associated infrastructure; and an additional 7.5 acres within Waikōloa Ahupuaʻa for the installation of new power lines for the existing Parker wells (see Figures 2 and 3). The installation of the power lines to Parker wells No. 1, 2, 3 and 4 will occur on four contiguous, 40-foot wide easements (Easements J, K, L, and M) across TMK: (3) 6-8-01:001 (Figure 4). Large portions of the project area have been previously developed.

The Lālāmilo survey area, previously the location of the Lālāmilo Wind Farm and its associated infrastructure (from ca. 1985 to 2010), includes Lot A that is accessed by a 20-foot wide roadway within the 1.947-acre Easement J (see Figure 3). This existing gravel/paved road extends (within the easement) for a distance of roughly 495 meters. It follows a meandering course up a hill from a gate in a rock wall (SIHP Site 9012) at the western end of Easement J to the western boundary of Lot A (Figures 5 and 6). Along its route to Lot A the road crosses over a culvert within a small drainage (Figure 7), and passes above-ground electrical boxes (Figure 8) for an existing buried conduit within which the proposed collected line will be pulled. At the western boundary of Lot A the access road continues north for roughly 250 meters to the old wind farm's operations and maintenance (O & M) building, which has two adjacent towers, a parking area, a water catchment tank, and a more recently erected meteorological tower nearby (an older meteorological tower is located in the northern portion of Lot A).

In addition to the O & M building (Figure 9), the 78.081-acre Lot A formerly housed 120 Jacobs wind generators, aligned in five arrays. The wind turbines and towers (with the exception of two) have been removed from the property, but the locations of the five arrays are marked by five parallel swaths of bulldozed land (four of equal length, and one of shorter length; see Figure 4) that extend northwest/southeast across the lot (Figure 10). The four corners of the Lot A are each marked by a metal pipe stuck in concrete. A fence line, with old bulldozed roads along either side of it, at the boundary between Lālāmilo and Waikōloa *ahupuaʻa*, extends along the roughly 587 meter long southern boundary of Lot A (Figure 11). The remaining boundaries, are not visually marked, but are straight lines projected between the corner pins. The five former wind turbine arrays occupied the southwestern portion of Lot A where the flattest terrain occurs (Figure 12). At the northwestern end of the four, equal length, bulldozed swaths a short northwest facing slope is present, and to the northeast of the *mauka* most swath the land gradually becomes steeper and hillier. A prominent double ridge formation, with a natural drainage channel between, occurs in the western corner of Lot A at the northwestern end of the *makai* most bulldozed swath. This ridge is likely why that *makai* array was the shortest of the five.

Figure 4. Current Google Satellite™ image showing the current project area outlined in red.

Figure 5. Lālāmilo survey area, gravel road and gate at the western end of Easement J, view to the northwest.

Figure 6. Lālāmilo survey area, paved road near the western boundary of Lot A, view to the southwest.

Figure 7. Lālāmilo survey area, culvert beneath the existing access road, view to the west.

Figure 8. Lālāmilo survey area, electrical along the southern edge of the existing road, view to the southwest.

Figure 9. Lālāmilo survey area, the old wind farm's office and maintenance building on Lot A, view to the northeast.

Figure 10. Lālāmilo survey area, bulldozed swath of land within Lot A that formerly housed an array of wind towers, view to the northwest.

Figure 11. Lālāmilo survey area, fence line along the southern boundary of Lot A, view to the southwest.

Figure 12. Lālāmilo survey area, southwestern portion of Lot A where the five arrays of wind turbines were formerly located, view to the northwest.

The Waikōloa portion of the project area, where power lines will be connected to four existing wells (Parker wells No. 1, 2, 3, and 4), includes four contiguous, 40-foot wide access easements (Easements J, K, L, and M) across TMK: (3) 6-8-01:001 that total 7.5 acres (see Figure 2). This survey area contains an existing 20-foot wide paved roadway that extends for 2.1 kilometers along the *mauka* (eastern) edge of a rock wall (SIHP Site 9012) from a gate at the northern end of Easement J (Figure 13) to the termination of the pavement at the southern end of Easement M (Figure 14). Easement J also includes a 55-meter long stub road at its southern end that access Parker well No. 3 (see Figure 3). Nearly the entire length of the Waikōloa portion of the project area has been disturbed by bulldozing, including the space between the existing road and the wall (Figure 15), and the area along the eastern edge of the road to a distance of at least six meters (twenty feet). At one location within Easement J, between the northern gate and Parker well No. 3, the road crosses a small drainage and skirts a small hill, veering away from the rock wall (Figure 16); the area between the wall and the road at this location is the only portion of the Waikōloa survey area that has not been disturbed by bulldozing.

The current proposed re-development of the wind farm will include the placement of five Vestas V47-660 kW wind turbines with a maximum generation capacity of 3.3 MW. The maximum height of a wind turbine at the top of the blade is 198.5 feet (60.5 meters) above ground level. The five proposed turbines will be arranged in two arrays, consisting of two and three turbines, respectively (Figure 17). Associated infrastructure will include on-site access road improvement, electrical collection system, operations and maintenance building, new 13-kilovolt (kV) overhead electrical transmission line, and updated switchgear and electrical interconnection equipment. There are existing meteorological and radio towers on-site, which will be re-utilized for the project.

A new operations and maintenance (O&M) building will be constructed at the location of the existing O&M building. Existing roads remaining from the original Lālāmilo Wind Farm would be used to access the turbines. Where necessary the internal access road would be improved and widened to facilitate construction. Power generated by each of the turbines will be collected by a 13-kV underground electrical collection system. Cables will connect the individual wind turbines in a daisy chain configuration to an existing interconnection facility through existing buried and encased conduits, where the power would then be transmitted to the wells through both existing and new 13-kV overhead transmission lines. The new transmission line to power the Parker Wells will be approximately 1.3 miles (2.1 kilometers) long and installed adjacent to an existing road within an existing 40-foot-wide right-of-way and easement. Poles would be spaced approximately every 300 feet (91 meters), resulting in the installation of up to 25 new poles. There is an existing 13-kV transmission line running between the interconnection facility and Lālāmilo Wells. No Project-related activities are proposed for these wells, other than the provision of power.

At the completion of the construction phase; all construction-related waste would be properly handled in accordance with county, state, and federal policies and permit requirements; and removed from the area for disposal or recycling as appropriate. All disturbed soil area that will not be used as part of the operations will be stabilized and returned to preconstruction conditions. The Lālāmilo Wind repowering project has an estimated 40-year lifespan. Upon expiration of the current 20 year term Power Purchase Agreement (PPA) between the Department of Water Supply (DWS) and Lālāmilo Wind Company LLC, DWS will evaluate whether to continue operation and extend the PPA, or to recommend early decommissioning of the project. As required in both the lease with DLNR and the PPA with the DWS, when the project is decommissioned, the power generation equipment will be removed and the site returned to a condition as close to its pre-construction (post-2010 decommissioning of the earlier wind farm) state as possible.

Figure 13. Waikōloa survey area, existing road at the western end of Easement J, view to the north.

Figure 14. Waikōloa survey area, termination of the paved road at the southern end of Easement M, view to the north.

Figure 15. Waikōloa survey area, existing paved road within Easement L, view to the north.

Figure 16. Waikōloa survey area, undisturbed portion of Easement J between the rock wall and the road, view to the south.

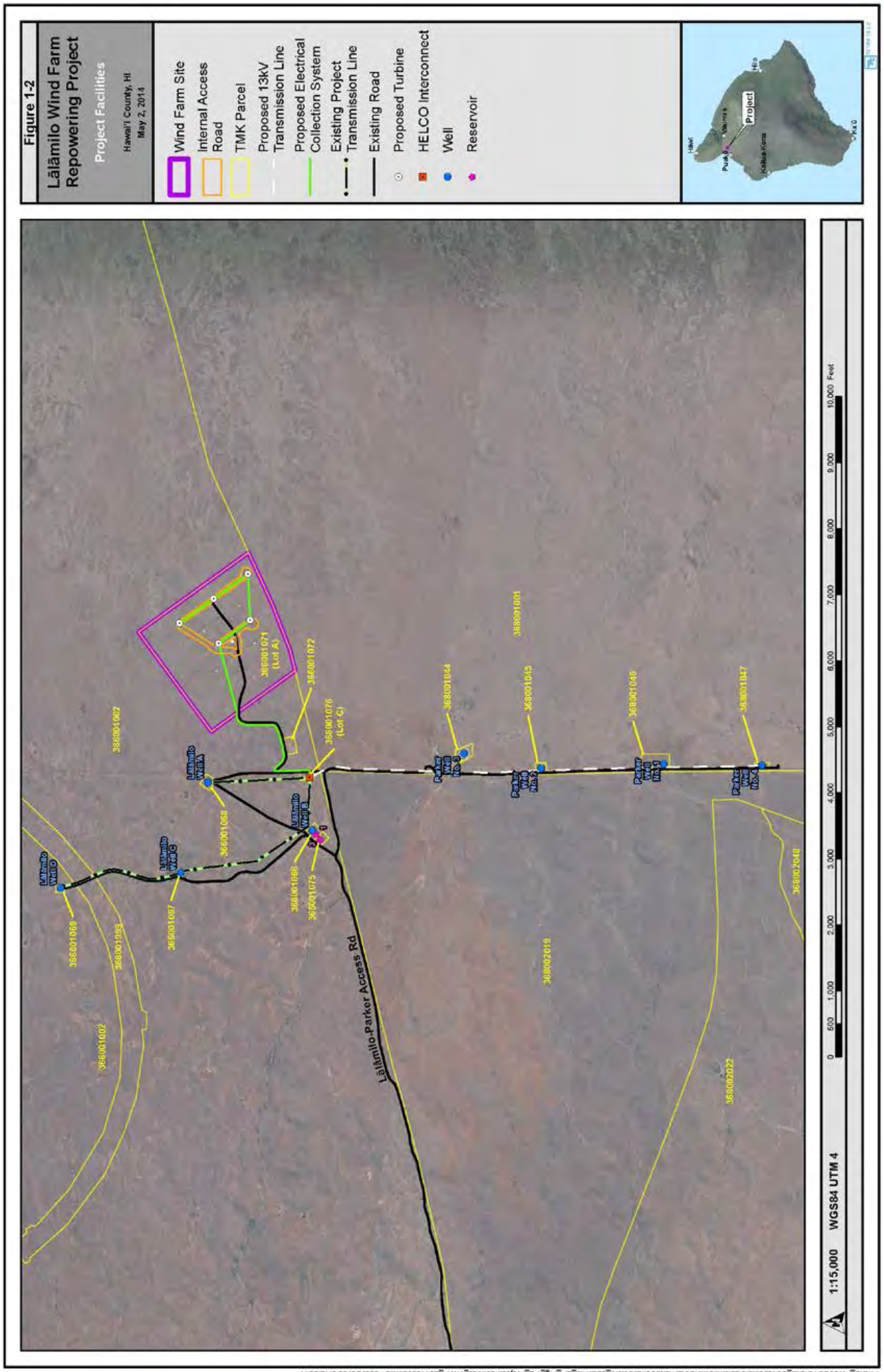

Figure 17. Construction plan for the Lālāmilo Wing Repowering Project.

3. CULTURE-HISTORICAL CONTEXT

Archaeologists and historians describe the inhabiting of Hawaiʻi in the context of settlement that resulted from voyages taken across the open ocean. For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawaiʻi were underway by A.D. 300, with long distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian Kahiki—were the Marquesas and Society Islands (Cordy 2000; Emory in Tatar 1982:16-18).

The question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered. Several theories have been offered derived from various sources of information (i.e., genealogical, oral-historical, mythological, radiometric), but none of these theories is today universally accepted (c.f., Kirch 2011; Wilmshurst et al. 2011). The three most popular theories place the first settlement at around A.D. 300, A.D. 600, and A.D. 1000, respectively. 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 establish a uniquely Hawaiian culture.

Comprehensive and detailed culture-historical (both archival and oral) background information relative to the general project area can be found in Barrera and Kelly (1974), Clark (1987), Clark and Kirch (1983), Jensen (1994), and Maly (1999). The prehistory of South Kohala is understood only in broad terms (Kirch 1985; Rosendahl and Carter 1988). In general, Precontact population was centered both in the uplands and along the coast. Initial occupation of the area probably began at small coastal settlements at selected areas, where early inhabitants exploited the diverse marine resources (Jensen 1994). The upland habitation that followed focused on agricultural field systems, which undoubtedly provided much of the produce for the coastal inhabitants (Carlson and Rosendahl 1990). The earliest inhabitants emphasized the use of natural caves and overhangs, along with the construction of small, simple surface features for habitation purposes, but as populations increased and expanded, so did the occurrence of more permanent habitation structures in both the coastal and upland areas (Jensen 1994). A network of coastal and inland trails, over which the exchange of goods occurred, connected the coastal and upland population centers and resource areas (Hommon 1976). The current study area occupies a dry environmental zone intermediate between the coastal *kula* and the fertile agricultural uplands. It is within this context that the following discussion of the history and culture of the study area is framed.

The initial settlement in Hawaiʻi is believed to have occurred from the southern Marquesas Islands. This was a period 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). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *ʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. 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 near shore fisheries, enriched by nutrients carried in the fresh water, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found (McEldowney 1979:15). In these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence level agriculture and fishing (Handy and Handy 1972:287).

Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, and by about A.D. 1200, the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000:130). The current project area is situated within the District of South Kohala in the *ahupuaʻa* of Lālāmilo and Waikōloa (Figure 18). As described by Handy and Handy:

> 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. (1991:528)

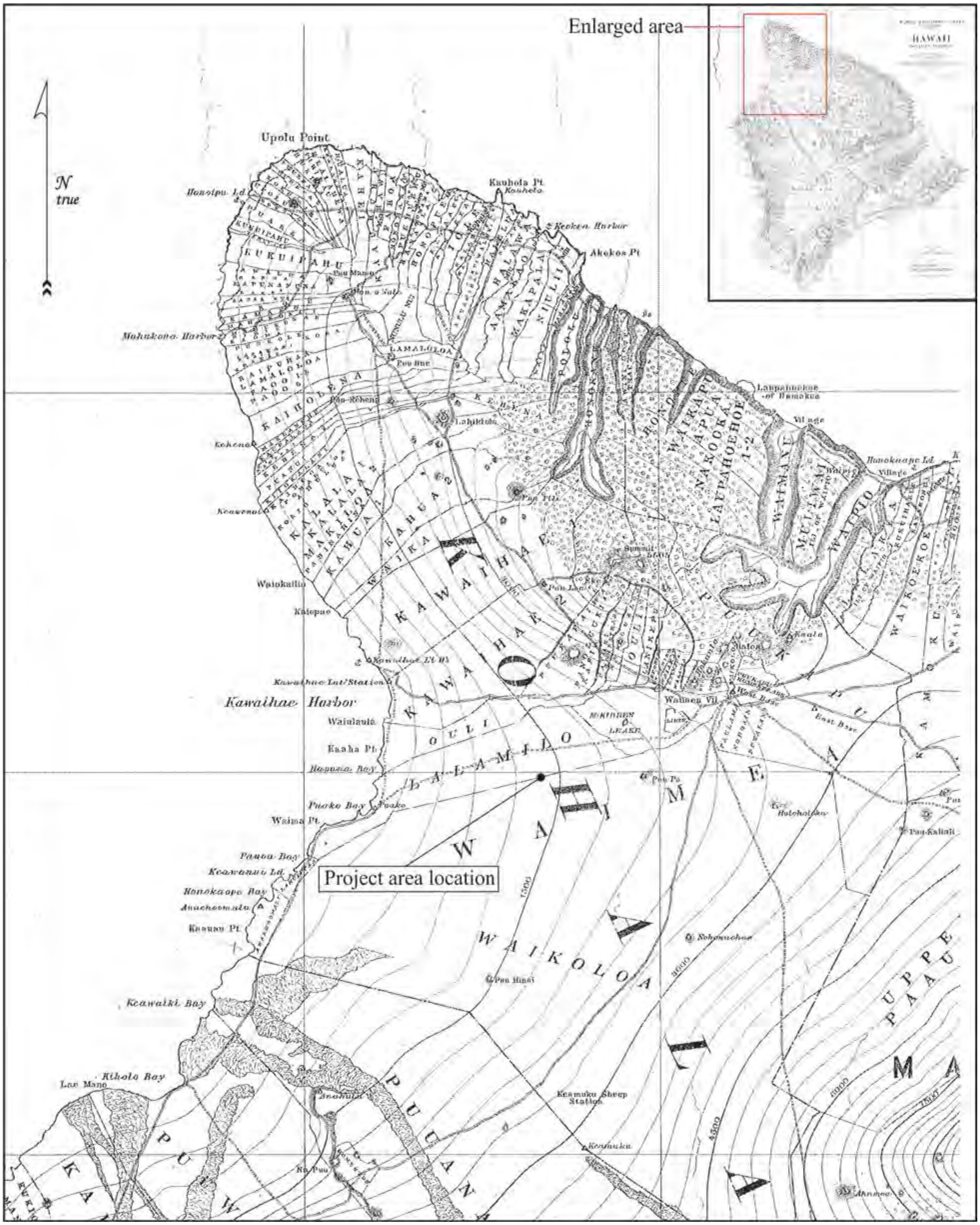

Figure 18. Portion of Hawai‘i Registered Map No. 2124 showing Lālāmilo and Waikōloa *ahupua‘a* (prepared by John M. Donn in 1901).

In the District of Kohala, the long ridge of Kohala Mountain 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 has been collected from Kapaʻanui, where Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 461, and from ʻAnaehoʻomalu where Barrera (1971) reported A.D. 900 as the initial date for settlement. These early dates should be viewed with suspicion (see Kirch 2011), but it is possible that they represent the earliest establishment of small, short-term camps to exploit seasonal, coastal resources. 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).

By the 1300s a uniquely Hawaiian culture had evolved. The portable artifacts found in archaeological sites of this period 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. A few areas in Hawaiʻi produced quality basalt for adze production, and the most well-known adze quarry (Keanakakoʻi) is located at 11,000 feet on Mauna Kea. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *ʻulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As population increased, the result was social stress, hostility, and war between neighboring groups (Kirch 1985). Soon, large areas of Hawaiʻi were controlled by a few powerful chiefs.

Increased social stratification led to major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions were settled and the more marginal leeward areas were being developed. It was during this timeframe that a second major migration settled in Hawaiʻi, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pāʻao arrived in the islands from Tahiti. 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 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 (Kamakau 1991). In 1866, Kamakau told the following story of their arrival in Hawaiʻi:

> Puna on Hawaiʻi Island was the first land reached by Pāʻao, and here in Puna he built his first *heiau* for his god Ahaʻula and named it Ahaʻula [Wahaʻula]. It was a *luakini*. From Puna, Pāʻao went on to land in Kohala, at Puʻuepa. He built a *heiau* there called Moʻokini, a *luakini*.
>
> It is thought that Pāʻao came to Hawaiʻi in the time of the *aliʻi* Laʻau because Pili ruled as *moʻi* after Laʻau. You will see Pili there in the line of succession, the *moʻo kūʻauhau*, of Hanalaʻanui. It was said that Hawaiʻi Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawaiʻi Island had been without a chief for a long time, and the chiefs of Hawaiʻi were *aliʻi makaʻāinana* or just commoners, *makaʻāinana*, during this time.
>
> . . . There were seventeen generations during which Hawaiʻi Island was without chiefs—some eight hundred years. . . . The lack of a high chief was the reason for seeking a chief in Kahiki, and that is perhaps how Pili became the chief of Hawaiʻi. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawaiʻi Island. (1991:100–102)

There are several versions of this story that are discussed by Beckwith (1970), 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.

Population continued to grow through the A.D. 1400s, and there was a concerted effort to increase upland agriculture; Rosendahl (1972) has proposed that settlement at this time was related to 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. Hommon (1976) 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 fostered 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. Expanding on Hommon's concepts, Kirch (1985) suggests that the *ahupua'a* system was established sometime during the A.D. 1400s, adding another component to a then 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* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). 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 name of an *ahupua'a* sometimes indicates its importance, records its history, or reveals something about its resources or population. Waikōloa may have been named for a cold northwest wind that sometimes blows across the Hawaiian Islands (Pukui et al. 1974). There is slight discrepancy in the pronunciation of this *ahupua'a* however, either Waikōloa or Waikoloa, which literally translates as "duck water". The name Lālāmilo literally translates as "*milo* tree branch" (Pukui et al. 1974). The Hawaiian language newspaper *Ka Hoku o Hawaii* contained the following traditional *mo'olelo* of the naming of the *ahupua'a* of the region in a two-part article published on July 5 and 19, 1917:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert *lawai'a hī-'ahi* (deep sea tuna lure fisherman) and Pili-a-mo'o, a powerful priestess and 'ōlohe. Kanakanaka and Piliamo'o were the parents of Nē'ula (a fishing goddess), and she married Pu'u Hīnai a chief of the inlands. Nē'ula and Pu'u-hīnai were the parents of Lālāmilo. Kanakanaka's sister was the wind goddess, Waikōloa, for whom the lands are now named.
>
> Lālāmilo gained fame as an expert 'ōlohe and fisherman. And through his wife Puakō, he came to possess the supernatural leho (cowry octopus lure) which had been an 'ōnohi (cherished) possession of Ha'aluea, a goddess with an octopus form... How this octopus lure came to rest on the reefs fronting this land remains a mystery . . .
>
> Puakō was the daughter of Wa'awa'a (kāne) and Anahulu (wahine), and the sister of: 'Anaeho'omalu (wahine); Pū'āla'a (kane); and Maui-loa (kāne). Puakō's great desire was to eat he'e (octopus), and Pu'āla'a was kept continually busy acquiring he'e for Puakō, and getting pa'ou'ou fish for 'Anaeho'omalu. When he could no longer provide sufficient numbers of fish for his sisters they left Puna and set out in search of suitable husbands who could provide for their needs.
>
> Because of their great love for 'Anaeho'omalu and Puakō, Anahulu, Wa'awa'a, their relatives and attendants also moved to the Kona - Kohala region and dwelt at sites which now bear their names; only Pū'āla'a remained in Puna. This is how Pu'u- Huluhulu, Pu'u-Iki, and Mauiloa came to be named; and Pu'u Anahulu (Ten day hill [ceremonial period]) was named for Anahulu, the chiefess wife of Wa'awa'a (Pu'u Wa'awa'a).
>
> Arriving at Kapalaoa in the Kekaha lands of Kona, 'Anaeho'omalu married Nāipuakalaulani, son of the chiefess Kuaīwa of Kapalaoa. Puakō went on to Waimea where she met with natives of that area, and was introduced to the chiefess Nē'ula, mother of Lālāmilo. When Nē'ula learned that Puakō greatly coveted he'e, she told Puakō that her son was the foremost lawai'a 'ōkilo he'e (octopus fisherman) of the region. And because Puakō was so beautiful, Nē'ula introduced her to Lālāmilo. Lālāmilo saw Puakō, and compared her to the foremost "he'e" which he could catch. (translated in Maly and Maly 2002: 22-23)

Traditionally, Waikōloa and Lālāmilo were *'ili* of the *kalana* (or 'okana) of Waimea, a land division that in ancient times was treated as a sub-district, smaller than a district (*moku o loko*), but comprised of several other land divisions that 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, Pu'ukapu, and Waikōloa (Figure 19). Bernice Judd, a former librarian at the Hawaiian Mission Children's society, explains that:

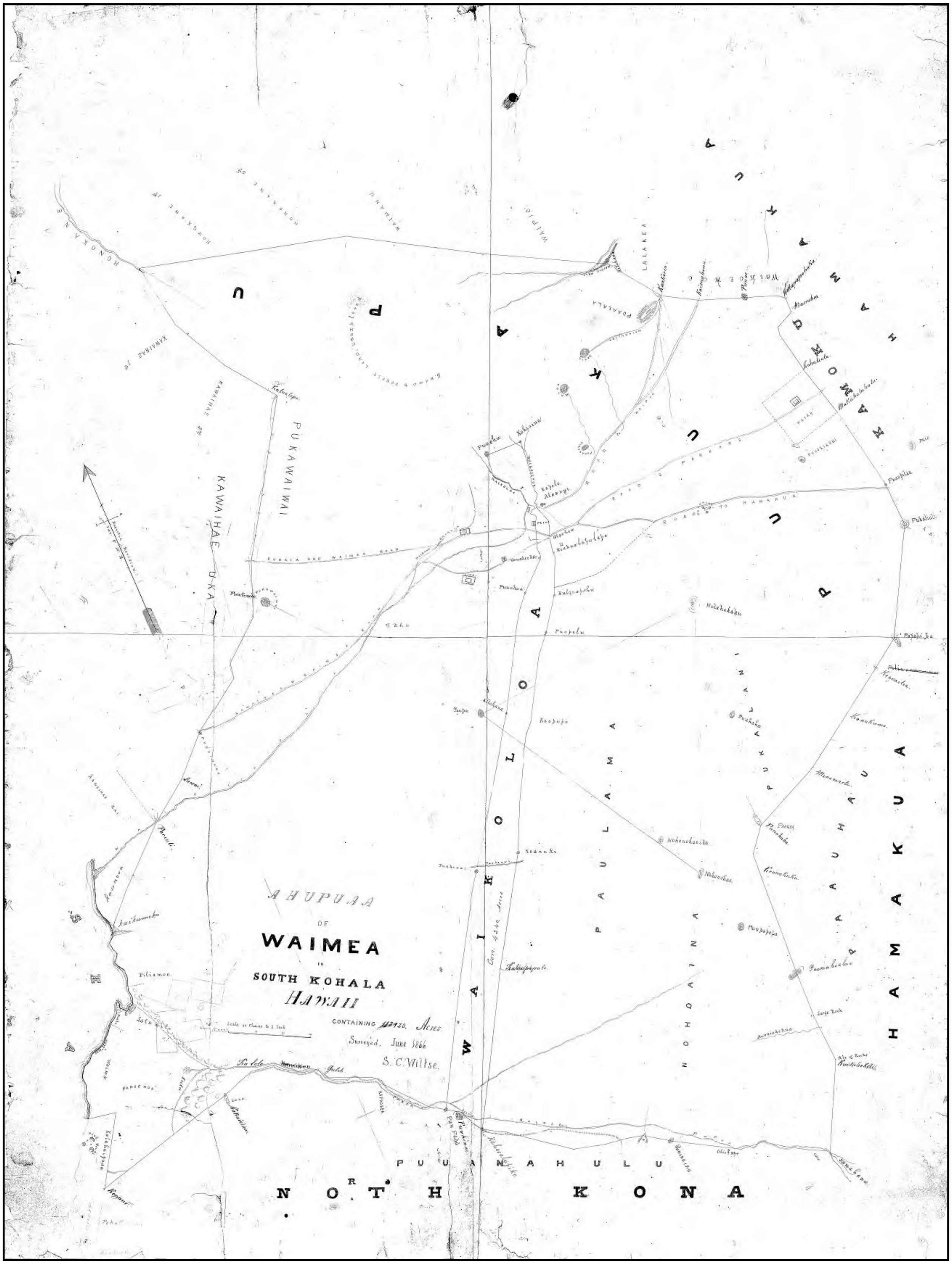

Figure 19. Hawai'i Registered Map No.712 showing the *ahupua'a* of Waimea, prepared by S. C. Wiltse, June 1866.

> 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 1832:14)

In some early accounts Waikōloa is referred to as Waikōloa Nui and Lālāmilo is referred to as Waikōloa Iki (Maly 1999). In other references Lālāmilo is referred to as Puakō, which today is the name of a small village on the coast within Lālāmilo. According to Dunn and Rosendahl (1992) land records of the mid-1800s reveal that Lālāmilo was actually the name of an *ʻili* in Puakō, but Puakō either got absorbed into other *ahupuaʻa* and the *ʻili* of Lalamilo became an *ahupuaʻa*, or the names just got switched around on Historic maps. Unlike the map of Waimea prepared by S. C. Wiltse in June 1866 (see Figure 19), a 1901 map prepared by John M. Donn (see Figure 18) and a 1928 Hawaiian Government Survey map (Figure 20) both show the *ahupuaʻa* of Waikōloa and Lālāmilo as they appear today.

The *aliʻi* and the *makaʻāinana* (commoners) were not confined to the boundaries of the *ahupuaʻa*; when there was a perceived need, they also shared with their neighbor *ahupuaʻa ohana* (Hono-ko-hau 1974). The *ahupuaʻa* were further divided into smaller sections such as the *ʻili, moʻoʻaina, paukuʻaina, kihapai, koele, hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *moʻi* (king). *Heiau* building 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 it was the need to supply chiefs' staying at Kawaihae with food that eventually lead to an expansion of upland agriculture in the Waimea area (Barrére 1983:27). Rechtman and Prasad (2006) suggest that the uplands of the region were exploited for forest resources possibly as early as the 13th and 14th centuries, followed by agriculture and prolonged residence in the 16th century. Kirch (1985) notes that dates attained by archaeological investigations demonstrate active, intensive use of the Waimea-Lālāmilo area for agriculture by the mid-17th century.

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 and irrigated taro (Kirch 1985). Here, an agricultural complex with an extensive network of fields fed by a system of irrigation ditches running from the Waikoloa and Kahakohau Streams, dominated the landscape. Burtchard and Tomonari-Tuggle (2002) note that the Waimea-Lālāmilo field complex was also characterized by spatially limited residential sites, linear, low earthen ridges, and irrigation ditches located along (Waikoloa Stream) at the eastern margins of the system. Kirch surmises that the fields were perhaps intermittently irrigated, and that "simple furrows" were utilized to "direct water across the sloping field surfaces," as "the capacity of the ditches was insufficient to have kept all fields constantly watered, and some method of rotation must have been practiced" (1985:231). 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 and Handy 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" (1991:532). The name of the village of Puakō, which literally translates as "sugarcane blossom" (Pukui et al. 1974), 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).

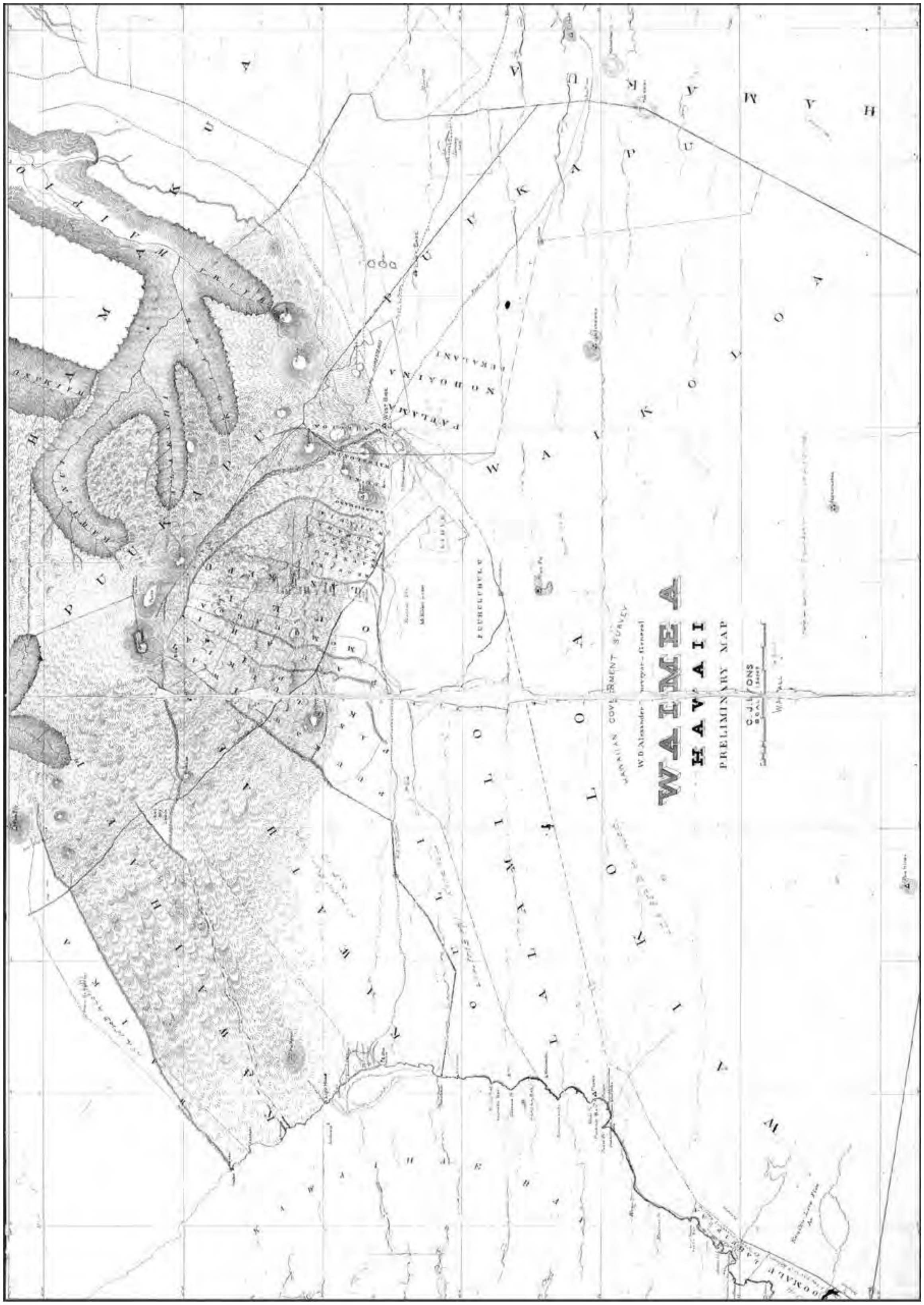

Figure 20. Registered Map No. 1080 showing *kalana* of Waimea (prepared by C.J. Lyons in 1885).

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 and Handy 1991:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy and Handy 1991:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903).

Pukui (1983) cites a proverb that reference Kohala. She provides an explanation and notes that Hawaiian proverbs have layers of meaning 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.

Pukui interprets this proverb as follows:

> 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. (1983:127)

By the seventeenth century, large areas of Hawaiʻi Island (*moku āina* – districts) were controlled by a few powerful *aliʻi ʻai 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 Hawaiʻi, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ʻUmi a Līloa, a renowned *aliʻi* of the Pili line who ruled from Waipiʻo Valley, is often credited with uniting the island of Hawaiʻi under one rule (Cordy 1994). According to Kamakau (1992) ʻUmi was skilled fisherman, and fishing for *aku*, his favorite fish, often brought him to the beaches of South Kohala from Kalahuipuaʻa to Makaula, where he also fished for *ʻahi* and *kala* with many other famed fishermen and all the chiefs of the kingdom. ʻUmi's reign lasted until around ca. A.D. 1620, and was followed by the rule of his son, Keawenui a ʻUmi, and then his grandson, Lonoikamakahiki (Cordy 1994).

Kirch (1985) places the beginning of the Proto-Historic Period (A.D. 1650–1795) during the rule of Lonoikamakahiki. This was a time marked by both political intensification and stress an continual conquest by the reigning *aliʻi*. Wars occurred regularly between intra-island and inter-island polities during this period, and included battles that transpired in the vicinity of the current project area. One such battle was fought between Lonoikamakahiki (Lono) and his older brother, Kanaloakuaʻana, who rebelled against him. According to Fornander, Kanaloakuaʻana and his rebel forces were situated at:

> . . . the land called Anaehoomalu, 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 the 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 Kaunooa [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 [on the plain north of Waikōloa] and Puukohala, near the Heiau of that name, in both of which Lono was victorious. . . (Fornander 1996:120-121)

Later, Lonoikamakahiki battled the forces of Maui led by Kamālālawalu (Kama) on the plain of Waikōloa below Puʻu ʻŌāʻoaka (Maly and Maly 2002). According to Kamakau:

> After Kama-Iala-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 Kaʻu and Puna were coming down from Mauna Kea, and those of Waimea and Kohala were on the level plain of Waimea [Waikōloa]. The men covered the whole of the grassy plain of Waimea like locusts. Kamalalawalu with his warriors dared to fight. The battlefield of Puʻoaʻoaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led [Kamalalawalu's forces] 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 lightning, breaking the bones into pieces and causing sudden death as if by bullets . . .
>
> . . . The Maui men who were used to slinging shiny, water-worn stones grabbed up the stones of Puʻoaʻoaka. 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 . . . The warriors of Maui were put to flight, and the retreat to Kawaihae was long. [Yet] there were many who did reach Kawaihae, but because of the lack of canoes, only a few escaped with their lives ... Kamalalawalu, ruler of Maui, was killed on the grassy plain of Puako, and some of his chiefs were also destroyed. (1991:58-60)

By the 1700s, the rule of Hawai‘i Island was divided amongst the chiefs of Kona and Hilo (Kamakau 1992). Keawe, a Pili line ruler and the son of Kanaloakapulehu, was the chief of Kohala, Kona, and Ka‘ū. When Keawe died, he split the rule of his lands between two of his sons, further dividing the island’s chiefdoms; Kalaninui‘iamamao became the ruling chief of Ka‘ū, and Ke‘eaumoku became the ruling chief of Kona and Kohala (Kamakau 1992). Wars between the *ali‘i* continued unabated through this transition.

After Keawe’s death, Alapa‘inui, the son of former Kona war chief Kauauanui a Mahi, desired to take control of Hawai‘i Island (Kamakau 1992). Alapa‘inui, who had been living on Maui since the death of his father, returned to Hawai‘i and waged war against the chiefs of Kona and Kohala. Alapa‘inui was eventually victorious and he took the chiefs of those districts captive, proclaiming Kona and Kohala his own. Kekaulike, the ruler of Maui, much preferred the former chiefs of Hawai‘i Island, and wished to help them reclaim their lands. The Maui forces attacked Alapa‘inui, but were unable to defeat him. Although Alapa‘inui’s forces were never beaten, the frequent attacks by Kekaulike did prevent him from taking the chiefs of Hilo and Ka‘ū captive (Alapa‘inui did eventually gain control of these districts however). Alapa‘inui later fought and defeated the forces of O‘ahu on Moloka‘i, and after Kekaulike’s death he fought Kauhi (his rival’s oldest son) on Maui, where he was also victorious. Alapa‘inui ruled for many years, but at the end of his reign, after moving to Kikiako‘i in Kawaihae, he became seriously ill. It was there at the *heiau* of Mailekini that he appointed his son Keawe‘ōpala ruler of the island (Kamakau 1992).

During this time of warfare, and following the death of Keawe, Kamehameha was born in the North Kohala District in the *ahupua‘a* of Kokoiki, near the *heiau* of Mo‘okini (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992:66–68) places the birth event sometime between A.D. 1736 and 1758, most likely 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 Hālawa, North Kohala (Williams 1919).

It was in 1754 that Keawe‘ōpala became the ruler of Hawai‘i, but many of the chiefs who were deprived of their lands battled against him. Keawe‘ōpala was soon defeated in South Kona by Kalani‘ōpu‘u, who then became the ruler of Hawai‘i Island (Kamakau 1992). Kalani’ōpu‘u was a clever and able chief, and a famous athlete in all games of strength, but according to Kamakau (1992), he possessed one great fault: he loved war and had no regard for others’ land rights. Although challenged by many rivals, Kalani‘ōpu‘u maintained his rule over Hawai‘i Island for nearly thirty years.

About A.D. 1759, Kalani‘ōpu‘u conquered East Maui and defeated his wife’s brother, the Maui king Kamehamehanui, by using Hāna’s prominent Pu‘u Kau‘iki as his fortress. He appointed one of his Hawai‘i chiefs, Puna, as governor of Hāna and Kīpahulu. Following this victory, Ke‘eaumoku, the son of Keawepoepoe who had originally supported Kalani‘ōpu‘u against Keawe‘ōpala, rebelled against the Hawai‘i chief. He set up a fort on a hill between Pololū and Honokāne Valleys in windward North Kohala, but Kalani‘ōpu‘u attacked him there and was victorious. Using ropes, Ke‘eaumoku escaped to the sea and fled in a canoe to Maui where he lived under the protection of the Maui chiefs (Kamakau 1992).

In A.D. 1766 Kamehamehanui, the king of Maui, died following an illness and Kahekili became the new ruler of that island. Ke‘eaumoku took Kamehamehanui’s widow, Namahana, a cousin of Kamehameha I, as his wife, and their daughter, Ka‘ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu‘u Kau‘iki, Hāna, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani‘ōpu‘u and his Hāna forces raided and destroyed the neighboring district of Kaupō in Maui, 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‘ilio 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 Western explorers in Hawaiʻi signified the end of the Precontact Period, and the beginning of the Historic Period. With the arrival of foreigners, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the late Proto-Historic Period/early Historic Period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first 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 (Kirch 1985; Kent 1983). 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 (Kirch 1985; Kent 1983). 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). Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces began to have a devastating impact on traditional life-ways in the Hawaiian Islands. This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in the Hawaiian Islands on January 18, 1778. The following January 17th [1779], on a return trip to Hawaiian waters, Cook anchored near Kaʻawaloa along the north shore of Kealakekua Bay in the South Kona District to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many of chiefs and commoners were gathered around the bay celebrating. According to John Ledyard, a British marine on board Cook's ship, upward of 15,000 inhabitants were present at the bay, and as many as 3,000 canoes came out to greet the ships (Jarves 1847:59). It has been suggested that Captain Cook was mistaken for the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992).

On January 24th, Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island, left his battle with Kahekili on Maui, and arrived at Kealakekua Bay. He landed at ʻAwili in Kaʻawaloa, where he stayed at the home of the chief Keaweaheulu in Hanamua (Kamakau 1992). Upon arriving at the village, Kalaniʻōpuʻu immediately forbade others from approaching Cook's ships, but on January 26th he visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawaiʻi, was present at this meeting (Jarves 1847).

On February 4th, Cook set sail from Kealakekua Bay, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua Bay to make repairs. With Cook's return many of the inhabitants of Kealakekua began to doubt that he was actually the physical manifestation of Lono (Kamakau 1992). On February 13th, several natives were discovered stealing nails from the British ships. They were fired upon by the crew, and a chief close to Kalaniʻōpuʻu named Palea was knocked down, and his canoe taken. That night one of Cook's boats was stolen, and the following morning Cook set ashore at Kaʻawaloa with six marines to ask Kalaniʻōpuʻu for its return. Kalaniʻōpuʻu, however, denied any knowledge of the theft; Cook decided to hold the chief captive until the boat was returned (Kamakau 1992). When Cook tried to seize Kalaniʻōpuʻu, however, a scuffle ensued and Cook was killed (along with four of his men and several natives) there on the shores of Kaʻawaloa, struck down by a metal dagger.

After Captain Cook fell, the British ships fired cannons into the crowd at the shore and several more natives were killed. Kalaniʻōpuʻu and his retinue retreated inland, bringing the body of Cook with them. Kamakau writes:

> . . . The bodies of Captain Cook and the four men who died with him were carried to Ka-lani-ʻopuʻu at Maaunaloia, and the chief sorrowed over the death of the captain. He dedicated the body of Captain Cook, that is, he offered it as a sacrifice to the god with a prayer to grant life to the chief (himself) and to his dominion. Then they stripped the flesh from the bones of Lono. The palms of the hands and the intestines were kept; the remains (*pela*) were consumed with fire. The bones Ka-lani-ʻopuʻu was kind enough to give to the strangers on board the ship, but some were saved by the kahunas and worshiped. (1992:103)

After the death of Captain Cook 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. Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. Kalaniʻōpuʻu first went to Hinakahua in Kapaʻau, North Kohala where he amused himself with "sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks" (Kamakau 1992:106). During his stay 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 Imakakoloʻa.

Imakakoloʻa was defeated in Puna by Kalaniʻōpuʻu's superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalaniʻōpuʻu "went to Ka-ʻu and stayed first at Punaluʻu, then at Waiohinu, then at Kamaʻoa in the southern part of Ka-ʻu, and erected a heiau called Pakini, or Halauwailua, near Kamaʻoa" (Kamakau 1992:108). Imakakoloʻa was eventually captured and brought to the *heiau*, where Kiwalaʻō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kiwalaʻō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloʻa and offered it up to the god, and the freeing of the tabu for the *heiau* was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawaiʻi. After usurping Kiwalao's authority with a sacrificial ritual in Kaʻū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalaniʻōpuʻu died in April of 1782 and was succeeded by his son Kiwalaʻō.

After Kalaniʻōpuʻu died, several chiefs were unhappy with Kiwalaʻō's division of the island's lands, and civil war broke out. Kiwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona in July of 1782. Supporters of Kiwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Mokuʻōhai with their lives and laid claim to the Hilo, Puna, and Kaʻū Districts. According to ʻIʻi (1963), nearly ten years of continuous warfare followed the death of Kiwalaʻō, as Kamehameha endeavored to unite the island of Hawaiʻi under one rule and conquer the islands of Maui and Oʻahu. Keōua became Kamehameha's main rival on the island of Hawaiʻi, and he proved difficult to defeat (Kamakau 1992). Keawemauhili would eventually give his support to Kamehameha, but Keōua never stopped resisting. Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Puʻukoholā at Kawaihae, which he dedicated to the war god Kūkaʻilimoku (Fornander 1996).

When the construction of Puʻukoholā Heiau was complete in the summer of 1791, Kamehameha sent two of his counselors, Keaweaheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Puʻukoholā Heiau by this ruse, but when he arrived at Kawaihae he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keōua gave Kamehameha undisputed control of Hawaiʻi Island by about the year 1792 (Greene 1993). Between 1792 and 1796 Kamehameha mostly resided at Kawaihae and worked the lands of the Lālāmilo-Waikōloa-Waimea region (Maly and Maly 2002). By 1796, Kamehameha had conquered all the island kingdoms except for Kauaʻi. 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).

In the twelve years following the death of Captain Cook, sixteen foreign ships (all British and American) called in Hawaiian waters (Restarick 1927). In 1790, two sister ships, the *Eleanora* and the *Fair American*, were trading in Hawaiian waters when a skiff was stolen from the *Eleanora* and one of its sailors was murdered. The crew of the *Eleanora* proceeded to slaughter more than 100 natives at Olowalu [Maui]. After leaving Maui, the *Eleanora* sailed to Hawaiʻi Island, where one of its crew, John Young, went ashore and was detained by Kamehameha's men. The other vessel, the *Fair American,* was captured by the forces of Kamehameha off the coast of North Kona, and in an act of retribution for the Olowalu massacre, they slaughtered all but one crew member, Isaac Davis. Guns and a cannon (later named "Lopaka") were recovered from the Fair American, and were kept by Kamehameha as part of his fleet (Kamakau 1992). Kamehameha made John Young and Isaac Davis his advisors.

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 during his 1793 and 1794 visits, giving them as gifts to Kamehameha I, who immediately made the cattle *kapu*, thus preventing them from being killed (Kamakau 1992). Five cows, one bull, two ewes, and a ram brought to the island by Vancouver in 1793 were set free to roam in the saddle area of Waimea between Mauna Kea, Mauna Loa, and Hualālai (Escott 2008).

During one of his visits Vancouver anchored at Kawaihae and a member of his crew, Archibald Menzies, a surgeon and naturalist, trekked inland towards Waimea. Menzies' journal records the journey and describes the land in the vicinity of the current project area:

> I travelled a few miles back…through the most barren, scorching country I have ever walked over,

> composed of scorious dregs and black porous rock, interspersed with dreary caverns and deep ravines…The herbs and grasses which the soil produced in the rainy seasons were now mostly in the shriveled state, thinly scattered and by no means sufficient to cover the surface from the sun's powerful heat, so that I met with few plants in flower in this excursion. (Menzies 1920:55)

Around the turn of the century, Kamehameha gave Waikōloa Nui Ahupuaʻa (excluding the coastal *ʻili* of ʻAnaehoʻomalu and Kalāhuipuaʻa) to Isaac Davis (Rosendahl 2000). Although the land gifted to Davis encompassed a large area, it lacked extensive resources, and was primarily a place for catching birds and gathering *pili* grass. When Davis died in 1810 without naming an heir, John Young took control of the land to protect it for Davis' children, who were at that time too young to take on the responsibility (Rosendahl 2000). Lālāmilo, or Waikōloa Iki, with its fertile upland agricultural complex, remained under the control of Kamehameha.

During the first part of the nineteenth century, Hawaiʻi's culture and economy continued to change drastically as capitalism and industry established a firm foothold in the islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine. Kamehameha, who resided on the Island of Oʻahu at this time, did manage to maintain some control over the trade of sandalwood on Hawaiʻi Island (Kuykendall and Day 1976; Kent 1983).

Upon returning to Kailua 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 added to the breakdown of the traditional subsistence system. Kamakau 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" (1992:204). Once Kamehemeha 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 1992:204). 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 and Handy 1991). While in Kailua, 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.

By the early nineteenth century the *kapu* cattle given to Kamehameha by Vancouver had multiplied to the extent that they were becoming a scourge for the native planters Waimea region. To protect the upland agricultural fields from the grazing cattle, sometime between 1813 and 1819, Kamehameha ordered that a wall be built from the northern boundary of Waikōloa Nui to near Puʻu Huluhulu (Barrère 1983). The wall was designed to keep wild cattle in Waikōloa Nui, and out of the more agriculturally productive areas on the Waimea side. This wall was called Kauliokamoa after the *konohiki* who oversaw its construction (Wolforth 2000).

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and 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 eliminate all of the regular *kapu* that maintained social order and the separation of men and women, 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 the responsibility of the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered:

> The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*ʻainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-aliʻi, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

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 purification ceremonies Liholiho returned to Kamakahonu:

> 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 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 eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god *Kū-Kailimoku*, 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 (Oliver 1961; Kamakau 1992). Liholiho moved his court to O'ahu, lessening the burden of resource procurement for the chiefly class on the residents of Hawai'i Island. 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 sandalwood trade wreaked havoc on the lives of the commoners, as they weakened from the heavy production, exposure, and famine just to fill the coffers of the *ali'i*, who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). 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 went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar and cattle industries.

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 1969:399). Ellis notes that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. During his travels along the coast of North 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 writes:

> 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 2004:405-406)

Ellis also describes another of his travelling companion's journey 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. (Ellis 2004:412)

In 1822 John P. Parker, originally of Newton, Massachusetts, was one of the early foreigners granted permission to hunt bullock for the crown (Escott 2008). 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 (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).

The population of South Kohala continued to reside either near the shore or in the uplands of Waimea throughout the first half of the nineteenth century, but with the arrival of foreigners in Hawai‘i, the introduction of a western economy, and the rise of the sugar and cattle industries, life in Kohala began to change drastically. Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically; initially through deforestation from the collection of sandalwood, followed by the introduction of cattle to these lands (Rechtman and Prasad 2006). Foraging cattle wreaked havoc on the agricultural fields and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes. From the 1820s until the 1840s a sugar mill operated in the Waimea area. New crops, such as Irish potatoes, watermelons, cabbage, onions, tomatoes, mulberries, figs, and beans were also introduced in Historic times. 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). However, commercial ventures soon replaced traditional agricultural practices, and the Waimea landscape was substantially altered as a result of this post-contact change (Rechtman and Prasad 2006).

In 1830 the appointed governor of Hawai‘i Island, Kuakini, moved to 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). According to an 1830 Missionary Commission Report (Lyons 1875) another trail followed the boundary of Waikōloa and Lālāmilo *ahupua‘a* from Waimea to the coastal village of Puakō, passing by the current project area. Hawai‘i Registered Map Nos. 574 (prepared by Kaelemakule – no date; Figure 21), 1080 (prepared by C. J. Lyons and W.A. Wall in 1885; see Figure 20), and 2993, (prepared by Chas L. Murray in 1929; Figure 22), all show an "old trail" following the boundary between the two *ahupua‘a*. A September 10, 1836 article in the *Sandwich Island Gazette* describes the terrain traversed by the trail:

> . . . [the trail] consists of a gradual descent of about 10 miles to the seaside. It is entirely composed of an uneven rocky waste, covered with long grass. This barren tract is untenanted and uncultivated. Rain seldom falls here and, besides the grass, nothing is seen to vary the monotony until you approach the coast, when the eye is relieved by the yellow blossoms of the Nohu [*Tribulus cistoides*]. (*Sandwich Island Gazette* September 10, 1836)

In 1835 Lorenzo Lyons, a minister from Waimea, trekked along this trail to the village of Puakō, which he briefly described as follows:

> Puako is a village on the shore, very like Kawaihae, but larger. It has a small harbor in which native vessels anchor. Coconut groves give it a verdant aspect. No food grows in the place. The people make salt and catch fish. These they exchange for vegetables grown elsewhere. (Lyons in Doyle 1953:85)

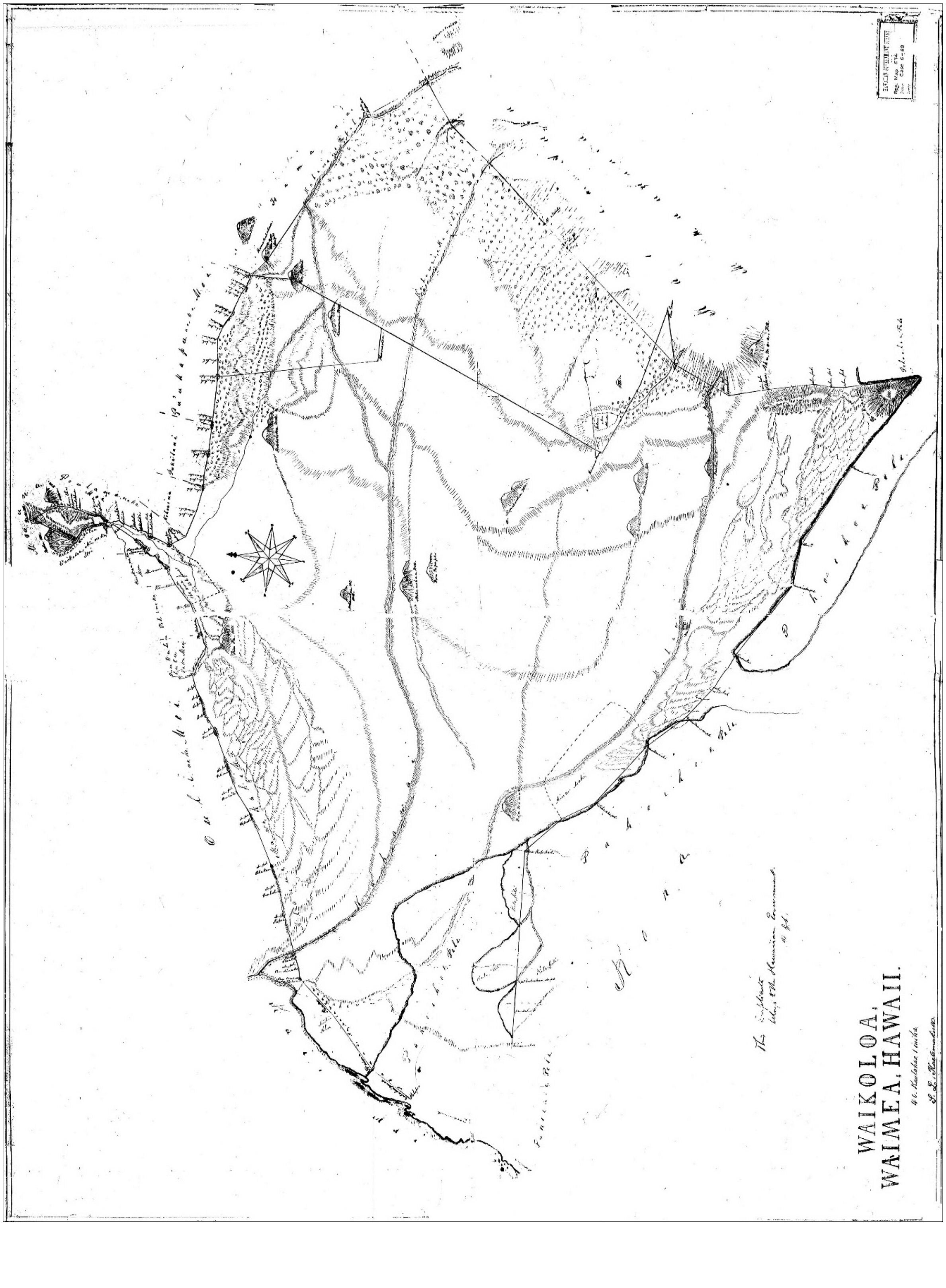

Figure 21. Registered map No. 574 showing an old trail along the Lālāmilo/Waikōloa *ahupuaʻa* boundary (prepared by Kaelemakule, n.d.).

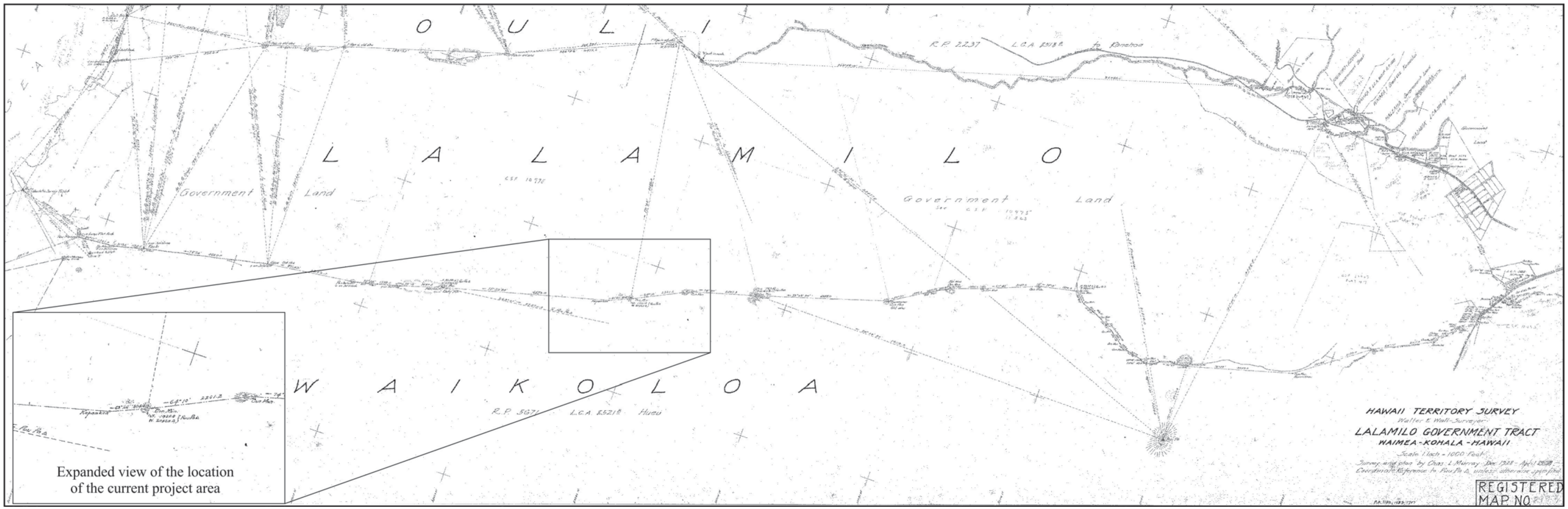

Figure 22. Registered Map No. 2993 showing an old trail running along the *ahupua'a* boundary of Lālāmilo and Waikōloa (prepared by Chas L. Murray in 1929).

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). In 1837 there were sixty foreigners in Waimea employed as mechanics and bullock hunters (Brundage 1971); and in his report to the American Board of Commissioners to Foreign Missions in 1840, Lorenzo Lyons stated "in my field are sixty or seventy foreigners, from seven or eight different nations. They are beef catchers, sugar manufacturers, shoe makers, merchants, masons, doctors, formers, and what not" (Doyle 1953:118). 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 lead to further efforts to tame, brand, fence, and herd privately owned cattle (Wilkes 1945). The decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, lead to a period of economic hardship and population decline in the Waimea area (Escott 2008).

By the mid-nineteenth century, leeward settlement had shifted to the windward side of Kohala as the leeward, agriculturally marginal areas were abandoned in favor of more productive and wetter sugarcane lands. 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. The wetter windward slopes of North Kohala and the Waimea plain were the focus of the shifting settlement pattern and they eventually became the population centers for the district. 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. (1988:33)

Throughout the first half of the nineteenth century the native population of the district declined rapidly as native populations were decimated by disease and a depressed birth rate. Epidemics in 1848 and 1849 killed more than 10,000 people in twelve months throughout the Hawaiian Islands (Tomonari-Tuggle 1988). In 1848 in North Kohala, Rev. Bond reported that 100 people had died within a three week period, and in October of that year he reported that a measles epidemic had nearly every resident of the district in the hospital (Damon 1927). Following these epidemics, the population of the district had been reduced to nearly half of the reported population in 1835; the number of coastal residents soon dwindled and most of the coastal villages were left to a few solitary residents. An 1848 description of the town of Waimea cited in McEldowney (1983:432) stated that "it can scarcely be said that there is any native population at all." This statement seems to sum up the demographic changes that were taking place as the native population had been severely reduced by disease, displacement, and the ongoing changes in land tenure.

By the middle of the nineteenth century, the ever-growing population of Westerners forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership in the Hawaiian Islands, and the Great *Māhele* became the vehicle for determining ownership of native lands. During this period, land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki,* were defined. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands 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 (Chinen 1961:13).

During the *Māhele,* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. All three types of land were subject to the rights of the native tenants therein. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai'i to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands. The boundary information was collected between ca. A.D. 1873 and 1885 and was usually given in Hawaiian, but transcribed in English.

The disposition and distribution of the lands of Waimea was a complicated issue, and was a matter of much testimony and debate among Commissioners, *kama'āina* informants, and land petitioners. Waimea was a discrete land unit (see Figure 19) but considered by some to not be an *ahupua'a*; rather it was considered to be a *kalana* or *'okana*, a unit larger than an *ahupua'a*. To further complicate the issue, some of the land units within Waimea were considered *ahupua'a* and others *'ili kupono*. As a result of the *Māhele* testimony and the Boundary Commission Testimony, many smaller *ahupua‘a* names were dropped and the relatively independent *‘ili kupono* were given *ahupua‘a* status, and except for a portion of the Waikoloa *ahupua‘a* (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. 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.

Lālāmilo Ahupua‘a was awarded to William C. Lunalilo as part of LCAw. 8559-B. Lunalilo, who became the first popularly elected Hawaiian King in 1874, died at age thirty-nine just twenty-five days after assuming the throne (Kelly 1983). Seventeen *kuleana* were claimed within Lālāmilo (Haun et al. 2003), including four at the coast (listed as being within Puakō) and thirteen in the uplands (listed as being within Waimea). The four *kuleana* at the coast were all house lots that were not awarded, while the thirteen inland *kuleana*, which were awarded, were for house lots and cultivation. None of the *kuleana* were in the vicinity of the current project area.

Waikōloa (Nui) Ahupua‘a was awarded to George Davis Hū‘eu. Kamehameha I had originally given the land to George’s father Isaac Davis. This award did not include the coastal areas of ‘Anaeho‘omalu and Kalāhuipua‘a, which were retained by the crown; thus the Davis Hū‘eu award was primarily restricted to the non-agricultural *pili* lands south of the agriculturally productive Lālāmilo area and *mauka* of the rich coastal resource area. Although at least twenty-six claims were made for *kuleana* in Waikōloa, only nine small residential lots were awarded near the town of Waimea (Maly and Maly 2002).

In the decades following the *Māhele* of 1848, which are characterized by a growing detraction from traditional subsistence activities, 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 and sugar industries. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements (such as Puakō in the vicinity of the current project area) 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 proceedings of the Land Commission ushered in changes in the traditional Hawaiian land tenure system that enabled foreigners to purchase lands which had previously been unavailable to them. 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 that year, 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. A year later, in 1852, 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 (Bergin 2004). By the mid-1850’s John Parker had turned most of the day to day operations of Parker Ranch over to his son, John Palmer Parker II.

By 1859, disputes regarding the boundary between the *ahupua‘a* of Pā‘auhau (in the Hāmākua District) and Waikōloa had arisen between Hū‘eu and Parker. The boundary issue was quickly resolved, but the dispute lead Lot Kamehameha, Minister of the Interior, to recommended to W. S. Spencer, Interior Department Clerk, that boundary testimony for all *ahupua‘a* be collected:

> From conversations with Surveyor Wilkes, I have come to the conclusion to recommend to H. Mj’s. Government to have all Government Lands, especially in Hamakua and Waimea, correctly surveyed, if possible excepting those tracts of Lands already sold to private parties. My reasons for recommending this step are that the Boundaries can only be defined and explained from the evidence of very old people now living in these Districts, and if the Government hesitates or delays this evidence, there will be shortly be no guide or information to enable them to come to a decision, as to the correct Boundaries. The people being all old and not likely to remain long as living evidences, in this world. . . (Department of the Interior letter dated May 29, 1859; in Maly 2002:70)

Disputes over the boundaries of Waikōloa Nui Ahupuaʻa, belonging to G. D. Hūʻeu, and the neighboring Crown lands of Waimea also soon arose. Testimony regarding the boundaries of Waikōloa Nui were heard on August 8 and 9, 1865 at Waimea. Several individuals knowledgeable of the boundaries testified, including Mi 1st who swore:

> I live on Waikoloa – I am a kamaaina of the lands in dispute. The name of the large land is Waimea – I am a witness for George Davis and also for the Rex [King] – Waimea is a Kalana – which is the same as an island divided into districts – there are eight Okana in Waimea. In those Okana are those lands said to extend out (hele mawaho). These lands came in to the possession of Kamehameha I who said to Kupapaulu, go and look out to of the large lands running to the sea, for John Young and Isaac Davis. Kupapaulu went to Keawekuloa, the haku aina, who said if we give Waikoloa to the foreigners they will get Kalahuipua [Kalahuipuaa] and Anaiomalu [Anaehoomalu] (two lands at the beach) then your master will have no fish. So they kept the sea lands and gave Waikoloa to Isaac Davis. John Young asked my parents if it was a large land they said, the black aa was Napuu, and the good land Waimea.
>
> They kept all the valuable part of the lands, and gave the poor land outside to Isaac Davis. They kept Puukapu, Pukalani, Nohoaina, Kukuiula (above the church), and Paulama; and gave Waikoloa to Isaac Davis. The other Waikoloa [Waikōloa Iki, or Lālāmilo], this side of the stream dividing them, was the King's. It comes down along the stream by Mr. Lyon's, then along the ditch, then along the wall of Puuloa, to Ahuli on the King's land, to the round hill, Uleiokapihe, and is cut off here by Davis' Waikoloa. - The wall was the boundary below, between Waikoloa of Isaac Davis and the land of the King, Kamehameha I. The latter built it by Kauliakamoa [Kauliokamoa]; to keep the cattle off from the King's land. The boundary runs to Liuliu, and the pili was all South, on Davis' land; then I know along an old road, Puupa, Waikoloa being South and Waimea North of the road, then to Kaniku. That is all I know.
>
> <u>Cross</u>. - My parents heard the command of Kamehameha I to Kupapaulu, and they told me, and also about John Young's asking about the land.
>
> I never heard that Puukapu, Nohoaina, Pukalani, and Paulama extended out to the pili. A road divided the land of the King and that of I. Davis.
>
> Waikoloa. - The wall was built to keep off the cattle, and to mark the land. The church is on the King's land. When Kalama measured Waikoloa he took in the church, I heard. I went with Kalama some of the time. Kalama said leave the old boundary and make a straight boundary, so I left them, lest Davis' land would go to the King. The boundary as I know it is from the English school house along a hollow, to the ditch near to Hoomaloo; thence to puu Makeokeo; thence to hills outside of Ahuli. The church is on Paulama which joins Waikoloa. (Boundary Commission, Volume A, No. 1 pg. 6)

Several named points along the boundary between Waikōloa and Lalāmilo are specified in 1865 Boundary Commission hearings. The points most proximate to the current project area include Puu Waewae, Kaala, Kapae, Pooholua, and Pohakau, Kapaakea, Palinui Puu Ananui, and Liuliu (Figure 23). Unfortunately no meanings for these names or legends associated with them are given. Other testimony indicates that Waikōloa Ahupuaʻa was a place for bird catching. Ehu, among others, testifies that, "Waikoloa was the land that had the birds" (Maly 1999:88).

By the mid-1860s the Waimea Grazing and Agricultural Company, founded by Robert C. Janion and William H. Green in 1861, and joined by F. Spencer and Company soon thereafter, had acquired considerable strategic assets around Waimea in an attempt to monopolize the livestock industry in the region (Bergin 2004). From the outset, Spencer, Janion, and Green maintained an adversarial relationship with Parker Ranch, and land disputes and allegations cattle rustling were common occurrences between these two competing entities. During the early 1860s Parker successfully thwarted Janion's men from harvesting unbranded cattle on his lands, but attacks by Frank Spencer contesting Parker's claim to more than 17,800 acres in Kaʻohe and Kemole were more difficult to resolve, and were still ongoing when John Palmer Parker, the founder of Parker Ranch, died on August 20, 1868 (Bergin 2004). At the time Parker Ranch controlled about 47,000 acres of land in the region, including the Lālāmilo portion of the current project area. The ranch lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr. (Bergin 2004).

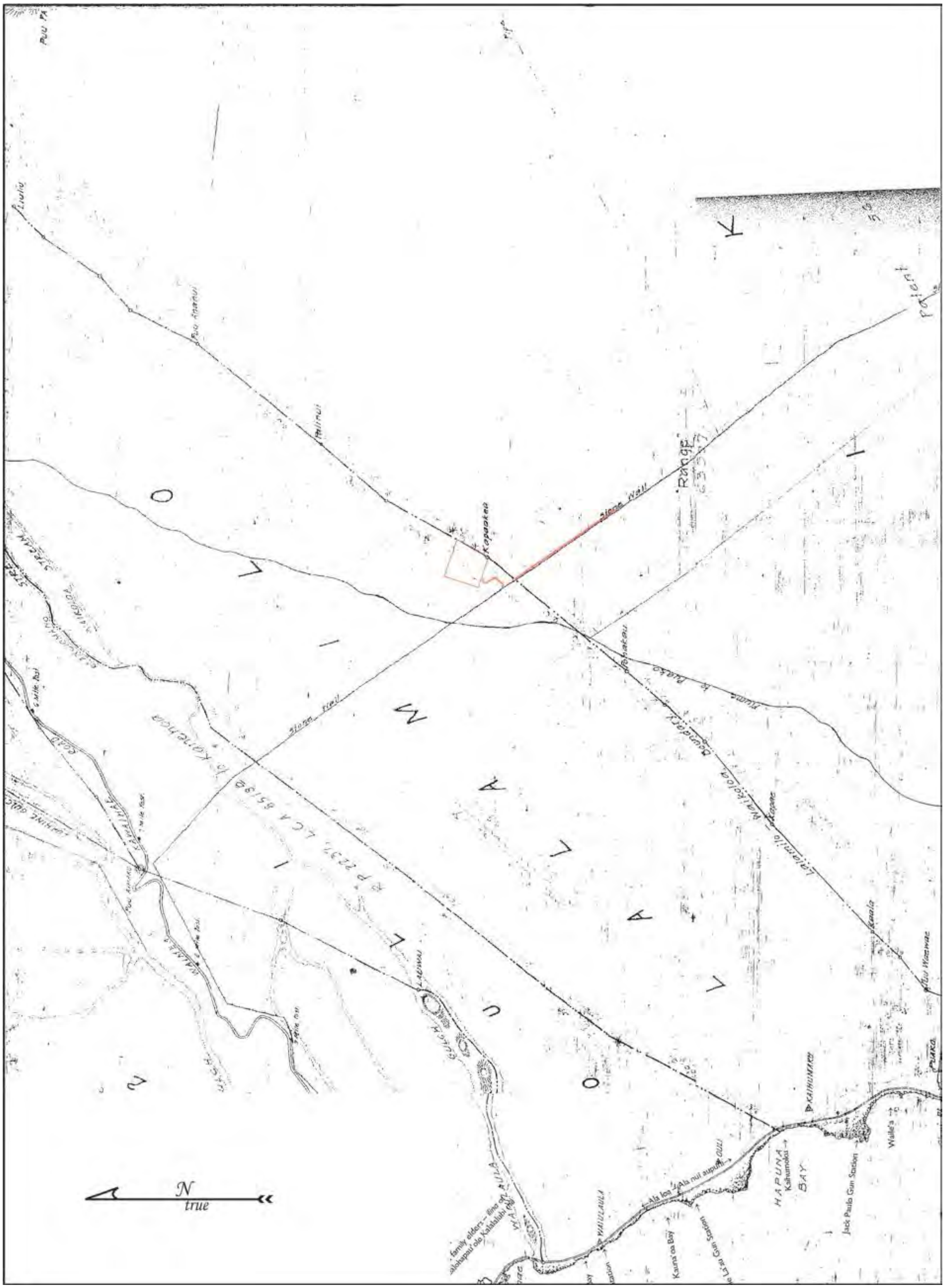

Figure 23. Portion of Hawai‘i Registered Map No. 2786 (prepared by Wright 1917 and annotated by Maly 1999) showing the current project area (outlined in red).

On July 2nd, 1868, G. D. Hūʻeu leased his remaining lands in Waikōloa Nui to the Waimea Grazing and Agricultural Company for a twenty year period (he had previously sold roughly 700 acres to Claude Jones on October 25th, 1866; Maly and Maly 2002). With the acquisition of this land, the Waimea Grazing and Agricultural Company became the largest ranching operation on the island (Escott 2008). Under the terms of the lease the Hūʻeu family was allowed to continue grazing their 1,000 head of cattle, 1,000 head of sheep, and 100 horses on the Waikōloa lands (Escott 2008).

Despite the growth of the ranching industry, Lorenzo Lyons estimated that by 1867 the population of Waimea was only four hundred people; during the 1870s the town of Waimea contained five stores and a hotel (Doyle 1945). An 1877 *Report of the Royal Commissioners on Development of Resources* documents the effects of cattle ranching on the environment of the Kohala-Waimea region, and the resultant out migration of the native population during this period:

> The forests on the Kohala mountains are dying rapidly. The land is mostly for grazing purposes, though on the mountain potatoes of fine quality can be raised in large quantities. In sheltered places, coffee would doubtless grow, but owning to the sparseness of the population and the superior attractions to other parts of the district, this part will hardly soon be settled. The once fertile and populous plain of Waimea looked sterile and desolate when visited by the Commission - a painful contrast to Kohala loko on the other side of the mountain.
>
> The complaint of the people is well founded. The water they use is fouled in many places by cattle, horses and other animals, and as the stream is sluggish it has no chance to free itself of impurities, and the water used by the people in their houses must be a cause of disease and death, especially to the children . . . It is little wonder that with his crops trodden out by the sheep or cattle of his stronger neighbors, his family sickened perhaps to death by the polluted waters, that the small holder should yield to despair, and abandoning his homestead seek employment in some other district, usually without making another home . . .
>
> The plains of Pukapu and Waimea·are subject to high winds, aggravated by the loss of the sheltering forests of former days. The soil however is very good in many places for sugar cane and other products. To develop its best resources, efforts must be made to restore the forests and husband the supply of water at their sources to furnish a supply for agricultural purposes. At present the lands are used almost exclusively for grazing purposes. Although the proprietors and lessors are probably not averse to the establishment of agricultural enterprises, it is to be feared that the denudation of the neighboring mountains and plains of the forests will render the climatic conditions unfavorable to success.
>
> It would seem that a wise appreciation of the best interests of this district, even of the grazing interests themselves, would lead to the decrease of the immense herds which threaten not only Waimea but even Hamakua with almost irreparable disaster. It is to be feared that they will in time render a large part of the land of little value even for grazing purposes. Owing to the increasing frequency and severity of droughts and consequent failure of springs. Some thousands of cattle are said to have died this last winter from want of water, and the works erected in Waimea for the purpose of trying out cattle have been idle for months for want of water.
>
> The commission do not propose here to discuss fully the vexed Questions of the causes of the diminution of the forests, but in view of the fact that they are diminishing and the streams and springs diminishing a corresponding rations, also that with the cattle running upon the lands as at present, any effort to restore them must be futile and any hopes of their recuperation vain, the Government, if it would wish to preserve that part of the island of Hawaii from serious injury, must take some steps for reclaiming the forests.
>
> In this connection we would say that it is unfortunate that large tracts of Crown and Government lands have been lately leased on long terms for grazing purposes, without conditions as to their protection from permanent injury, at rates much lower than their value even as preserves for Government purposes or public protection. The commission deem (sic) this a matter of grave importance, challenging the earnest attention of the Government, and involving the prosperity of two important districts (in Maly and Maly 2002:58-59).

By the late-1870s, largely due to persistent drought conditions within its grazing lands, the Waimea Grazing and Agricultural Company went out of business, and its herd was purchased by Parker Ranch (Parker Ranch would also eventually acquire the lease of Waikōloa Ahupua‘a; Bergin 2004). Francis Spencer formed Pu‘uloa Sheep and Stock Company, and continued to raise sheep in Waikōloa and neighboring lands. In October of 1876 Spencer sold his interest in the sheep ranch to George W. Macfarlane; included in this transaction were the Waikoloa Nui lands lease from G. D. Hū‘eu (Maly and Maly 2002). George Bowser, the editor of *The Hawaiian Kingdom Statistical and Commercial Directory and Tourists Guide*, visited Waimea in 1880 and stayed at Spencer's house. Browser writes:

> . . . Waimea has always been a place of some considerable importance, and there are around it several pretty homesteads, notably the residences of Mr. F. Spencer and the Reverend Lyons. From Mr. Spencer's veranda there is a striking view of Maunakea, the summit of which was at this time of the year still in its winter robe of snow. The snow never leaves this mountain top entirely, but the position of the snow-line varies considerably with the season of the year, and also from one year to another, according to the weather which characterizes them. The country all round is chiefly suitable for grazing, and, besides innumerable wild cattle, descended, no doubt, from those which Vancouver gave to Kamehameha I, there are some 20,000 head depastured in the neighborhood, the property of Mr. Parker, who has, besides, some large droves of horses, probably numbering a thousand head in all. Mr. Spencer has turned his attention chiefly to sheep farming, and occupies a large tract of country with his flock of 15,000 sheep and 15,000 goats. Waimea itself, although of immemorial age, and once populous, is now only a scattered village, with but two stores and a boarding and lodging house and coffee saloon. (Bowser 1880:540)

Upon leaving Waimea George Browser set out for Puakō, travelling along a trail that passed by the vicinity of the current project area. Browser provides the following description of the journey and the coastal village:

> . . . I made my start from the house of Mr. Frank spencer, leaving the Kohala district, I must say, with much regret. Fifteen miles of a miserably rough and stony road brought me to Puako, a small village on the sea-coast, not far from the boundary between the Kohala and Kona districts. There was nothing to be seen on the way after I had got well away from Waimea except clinkers; no vegetation, except where the cactus has secured a scanty foothold . . .
>
> At Puako there is some grief for the eye, in the shape of a grove of cocoa-palms, which are growing quite close to the water's edge. These had been planted right amongst the lava, and where they got their sustenance from I could not imagine. They are not of any great height, running from twenty to sixty feet. There are about a dozen native huts in the place. These buildings are from twenty to forty feet long and about fifteen feet high to the ridge of the roof. They only contain a single room each, and are covered with several layers of matting. (Bowser 1880:546)

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 Waikoloa that had formerly belonged to the Waimea Agricultural and Grazing Company. A sketch map prepared J. S. Emerson in 1882 during the Hawaiian Government Survey of South Kohala (State Survey Division, Book 251:109; reproduced by Escott 2008; Figure 24), shows the Parker Ranch grazing lands at that time and the network of trails that ran through them. 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 Parker Ranch was under the direction of Alfred W. Carter, 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 Nui 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 ‘Ōuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines *makai* of Waimea Town. He also acquired the Pu‘uloa Sheep and Stock Company, encompassing over 3,700 acres and including the Ke‘amuku 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 Humu‘ulu, Ka‘ohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

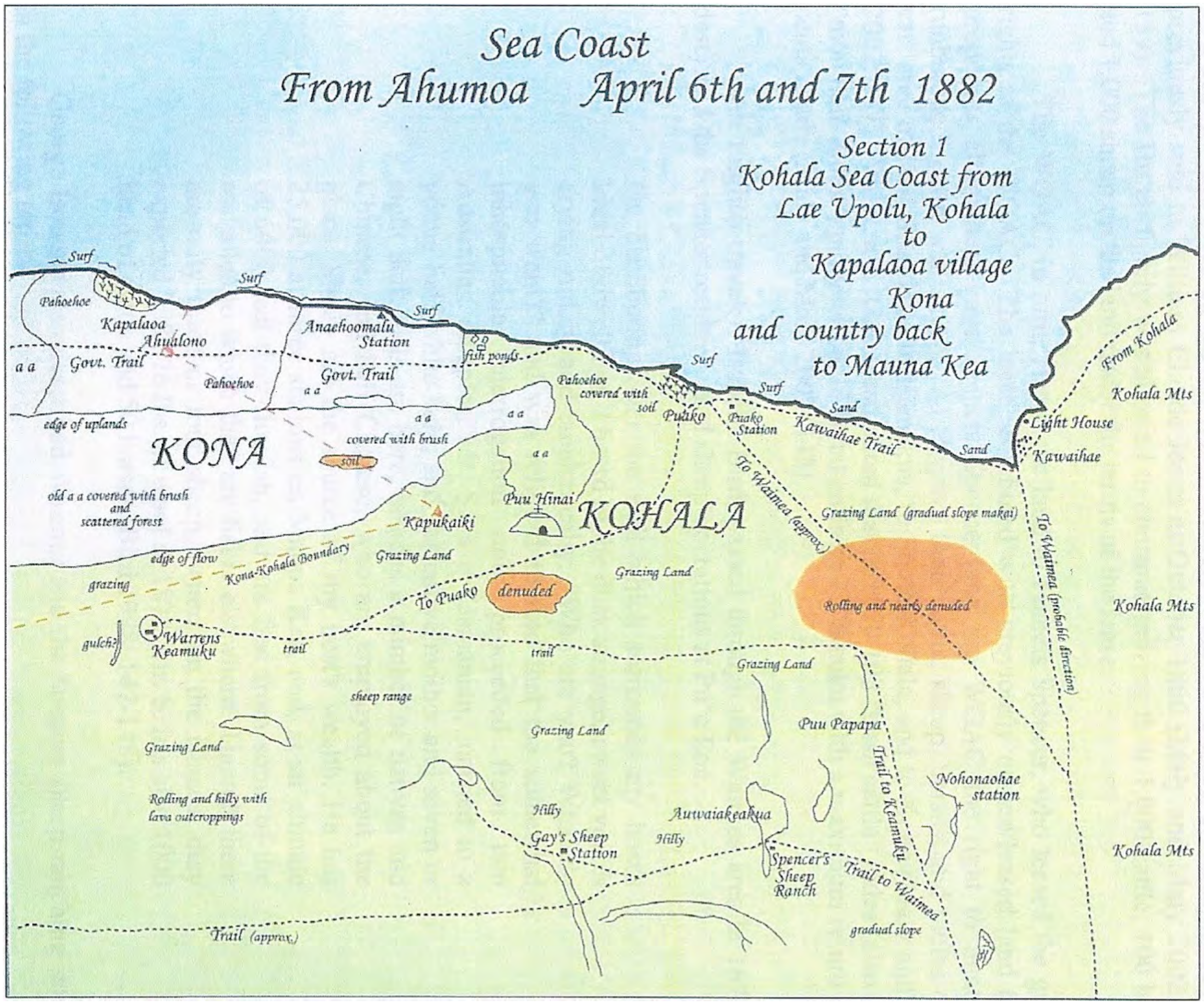

Figure 24. J. S. Emerson's sketch map of the South Kohala Sea Coast (from Escott 2008:43)

A few years prior A. W. Carter first being appointed Thelma Parker's guardian and trustee, Mr. Wilmot I. Vredenberg, a British national, during an 1895 hunting trip to South Kohala made a chance discovery of sugarcane growing wild in the Puakō area that ushered in a brief sugar industry in the coastal lands of Lālāmilo. Vredenberg immediately took the sugarcane to Robert Hind and his son John who had founded the Hāwī Mill and Plantation Company in North Kohala in ca. 1880 (Puakō Historical Society 2000). John Hind described this chance encounter, which would soon lead to the establishment of the short-lived Puakō Sugar Plantation (ca. 1895-1913):

> Mr. W. I. Vredenberg one Sunday came to Hawi in a state of considerable excitement, with four or five sticks of fine looking cane strapped to his saddle, which, as he put it, he discovered at Puako the day before while on a shooting trip. This cane was grown without irrigation, and he enthusiastically announced there were large areas of as good land as that on which these sticks were grown.... Conditions appeared extremely favorable.... Soil was analyzed... a well was sunk (about ten feet) water analyzed and found to contain no more salt water than other plantations, using well water. An experimental plot was planted, which for growth exceeded anything I had ever seen. (Hind n.d.:46-47)

The Hinds, excited by the prospects of a new plantation, soon entered into negotiations with the Parker Ranch for land at Puakō. Parker Ranch at that time used the lands around the bay, which they had purchased from Lunalilo, as a winter range, and they occasionally shipped cattle from there (Puakō Historical Society 2000). The Hinds were able to trade their rights to a piece of land in Hilo at Waipunalei for a swath of Parker Ranch land at Puakō, and they leased additional acreage from the Territory of Hawai'i (Maly 1999). These lands (between 1,500-1,800 acres) briefly became the Puakō Sugar Plantation.

Norman G. Campion, a marine engineer, was hired to design the Puakō sugar mill and oversee its construction on a four acre property along the shore (Grant No. 4856). A wharf was constructed first to facilitate the shipment of materials for mill construction. Then, as John Hind writes, "a fine up to date little mill with all the appurtenances which go with a modern plantation was installed [ca. 1905], on an ideal site, a hundred or so yards from the landing" (Hind ms.:50 in Maly 1999:122). The mill area housed crushing machinery, mixers, vats, and all the other mechanical necessities for the mill, along with dormitories and a camp for over three hundred workers, a company store, two schoolhouses, an office building, various storehouse and warehouse facilities, and a shed for honey processing machinery (Puakō Historical Society 2000). A rail line connected the mill operations with field operations. Other improvements to the plantation included the construction of an approximately eight-mile long wooden flume that carried water from Waikōloa Stream near Waimea to the coastal lands of the plantation (Maly 1999). Hawai‘i Registered Map No. 2786 (prepared by Wright in 1917; see Figure 22) shows some of the Puakō plantation infrastructure and the route of the flume across the current project area. A map prepared by the Territory of Hawai‘i for a Parker Ranch pasture lease in Lālāmilo Ahupua‘a in 1928 (C.S.F. 4947) shows the flume originating at Keanuiomano Stream (to the north of Waikōloa Stream) and then continuing across Lālāmilo and Waikōloa *ahupua‘a* (northwest of the current project area) to the coast near Puakō Bay (Figure 25).

Vredenberg, who had originally found the wild sugarcane at Puakō, was hired by the Hinds to manage the plantation (Puakō Historical Society 2000). In the beginning, Puakō Sugar Plantation was plagued by periods of heavy rain and floods, called freshets and semi-typhoons by John Hind (n.d), who lamented the destruction caused by the former, but came to welcome the latter, which "were of certain value, and over a series of years proved an asset" (Hind n.d.:48). The first sugar crop planted by the plantation (in ca. 1901) was decimated by a flood waters when several intermittently flowing streams overflowed their drainages (Puakō Historical Society 2000).

In 1901, soon after the establishment of the Puakō Sugar Plantation, the Inter-Island Telegraph Co. moved its wireless telegraphy station from Lā‘au Point, Moloka‘i to Puakō to establish a direct line of communication with the stations at Barber's Point, O‘ahu and Lahaina, Maui (U. S. House of Representatives 1917). In 1903, the Territorial Legislature of Hawai‘i granted a subsidy of $1,000 per month to the Inter-Island Telegraph Co. that stipulated, among other conditions, that a telegraph line between Puakō and the city of Hilo be built, enabling the residents of Hilo to quickly and securely transmit messages to Puakō, which could then be relayed to wireless stations on the other islands. Apparently the Inter-Island Telegraph Co. was not quick to build the telegraph line to Puakō, as illustrated in a commentary published in the August 30, 1904 edition of *The Hawaiian Star*:

> "We are now constantly hearing complaints of the wireless telegraph system. There is no fault found with the actual transmission of the messages across the water but merely with that part of the system where the telephone has to be used to carry the messages from the sender to the wireless station—Puako. Mistakes are thus frequently made in the wording. The transmission of a telegraphic message by telephone always arouses considerable curiosity along the line, and it is no exaggeration to say that every earcup is down and thus interfering with the efficiency of the instrument, and also making it difficult for the centrals to hear. This of course eliminates all privacy and every message becomes common property. Now according to the terms of the bill entitling the I. I. Wireless Telegraph Co. to a subsidy of $1000 per month from the government, it was made conditional that they should lay a land telegraph line from the wireless station (which is now at Puako) to Hilo. So far there is none laid. Instead of fulfilling theirs the company is drawing the subsidy and the public is left with the defective system. We know for a fact that in important messages where secrecy is necessary the telegrams have had to be carried by special messengers to the wireless office. The time is more than half gone and the public should see that the company carry out their in this respect, otherwise all the money will have been drawn by the company and the service still remain without its special telegraph "land line," which is therefore not in accordance with the governor's motto—economy." (*The Hawaiian Star*, Tuesday August 30, 1904 page 5)

By October of 1904 it was reported that "the necessary wire for the construction of the additional fifteen miles of telegraph line from Waimea to Puako, the wireless station, will arrive by the Kiuau, which will complete the telegraph line to Hilo" (*The Weekly Hilo Tribune*, Tuesday, October 18, 1904, page 5), and by February of 1905, F. J. Cross, the manager of the Inter-Island Telegraph Co. stated that "we have created and have been maintaining the wire telegraph line from Puako, Hawaii, to Hilo as required by the law under which we are paid by the Territory" (*Hilo Tribune*, 14 February 1905, pg. 6). Use of the Puakō telegraph line was apparently short-lived, as by 1911 the wireless station at Puakō had closed and been replaced by a new, more powerful station at Kawaihae (Department of the Interior 1912).

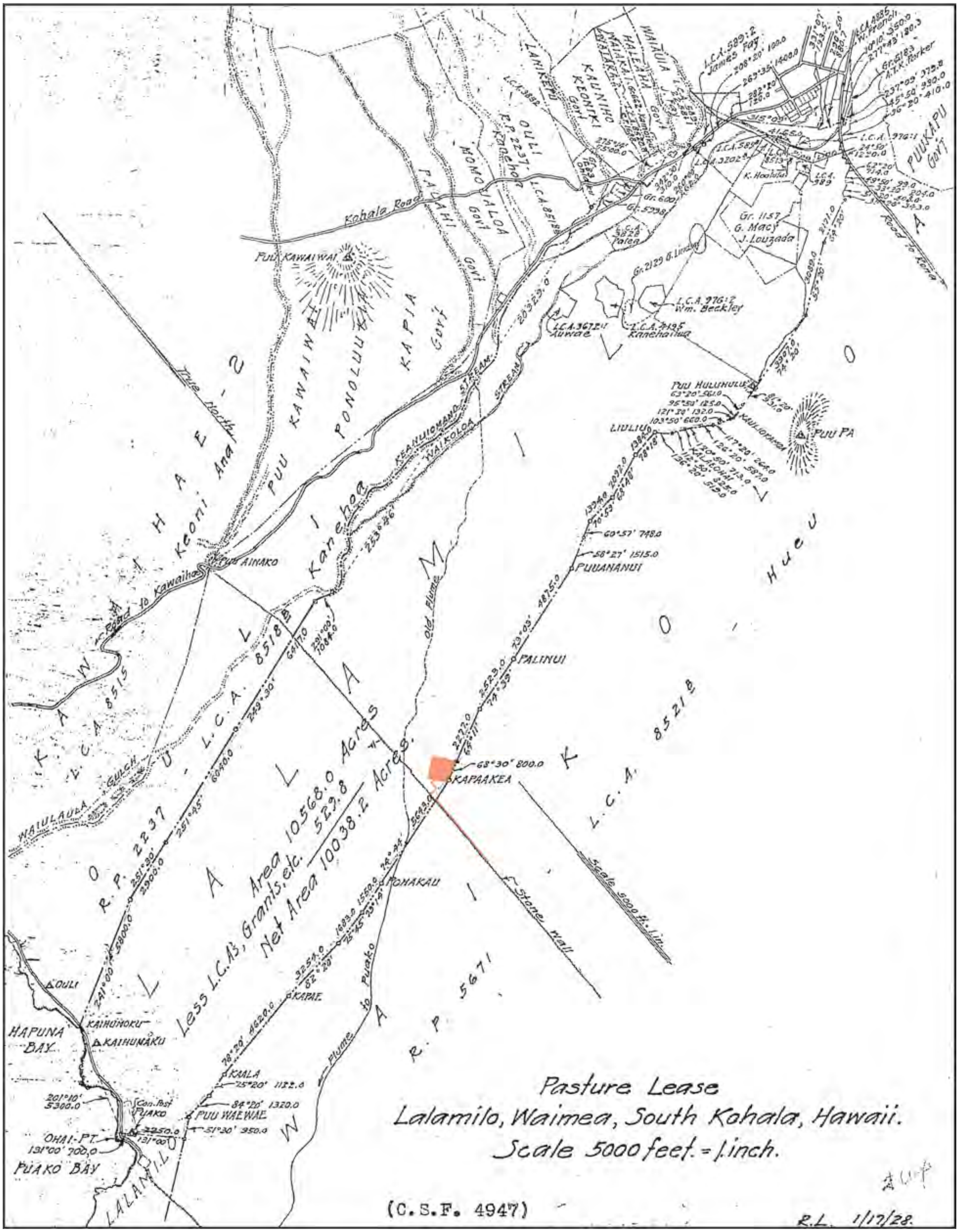

Figure 25. 1928 map (C.S.F. 4947 compiled by E.W. Hockley) showing the Parker Ranch lease of Lālāmilo and the route of the flume to Puakō (with the current project area in orange).

With establishment of the Puakō Sugar Plantation and other associated industries at Puakō, and the resulting influx of population (workers and their families) that followed, the need arose for better transportation routes linking the isolated community of Puakō with the neighboring communities of Kawaihae and Waimea. The September 12, 1905 edition of the *Weekly Hilo Tribune* reported that:

> Wilmot Vredenberg, manager of the Puako Sugar Co., asked that an appropriation of $300 to $400 per month for the construction of a road between Kawaihae and Puako. He said that he had no “pull,” and that during the five years that the Puako Plantation had been in existence, the Government has not expended $20 for clearing the trails of algeroba trees and rocks. (*The Weekly Hilo Tribune*, Tuesday, September 12, 1905, pg. 3)

By 1909, J. C. Searle had become the manager of the plantation. The March 25, 1909 *Evening Bulletin Industrial Edition* contains an article entitled “A History of the Progress of the Sugar Industry of Hawaii Since the Reciprocity Treaty of 1876,” which contains a short description of the Puakō Plantation Company, briefly describing its history, lands, and mill:

> Puako plantation is situated on the leeward side of the Island of Hawaii, five miles from Kawaihae. The plantation consists of between 500 and 600 acres. Three hundred acres of this is good cane land located upon a low flat near the sea, the soil having been washed down from the mountains by freshets. The land was obtained by John Hind and his associates from the Parker Ranch in 1898, the first cane being planted by W. L. Vredenberg in 1899.
>
> Finding that owing to the small rainfall at Puako (and the surrounding country) was not enough to counteract the salt in the well water, arrangements were made with the Parker Ranch to take the Waiaka water of Waimea and a nine mile three board flume was built from the Waiaka Glulch to Puako Plantation.
>
> Four gasoline engines pump 2,500,000 gallons of water every ten hours for irrigation purposes.
>
> The plantation employs sixty-five men, all of whom work by the day. Like other plantations Puako is short of labor. The 1908 crop was about 403 tons and the 1909 crop is estimated at 800 tons.
>
> The mill buildings was [sic] erected in 1901. The six-roller Cora mill which was manufactured by Fulton Iron works of St. Louis, was erected in the same year. The mill has run very satisfactorily ever since and has not needed overhauling. Its principle features are the Lillie effect, Deming system of clarification, mud presses, etc. Room has been left for a new three-roller mill should it be needed. The cane carrier is supplied with revolving knives and bagasse is fed automatically to the furnaces.
>
> Two fast gasoline launches are maintained for carrying mail, passengers and freight between Kiholo, Puako and Kawaihae, connecting with the island steamers Mauna Kea and Mauna Loa, besides being available for trips to Kona and Kohala. (pg. 29)

According to John Hind (n.d.), while the floods that plagued the plantation’s early years were an annoyance, the often strong, on-shore winds that dried the moisture from the soil, deposited salt in the fields, and broke the cane stalks during the following years were the real hindrance to growing sugarcane at Puakō. It was the winds and lack of water that eventually led to the closure of the plantation, after only a brief period of operation, in ca. 1913. Hind describes the difficulties faced by the plantation during its brief existence as follows:

> . . . the high winds proved disastrous. During the first year or two we only had a few severe visitations, but later, while we might be exempt for several months, and everything flourishing, we would have a continuation of storms, which at times would threaten to put us off the map. And I may say in passing, were it not for these heavy wind storms, and conditions could continue as they were during the first few months of our operations there, Puako would be worth $35,000.00 to $50,000.00 a year. I have seen the property more than once, look good for either of these amounts and after a three days blow, look like thirty cents. The principle cause of this sudden deterioration being the thorough drying out of the soil, leaving the salt, which could not be washed out in time, by subsequent irritations. We found a good rain was of very great benefit, and finally as a forlorn hope, after keeping tab, on the Waimea stream for over eighteen months, put in an eight mile flume, but strange as it may seem, the water failed just before the flume was finished. Mr. Carter the Manager of the Parker Ranch [c. 1903] attributed the failure to the unprecedented dry weather in the mountains, but as the stream, never after that, continued to flow with any degree of regularity, it would appear the shrinkage of forest area in the mountains was having its effect. Puako, as a sugar proposition, I was satisfied, was hopeless, so finally was closed down [by ca. 1913], and parts gradually sold off at what they would bring. . . (Hind n.d.:48-50)

A letter in the January, 1913 edition of the *American Sugar Industry*, however, reported that by May 22 of the previous year:

> One small sugar plantation has gone out of business as such. Puako Plantation, on Hawaii, is now part of the Hind stock ranch, and the land formerly occupied by sugar cane is now planted in sorghum for fodder for Hind's cattle. The mill has been dismantled, the sugar-making machinery going to Hawi mill while the engines are being retained for irrigation purposes. (Vol. XV No.1:49)

Robert Hind, and his son John, continued to use the Puakō lands for various economic pursuits even after the failure of the Puakō Sugar Plantation. According to Maly (1999) the Hinds extend their ranching interests in the area to include a *kiawe* feed lot and cattle shipping operation, and they also made honey and charcoal on their lease lands. The Hind's lease was located *makai* of the Parker Ranch grazing lands in Waikōloa and Lālāmilo *ahupua'a*. Thelma Parker, who had come of age to inherit the Parker Ranch holdings in 1912, reworked the legal arrangement with A. W. Carter, making the trustee of her properties for the foreseeable future (Bergin 2004). Thelma, who had married Henry Gaillard Smart, gave birth to the next Parker Ranch heir, Richard Palmer Kaleiokū Smart, on May 21, 1913. Soon after the birth (in 1914 and 1915 respectively) both Thelma and Henry Smart passed away, leaving baby Richard parentless (Bergin 2004).

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 Waikoloa 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 is 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 Waikoloa Stream had been tapped by a number of ditches or '*auwai,* and that the inhabitants of the area relied heavily on the water from Waikoloa Stream for the continued traditional existence. The firsthand accounts provided in the testimonies of the residents of the lands describe the Waikoloa 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.

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. By the time Carter acquired the Kohala Ranch Co., made up of the 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).

As a result of Carter's land acquisitions during the early to middle 1900s, the current project area became part of a much larger, consolidated Parker Ranch that operated throughout the Hāmākua, North and South Kohala Districts. New land use patterns within this expanded ranch property, quite different from the land use patterns just a half century earlier, dictated the need for improved routes of travel between different locations; as a result much of the old trail network of the South Kohala District was abandoned or replaced. While the Precontact trail between Puakō and Waimea followed the Lālāmilo/Waikōloa boundary, maps made as early as 1901 show the trail from Puakō to Waimea extending through the center of Lālāmilo Ahupua'a (see Figure 17). The 1923 U.S.G.S. Pu'u Hīnai quadrangle shows Puakō as a small village during this period with a few roads and houses along the coast, a coastal trail extending north to Kawaihae and south to Kīholo Bay, and a trail extending inland to Waimea, passing north of the current project area (Figure 26). By the 1940, the population of Waimea, at the center of Parker Ranch, had also expanded, and the lands in and around the town were divided into numerous house lots indicative of the new land tenure system.

Beginning in 1941, just months prior to the bombing of Pearl Harbor, with World War II already underway in Europe and Asia, the U.S. Army established an infantry headquarters in the Pu'ukapu area of Waimea (Bergin 2006). After the United States formally entered the war, the Army presence in Waimea expanded to include the U.S. Navy and Marines, and become one of the largest multi-force, U.S. military camps 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 housing approximately 20,000 soldiers. This cantonment would eventually come to be called Camp Tarawa. During World War II, and shortly thereafter, the lands surrounding the camp (including the current project area) were used as a firing range and as a training area for the U.S. Marines (Brundage 1971).

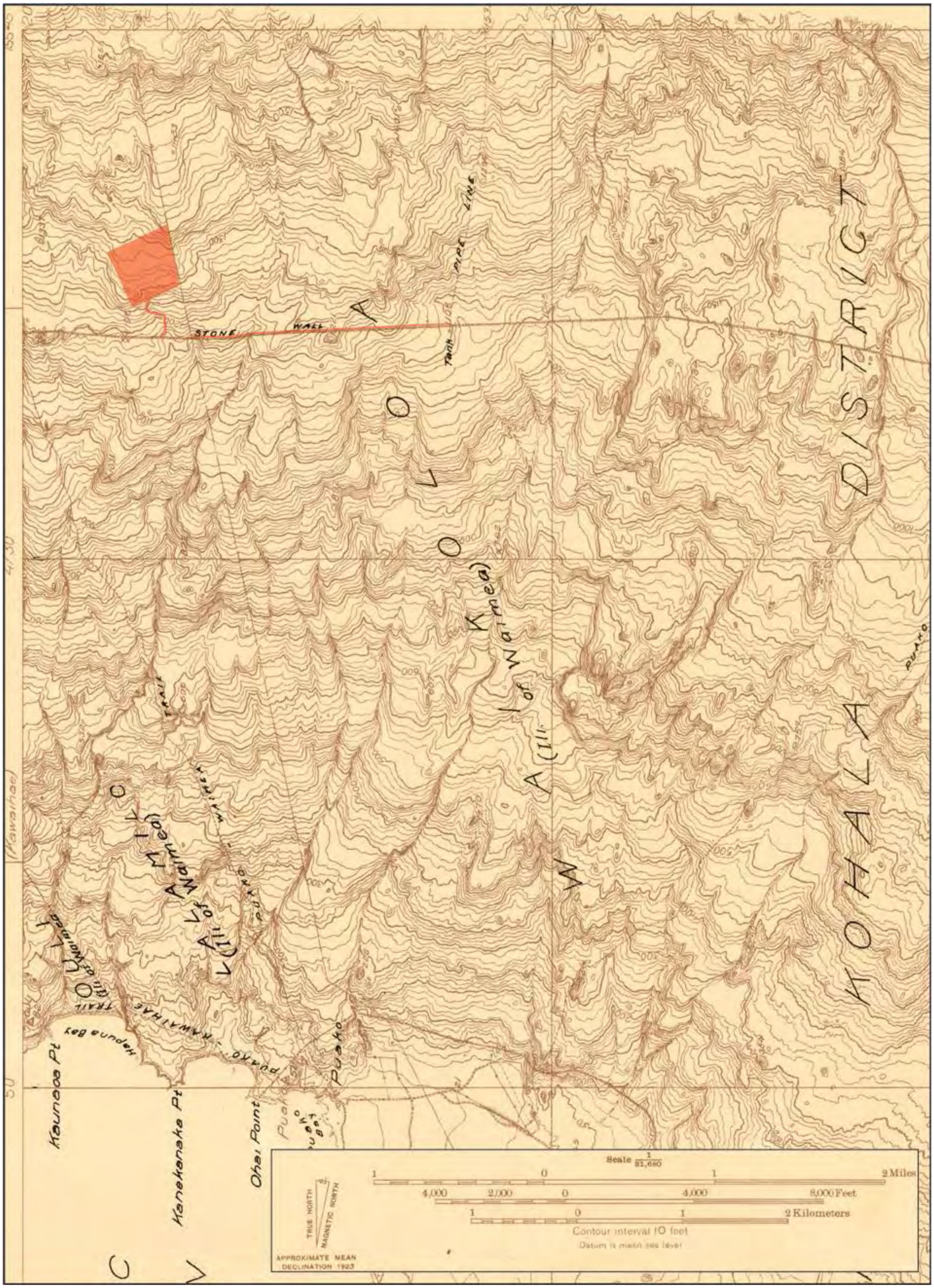

Figure 26. Portion of the 1923 U.S.G.S. Pu‘u Hinai quadrangle showing the current project area (shown in orange).

In December of 1943, nearly 123,000 acres of land in the Waimea-Waikōloa area were leased by the U. S. War Department for use as a troop training area (Escott 2008). With this lease the current project area became part of the U.S. Navy's 91,000-acre Waikōloa Maneuver Area, which included the 9,141 acre Lālāmilo Firing Range, and extended from the coast to the Pohakuloa Training Area, and from the Waimea-Kawaihae Road to south of the Waikoloa Road. Much of the area was acquired through a license agreement with Richard Smart of Parker Ranch for the nominal fee of one dollar (Haun et al. 2010). According to Escott:

> . . . The military utilized portions of this property for troop maneuvers and weapons practice, while other areas served as artillery, aerial bombing and naval gun fire ranges. Troop exercises were conducted using 30 caliber rifles, 50 caliber machine guns, hand grenades, bazookas, flame throwers, and mortars. Larger ordnance and explosive (OE) or unexploded ordnance (UXO) items used included 37 millimeter (mm), 75 mm, 105 mm, and 155 mm high explosive (HE) shells, 4.2 inch mortar rounds, and barrage rockets. From 1943 through 1945 nearly the entire Waikoloa Maneuver Area was in constant use, as the Marine infantry reviewed every phase of training from individual fighting to combat team exercises. Intensive live-fire training was conducted in grassy areas, cane fields, and around the cinder hills of Pu'u Pa and Pu'u Holoholoku. (2008:47)

The 2nd Marine Division was the first to train at Waikōloa, for five months, in preparation for the invasion of Saipan and Tinian. The 5th Marine Division replaced the 2nd Division in August 1944, and used the Waikōloa Maneuver Area to prepare for the assault on Iwo Jima. While training, the marines resided at a military camp established just outside of Waimea Town. Initially called Camp Waimea, the camp was later renamed Camp Tarawa in honor of the first successful invasion of the Pacific War. Camp Tarawa was the largest U.S. Marine training facility in the Pacific, covering an area of approximately 467 acres, and between 1943 and 1945 as many as 50,000 men passed through the camp on their way to the Pacific Theater (Escott 2008). According to Nees and Williams (2000), in addition to the 2nd and 5th Marine Divisions, the 31st Naval Construction Battalion, the 471st Army Amphibian Truck Company, the 726th Signal Aircraft Warning Company, the 11th Amphibian Tractor Battalion, the 5th Joint Assault Signal Company, and the 6th Marine War Dog Platoon also passed through Camp Tarawa.

The last of the Marines of the 5th Division departed Camp Tarawa in June of 1946, and the Waikōloa Maneuver Area, with the exception of the 9,141 acre Lālāmilo Firing Range, was returned to the Parker Ranch in September of 1946 (Haun et al. 2010). The Lālāmilo Firing Range, through a permit granted by the Territory of Hawai'i, was retained by the U.S. Marines as a training area and camp site until 1953 (Escott 2008). When the use permit was cancelled in December of that year, the lands once again reverted to leased cattle pasture administered by the Territory of Hawai'i. Clean-up of unexploded ordnance (UXO) within the Waikōloa Maneuver Area is still ongoing.

Following World War II, the lands of Waikōloa (in ca. 1946) and Lālāmilo (in ca. 1953) in the vicinity of the current project area were once again used as cattle pasture. Parker Ranch retained fee simple ownership of Waikōloa, but the lease of Lālāmilo reverted back to the Territory of Hawai'i, and then in 1959 to the State of Hawai'i, and was eventually assigned to Palekoki Ranch. The use of the project area lands for military training exercises during World War II opened new access routes to inland and coastal locations that were previously unavailable, but that could now be traveled by motorized vehicle (Maly 1999). The 1956 U.S.G.S. Pu'u Hīnai quadrangle (unlike the 1923 quadrangle; see Figure 26) shows the Puakō-Waimea trail extending inland from Puakō Bay through Waikōloa Ahupua'a to a north/south fork in the road (Figure 27); the northern fork, labeled Puakō-Waimea Trail, extends northeast into Lālāmilo Ahupua'a, passing the northwest of the current project area on its way to Waimea; the southern fork continues east into the uplands of Waikōloa Ahupua'a. It is likely that this road was built by the U. S. military during World War II to access lands within the Waikōloa Maneuver Area and then used as the road to Waimea once the Waikōloa lands were returned to Parker Ranch and the Territory of Hawai'i at the conclusion of the war.

Since the 1950s modern development, concentrated along the coast and around the Villages of Waimea and Waikōloa, has been slowly encroaching on the project area lands. In 1949-50 the coastal lands of Lālāmilo were divided into the Puakō Beach Lots and a nice road was built to Kawaihae, bringing many new residents to the area (Maly 1999). During the 1970s the current alignment of Queen Ka'ahumanu Highway (Highway 19), extending from Kailua to Kawaihae, was constructed across the coastal sections of the *ahupua'a*, Waikōloa Road was built to connect the new lower highway with the upper highway (Highway 190), and the Village of Waikōloa was established at inland elevations to the south of the project area. With the construction of the new highways and the shifting of residential patterns, the older coastal roads and *mauka*/*makai* travel routes largely fell into disuse (the Puakō-Waimea trail is not shown on the 1982 U.S.G.S. Pu'u Hīnai quadrangle).

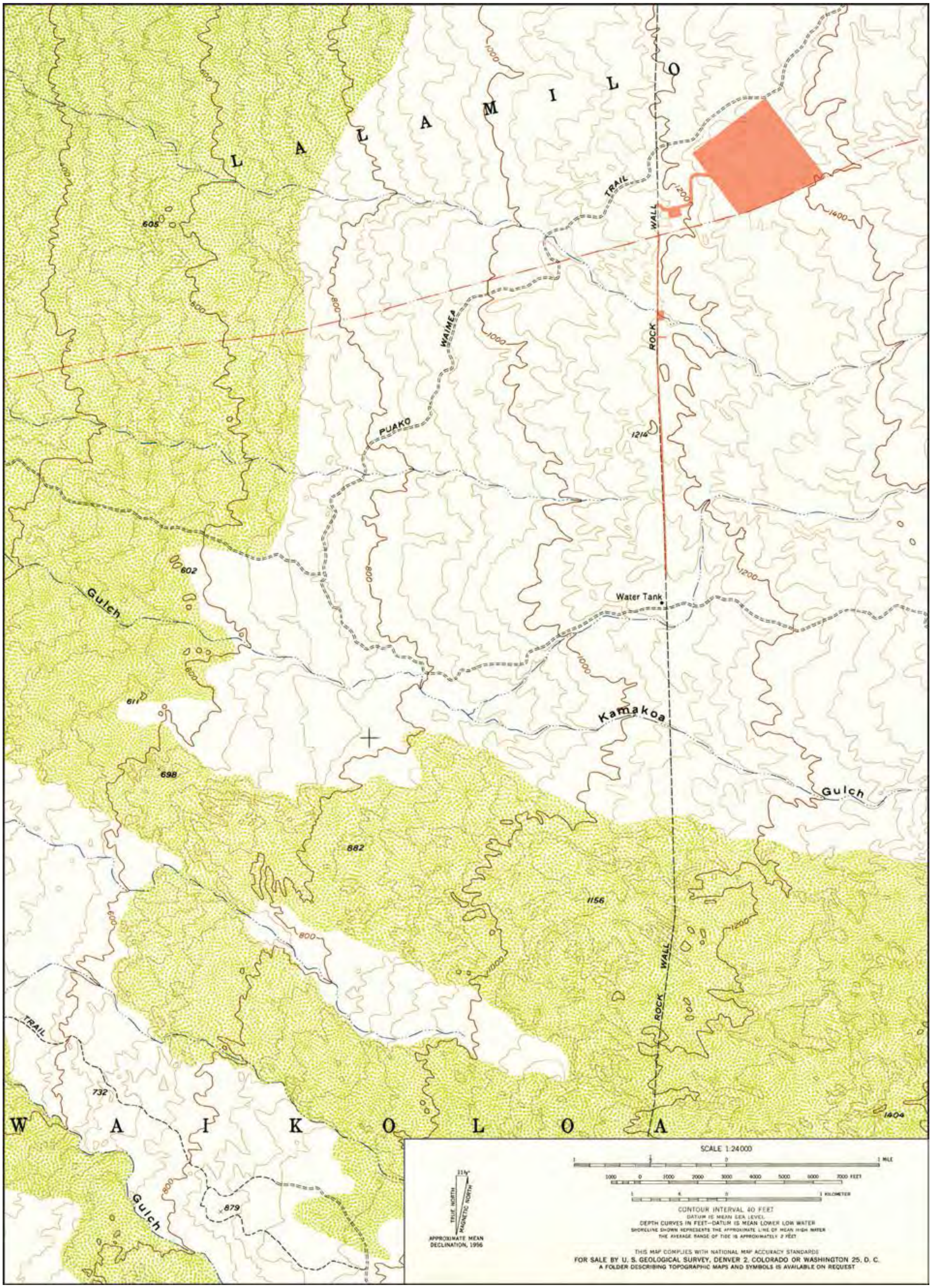

Figure 27. Portion of the 1956 U.S.G.S. Pu‘u Hinai quadrangle showing the current project area (shown in orange).

During the 1980s large resort properties were developed along the coast of Lālāmilo and neighboring lands. The resort developments required water, which necessitated the drilling of wells and the development of a modern water distribution system. Several wells were drilled in the vicinity of the current project area around this time (see Figure 3), and in 1985 the first Lālāmilo Wind Farm was erected as a power source for some of those wells. The wind farm (Figure 28), which was acquired by Hawaii Electric Light Company in 1987, continued to operate for almost twenty-five years, before being removed from the current project area in 2010.

Figure 28. October 17, 2009 aerial view (from Google Earth) of the first Lālāmilo Wind Farm.

4. PRIOR STUDIES

There have been numerous archaeological studies conducted in the *ahupuaʻa* of Waikōloa and Lālāmilo in the vicinity of the current project area (Figure 29 and Table 1). These are reviewed and discussed in Clark et al. (2014), and have largely concentrated on (1) the resort developments in the coastal areas of Lālāmilo and Waikōloa *ahupuaʻa*, (2) the intermediate zone of Waikōloa Ahupuaʻa between Queen Kaʻahumanu Highway and Waikōloa Village, and (3) the uplands of Lālāmilo Ahupuaʻa in the vicinity of Waimea Town. A few studies, mostly of small well projects and access corridors (Clark and Rechtman 2005; Rechtman 2003, 2005, 2008a, 2008b, 2008c; Rosendahl 1992a, 1992b) and of the route of the proposed Waimea-Kawaihae Road corridor (Barrera and Kelly 1974; Clark and Kirch 1983), have been conducted within the intermediate *pili* lands of Waikōloa and Lālāmilo *ahupuaʻa* at more proximate elevations to the current project area; three previous studies (Soehren 1984; Rosendahl 1992a, 1992b; Rechtman 2005) have included portions of the current project area; and as previously discussed the current project area was the subject of a recent archaeological inventory survey (Clark et al. 2014).

Table 1. Previous archaeological investigations in the vicinity of the current project area.

Year	*Author*	*Ahupuaʻa*	*Type of Study*	*Elevation (feet)*
1971	Ching	Waikōloa, Lālāmilo	Survey	140-200
1972	Rosendahl	Waikōloa, Lālāmilo	Salvage	142-200
1972	Bevacqua	Waikōloa	Survey	500-850
1974	Barrera and Kelly	Lālāmilo, Waikōloa	Reconnaissance Survey	10-2600
1978	Yent and Griffin	Lālāmilo	Reconnaissance	0-320
1979	Ching	Lālāmilo	Reconnaissance	2280-2480
1979	Kirch	Lālāmilo, Waikōloa, Kalāhuipuaʻa	Investigations	0-200
1981	Clark	Lālāmilo	Intensive Survey	2280-2480
1983	Clark and Kirch	Lālāmilo, Waikōloa	Investigations	10-2600
1984	Soehren	Lālāmilo	Reconnaissance	1280-1360
1987	Clark	Lālāmilo	Survey	2280-2480
1987	Kennedy	Waikōloa	Reconnaissance	200-490
1990	Burgett and Rosendahl	Lālāmilo	Inventory Survey	0-320
1991	Jensen and Burgett	Waikōloa	Inventory Survey	480-570
1991	Yent	Lālāmilo	Survey	0-320
1992a, b	Rosendahl	Waikōloa	Inventory Survey	1130-1240
1992	Schilz and Shun	Waikōloa	Inventory Survey	150-540
1992	Burgett et al.	Lālāmilo	Survey	
1992	Dunn and Rosendahl	Lālāmilo	Inventory Survey	
1993	Barrera	Lālāmilo	Inventory Survey	2440-2500
1994	Jensen	Lālāmilo	Inventory Survey	0-320
1994	Spear and Chaffee	Makapala to Lālāmilo	Inventory Survey	310-360
2000	Rosendahl	Waikōloa	Inventory Survey	100-190
2002	Moore et al.	Waikōloa	Inventory Survey	200-490
2003	Haun et al.	Lālāmilo	Inventory Survey	2100-2490
2003	Rechtman	Waikōloa	Assessment	1090-1160
2004	Sinoto and Dashiell	Waikōloa	Inventory Survey	550-1200
2005	Clark and Rechtman	Waikōloa	Inventory Survey	1150-1200
2005	Rechtman	Waikōloa	Survey	1130-1240
2006	Rechtman	Waikōloa	Survey	1260-1320
2008a	Rechtman	Lālāmilo	Survey	1180-1240
2008b	Rechtman	Waikōloa	Survey	1260-1320
2008c	Rechtman	Waikōloa	Survey	1200-1270
2010	Rieth and Morrison	Kawaihae, ʻŌuli, Lālāmilo, Waikōloa	Inventory Survey	0-2460
2011	Clark and Rechtman	Waikōloa	Inventory Survey	170-540
2014	Clark et at.	Waikōloa	Inventory Survey	200-530

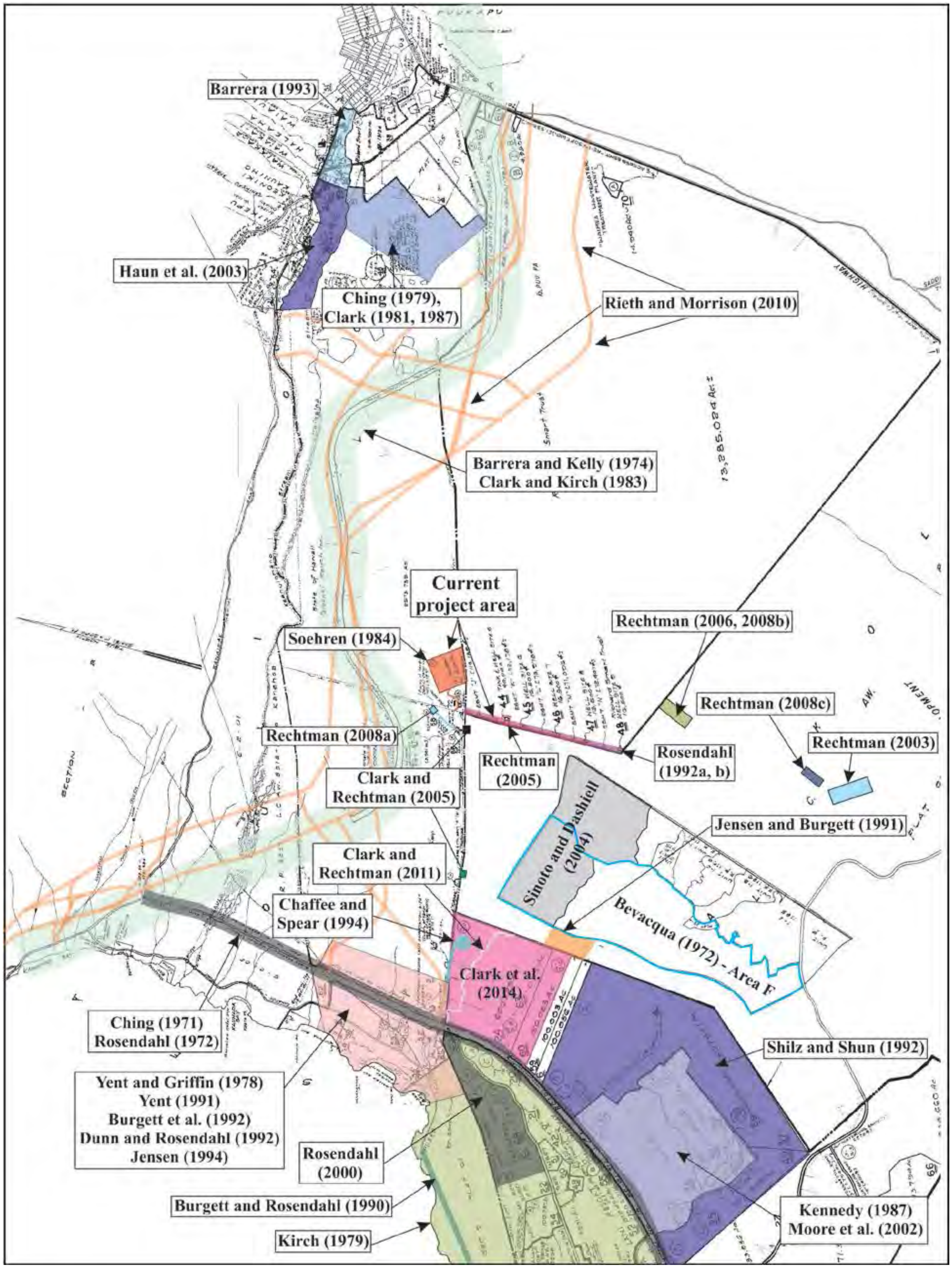

Figure 29. Previous archaeological studies conducted in the vicinity of the current project area.

There have been several Cultural Impact Assessment (CIA) studies conducted in the *ahupuaʻa* of Waikōloa, Lālāmilo, and adjacent areas, seven of which (Table 2) are discussed below. The project areas associated with each these studies is shown on Figure 30.

Table 2. Previous cultural impact studies in the area.

Year	*Author*	*Ahupuaʻa*
2002	McGuire and Haun	Lālāmilo
2003	Souza et al.	Lālāmilo, Waikōloa, ʻŌuli
2007	Wong Smith	Waikōloa
2009	Wong Smith	Waikōloa
2010	Haun et al.	Waikōloa
2010	McGerty and Spear	Puʻukapu, Waikōloa
2012	Fielder and Mooney	Kawaihae

Haun and Associates (McGuire and Haun 2002) prepared a CIA for the development of 266.4 acres of pasture land for commercial/industrial mixed use spaces and residential lots on behalf of the Department of Hawaiian Home Lands (DHHL) on TMKs: (3) 6-6-01:10, 54, 77 and (3) 6-6-04:012, 013, 014, 015, 016, 017) (Figure 30). Their project area was primarily utilized as pasture land, a portion of which was leased by Parker Ranch for grazing up until the mid-20th century. Data gathered during an earlier inventory survey of the project area identified a number of archaeological sites relating to habitation, agriculture, and burial functions. McGuire and Haun (2002) conducted informal interviews with *kūpuna* with ties to the Waimea area, including Hisao and Yutaka Kimura, Radcliffe Greenwell, Helen Aveiro, Elizabeth Lindsey Kimura, Mrs. Nobriga, Allen Lindsey, Ethel Andrade, Kū Kahakalau, and one anonymous contributor. According to McGuire and Haun (2002), none of the individuals consulted were surprised at the presence of archaeological sites and burials in their project area. As a whole, the informants generally recalled the project area as being pasture land, also remembering that it was utilized for military activities during WWII, and was the location of a Historic dump (McGuire and Haun 2002). Due to the fact that many of the surviving *kamaʻāina* and *kūpuna* affiliated with the project area had moved away or passed away long ago, many of the interviewees expressed to McGuire and Haun (2002) that it might be difficult to obtain further intimate information. Based on information gathered during their cultural assessment, McGuire and Haun (2002) recommended, among other things, that cultural monitoring of all ground disturbing activities be a part of the development strategy; and that all burials identified within their project area be preserved in place.

A CIA was prepared by Cultural Surveys Hawaiʻi (Souza et al. 2003) for a 6 mile portion of the proposed Waimea Trails and Greenway Project Route in Waimea, adjacent to the streams of Waikōloa and Keanuʻimanō (TMK: (3) 6-2, 5, and 6) (see Figure 30). The stated purpose of that assessment was to identify cultural resources, practices, and beliefs, and identify traditional Hawaiian activities pertaining to the specific study corridor. In an attempt to achieve their purpose Souza et al. (2003) examined existing archaeological information, researched historical accounts and oral traditions, land documents, and also conducted community consultation. Souza et al. (2003) conducted formal interviews with four individuals with ties to the Waimea area: Melvin Hewett, Hisao Kimura, Alan Lindsey, and Lynn Taylor. All of the interviewees expressed concern about Waimea's changing climate and the lack of water in the streams, however, they did not feel that the proposed Waimea Trails and Greenway Project would have any negative effects on the streams (Souza et al. 2003). According to Souza et al. (2003), the proposed route of the Waimea Trails would traverse past agricultural, habitation, and burial site features, and would terminate on the eastern end at the Historic Imiʻola Church and cemetery. As a result of the consultation, Souza et al. (2003) did not find any indication that cultural practices were on-going in the project area, nor did they identify any active cultural practitioners with ties to the immediate area. Although Souza et al. (2003) did not recommend any specific mitigation for the proposed trail, they did point out that based upon the presence of Historic properties, that there was a likelihood of encountering cultural material during trail construction, especially west of the county transfer station.

Helen Wong Smith (2007) prepared a CIA in support of the Bridge Aina Leʻa rezoning effort for 1,060 acres in Waikōloa Ahupuaʻa (TMK: (3) 6-8-01:025-040) to the south of the current project area (see Figure 30). As part of her assessment, Wong Smith reviewed selected Hawaiian and historical accounts of the area, as well as previous archaeological studies for Waikōloa. The information presented by Wong Smith indicates that the intermediate portion of Waikōloa had been sparsely populated. As a result of the assessment, Wong-Smith (2007) determined that aside from a single human burial in a natural lava tube, no cultural sites were present within the project area, although she noted that it was a possibility that archaeological resources could be encountered during construction.

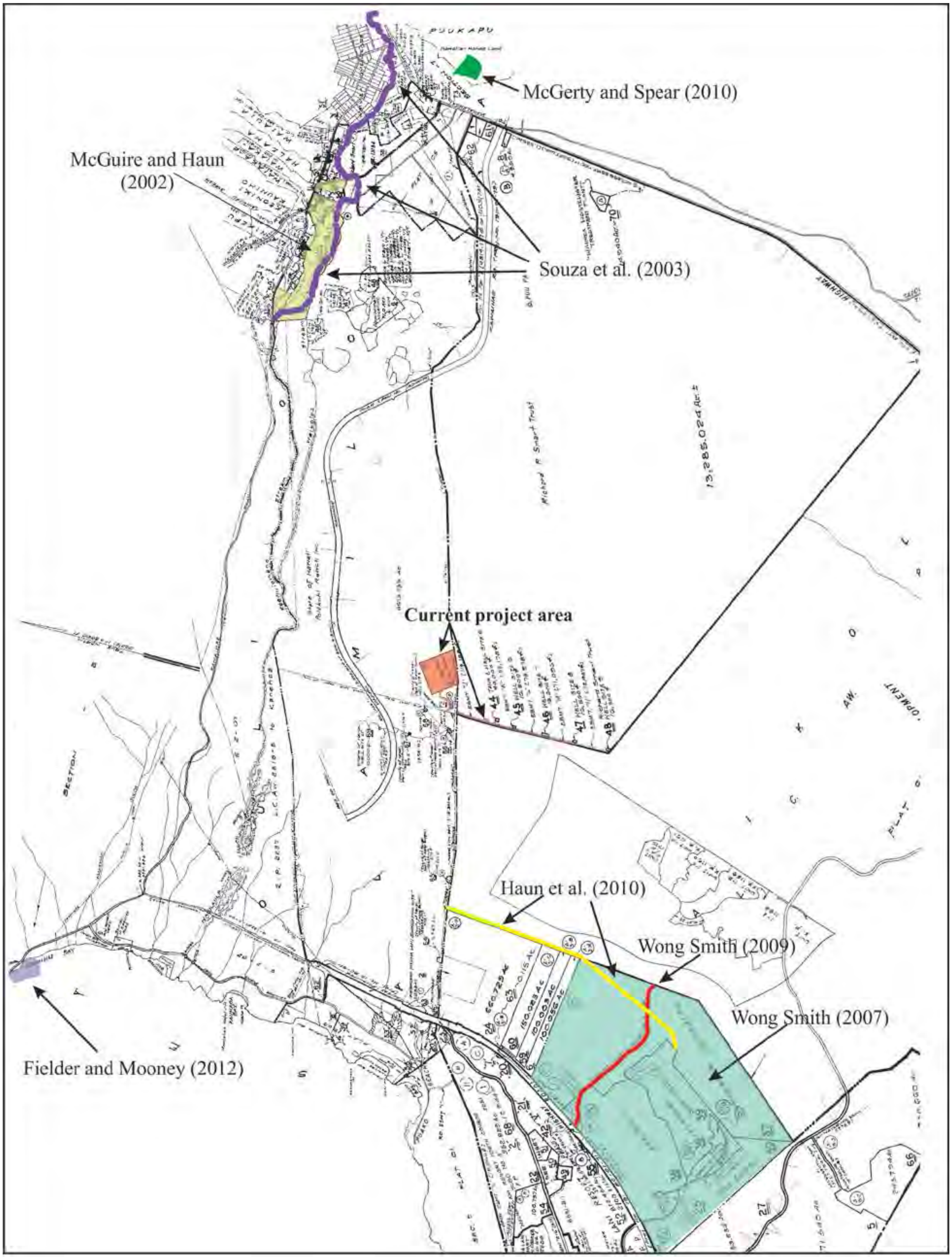

Figure 30. Previous cultural studies conducted in the vicinity of the current project area.

Two years later, Wong Smith (2009) prepared an addendum to her original CIA to address the presence of a *mauka-makai* trail through the Bridge Aina Le‘a project area that went unrecognized in her earlier study. The presence of the trail had been known to the State Historic Preservation Division since 1992. Wong Smith’s addendum study focused on documenting the trail location and gathering historical information from Robert “Sonny” Keakealani Jr., who knew about the trail from his father, Robert Keakealani, Sr.; no assessment was made of the resources nor were any impacts addressed. The trail was identified as a cattle trail used to drive livestock to Puakō; the trail was no longer used after the 1930s when cattle where shipped out of Kawaihae and Kailua instead of Puakō. A second addendum CIA to the 2007 Wong Smith CIA was prepared by Haun & Associates (Haun et al. 2010) to assess potential cultural impacts to a series of stream crossings adjacent to and within the larger, now called, ‘Aina Le‘a development area (see Figure 30). Based on historical documentary research and a field inspection, Haun et al. concluded that, “[t]he archival research and field inspection for this CIA addendum study did not identify any culturally significant resources or any evidence that the project areas are currently being used for any traditional cultural practices” (2010:19).

Scientific Consultant Services, Inc. (McGerty and Spear 2010) conducted a CIA for the proposed development of the Waimea District Regional Park to the east of the Parker Ranch racetrack in Waikōloa and Pu‘ukapu *ahupua‘a* (see Figure 30). Their research effort including a review of historical literature, the mailing out of several inquiry letters to Native Hawaiian organizations and individuals, and the newspaper publication of notices requesting any information on cultural resources or practices. They did not identify any cultural resources or practices in their literature review and no responses were received from the published notices. McGerty and Spear (2010:23) concluded that “[b]ased on, no additional suggestions or information from the contacted organizations, and negative results of the archival research, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by the development activities on a portion of the parcel. Because there were no cultural activities identified within the project area, there are no adverse effects.”

Pacific Legacy, Inc. (Fielder and Mooney 2012) completed a CIA for expansion and upgrade activities at Kawaihae Harbor straddling both Kawaihae 1st and 2nd *ahupua‘a* (see Figure 30). Their assessment relied on a review of historical documentary sources, as well as on community meetings and focused individual interviews. Fielder and Mooney (2012:39) concluded that, “several impacts have been identified with the construction of perimeter fencing, Pier 2A extension, a Pier 2C, as well as the dredging of the Kawaihae Deep Draft Harbor [inner harbor].” As mitigation they recommended, “[a] formal ‘town hall’ style meeting with stakeholders would be a good way to dispel misconceptions and begin a healthy discourse . . . the proposed establishment of a consultative body would serve as a ‘cultural compass’ and would ensure the implementation of appropriate mitigation measures to minimize any impacts, particularly those concerning traditional cultural practices.” (Fielder and Mooney 2012:39).

5. CONSULTATION

When assessing potential cultural impacts to resources, practices, and beliefs; input gathered from community members with genealogical ties and/or long-standing residency relationships to the study area is vital. It is precisely to these individuals for whom meaning and value are ascribed to traditional resources and practices. Community members may also retain traditional knowledge and beliefs unavailable elsewhere in the historical or cultural record of a place. As part of the current assessment study the following individuals were contacted: Ku‘ulei Keakealani, Barbara Robertson, Daniel “Danny” Kahikina Akaka Jr., Daniel Kawaiaea, Mason Maikui, and Kapono‘ai Molitau. An early consultation letter dated March 17, 2014 describing the project was sent to the Hawai‘i State Office of Hawaiian Affairs (OHA), which garnered no response; and a copy of this report was also furnished to OHA.

Ku‘ulei Keakealani was contacted by telephone and with respect to the current project area she directed us to the children of Anthony V. Phillips and Mary Kalani Ka‘apuni who all reside near one another on family land (Grant land handed down from their maternal grandfather John Ka‘apuni) in what is today referred to as the Lālāmilo Subdivision. Near the boundary of Lālāmilo and Keoniki *ahupua‘a*. The Phillips siblings (Barbara Robertson, Dorothy Nishie, Grace Inamine, and Tony Phillips) are all now in their seventies and eighties. As a family representative, Barbara Robertson was contacted by telephone and agreed to meet with the senior author of the current document on May 22, 2014 at her residence. Barbara spoke of her youth in the Waimea, Waiki‘i, and Kapa‘au areas of South and North Kohala. Her father Anthony was part Hawaiian and her mother Mary was full Hawaiian. It was from her mother’s side of the family that she and her siblings came to own their current properties in the Lālāmilo Subdivision. Her maternal grandfather, John Ka‘apuni, was awarded Grant 5998 in 1913. Barbara recalled how crowded with soldiers Waimea was during WWII and how as an employee of Parker Ranch, her father would be able to pick up keys and take the family down to the beach area known then as Camp Drewes (presently Mau‘umae). She graduated from Kohala High School in 1954 and served two years in the US Air force between 1956 and 1958.

The current proposed wind repowering project was described to her and location and development maps were shared. When asked, Barbara indicated that she was familiar with the current project area as there was a wind farm there before that she had seen from vantage points along the upper highway (Highway 190). The wind farm property is not visible from her residential community. With respect to any cultural places or practices, while she was aware of traditional agricultural, residential, and burial use of the portions of Lālāmilo to the immediate west and south of her property, she was unaware of any such places or activities within the portion of Lālāmilo that contains the current project area. She did not feel that the proposed wind repowering project would have any significant impacts on cultural properties or practices.

Danny Akaka is a cultural practitioner and the Director of Cultural Affairs at the Mauna Lani Resort. Danny was contacted by telephone on June 4, 2014. He was somewhat familiar with the project area having conducted a site blessing for the Parker Wells. While he was unaware of any past or present cultural practices occurring within the current project area, he did express his concern that the big stone wall [Site 9012] that extends across this part of South Kohala not be impacted. It was explain to Danny that the project was located *mauka* of this wall and that access to the wind farm project area was through an existing breach in this historic wall. Danny then related that several years back he had a conversation with an older Parker Ranch foreman (last name Awa‘a) who described managing a wall building crew that had worked on the construction of this wall. As the origin of this wall has been attributed to the late eighteenth/early nineteenth century, it is possible that during the middle twentieth century Parker Ranch repaired and/or extended this wall. Danny did not relate any other cultural impact concerns.

Located roughly 4.5 miles *makai* of the current project area is Pu‘ukohalā Heiau, the most prominent of several historic properties within the National Park Service’s Pu‘ukoholā Heiau National Historic Site. This *heiau* was an ancient place of worship that was dedicated by Kamehameha I in 1791 prior to his unification conquest. Pu‘ukoholā continues to be a significant cultural site for present day practitioners. In a 2004 Environmental Assessment prepared for the National Park Service with respect to the reestablishment of the historic scene at Pu‘ukoholā Heiau National Historic Site, it was asserted that “[w]hile the view from the heiau platform [Pu‘ukoholā] itself is not experienced by the majority of park visitors, the viewshed **from the heiau** is important to the Hawaiian people (Tetra Tech, Inc. 2004; ***emphasis ours***). In an effort to assess any impact the proposed project may have on the view from Pu‘ukoholā toward the eastern horizon, a visual simulation was prepared (Figure 31). While the point of reference was not taken from on top of the *heiau* for cultural sensitivity reasons, the location was at a comparable elevation at a nearby location that actually afforded a slightly better view toward to proposed wind farm area. As can be seen in the simulated view the wind turbines will be barely visible, and certainly do not have a cumulative effect considering all of the more prominently visible modern infrastructural elements.

The current proposed repowering project and the visual simulation (see Figure 31) was shared with Daniel Kawaiaea, the current National Park Service Superintendent at the Pu‘ukoholā Heiau National Historical Site. While not *kama‘āina* to the area, Daniel’s stewardship responsibilities for the *heiau* site coupled with his native Hawaiian esthetic positions him as an ideal person to comment with respect to potential impacts to this significant site. The senior author of the current report met with Daniel at his park headquarters on May 22, 2014. Daniel was presented with the proposed project as well as shown the visual simulation. He indicated that he did not expect that the wind turbines would have any significant visual impact to the *heiau*’s eastern view shed, but did offer that if the towers were of a natural color and/or non-reflective then whatever visual impact there would be would be lessened. Two other cultural practitioners for which Pu‘ukoholā Heiau holds significance were contacted: Mason Maikui (*Na Ao Koa o Pu‘ukoholā*), and Kapono‘ai Molitau (*Na Papa Kanaka o Pu‘ukoholā Heiau*). Both represent the leadership of their respective organization, which exercise cultural practices at the *heiau*. Contact with these two individuals was made via telephone and email. Using the latter, a project description was provided as well as the visual simulations and each were asked to provide their *mana‘o* with respect to potential cultural impacts. As of the time of writing of the current study no responses have been received.

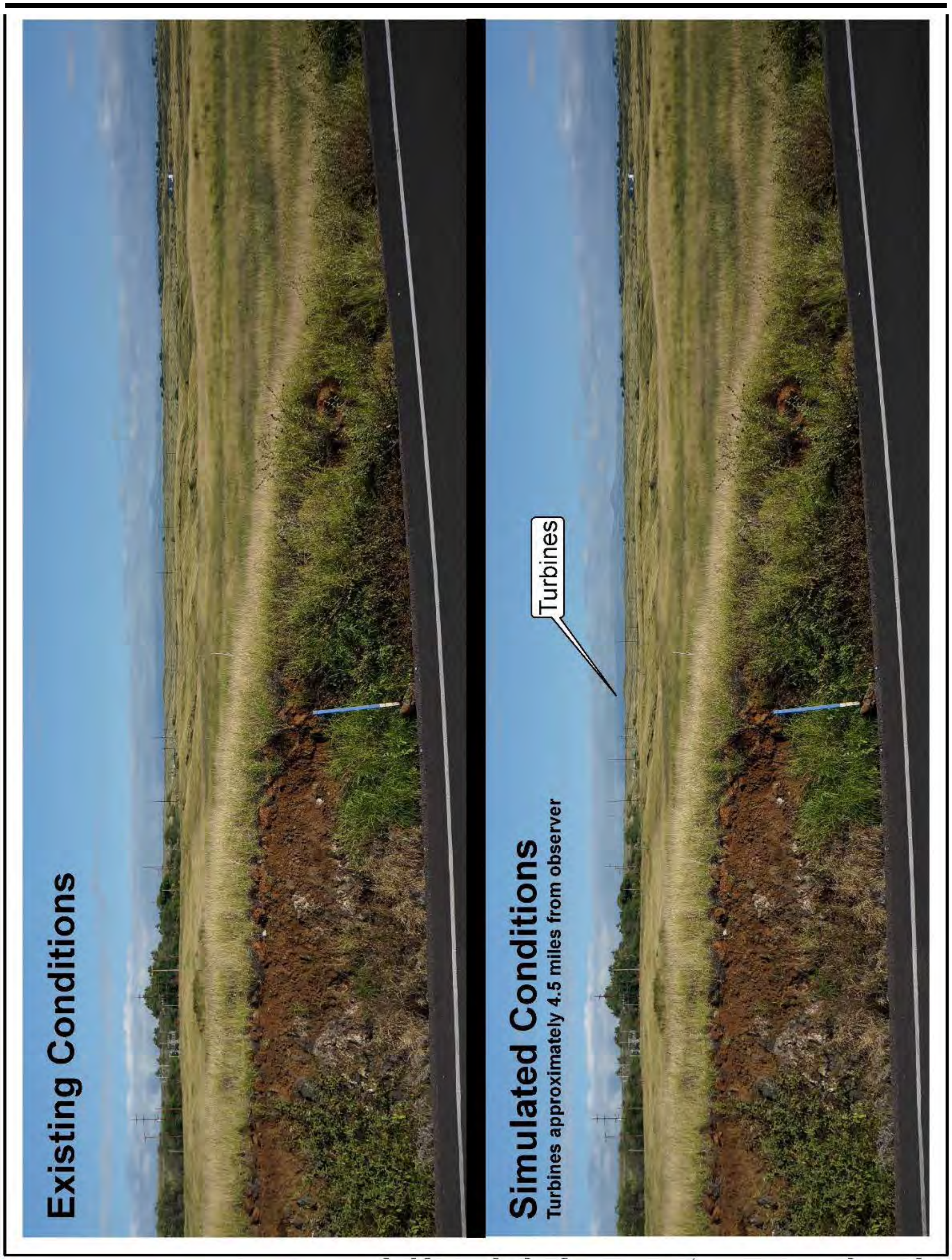

Figure 31. Visual simulation of the view plane looking east from Puʻukoholā Heiau.

6. POTENTIAL CULTURAL IMPACTS

The Office of Environmental Quality Control (OEQC) guidelines 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:

> "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 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. This is precisely because the concept of boundaries runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often times 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.

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, to specify any mitigation actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of the archaeological study (Clark et al. 2014) of the project area there were no resources of either a cultural or historical nature identified that would be affected by the proposed wind farm repowering project. Two of the three archaeological sites (SIHP Sites 30109 and 30110) that were found were fully documented, and the third (SIHP Site 9012) would be avoided during construction. The archival research and consultation conducted for the current study did not reveal the presence of any cultural resources or practices that exist or have occurred in the project area.

Looking at significant cultural resources further afield, Pu'ukoholā Heiau is identified as a traditional cultural property as well as a valued cultural resource. While it is located 4.5 miles *makai* of the current project area, its traditional view plane to the east could catch a glimpse of the proposed wind turbines. Thus, a view plan analysis (see Figure 31) was prepared, and consultation was sought with the National Park Service as stewards of this site as well as with cultural practitioners that use the *heiau*. While suggestions were offered to conceal the turbines as much as is possible, those consulted agreed that the visual impact to Pu'ukohola Heiau and the cultural practices that occur there would be minimal if at all.

The result of this Cultural Impact Assessment is that there are no specific traditional cultural properties, valued resources, or any traditional and customary practices identified that would be impacted by the proposed Lālāmilo Wind Farm Repowering Project.

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APPENDIX E

NOISE ASSESSMENT

Noise Assessment

Lālāmilo Wind Farm Repowering Project

Hawaii County, Hawaii

Prepared for

Site Constructors, Inc.

June 2014

TETRA TECH

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Acronyms and Abbreviations

dB	decibels
dBA	A-weighted decibels
HAR	Hawai‘i Administrative Rules
HDOH	State of Hawai‘i Department of Health
L_{eq}	equivalent sound level
L_{dn}	day-night sound level

1.0 INTRODUCTION

Noise would potentially affect the local environment during both construction and operation of the Project. Sounds originate with a source whether it is a human voice, motor vehicles on a roadway, or a wind turbine. A sound source is defined by a sound power level, which is a measure of the quantity of acoustical energy radiated by that source. This sound power then produced a sound pressure level at some distance that a listener may hear. How the sound power is radiated and distributed determines the sound pressure level at a specific location. Sound levels are presented on a logarithmic scale to account for the large range of acoustic pressures that the human ear is exposed to and is expressed in units of decibels (dB). For the purposes of the Project acoustic analysis, sound levels are expressed in A-weighted decibels (dBA), which compensates for the frequency response of the human auditory system. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and week. For example, this variation could result from variations in operational conditions related to changes in wind speed and other changing weather conditions or from other anthropogenic and/or natural sound sources not related to the Project. Two measures commonly used by federal, state, and local governments to relate the time-varying quality of environmental noise to its known effect on people are the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The L_{eq} is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a given time period, often daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) periods. The L_{dn} is the 24-hour L_{eq} with 10 dBA added to the nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for the greater sensitivity of people to sound during the nighttime hours.

2.0 REGULATORY FRAMEWORK

The state of Hawai'i regulates noise through Hawai'i Administrative Rules (HAR), Title 11, Chapter 46, "Community Noise Control", promulgated on September 11, 1996, which limits sound generated by new or expanded developments (HDOH 1996). The Hawai'i Community Noise Regulations (HAR 11-46) provide for the prevention, control, and abatement of noise pollution in the State. The purpose of these rules is to "provide for the prevention, control, and abatement of noise pollution in the State from the following noise sources: stationary noise sources; and equipment related to agricultural, construction, and industrial activities" (HAR 11-46). Sound from routine ongoing maintenance activities is considered part of routine operation and the combined total of the ongoing maintenance and routine operation are subject to the sound level limits. However, the Community Noise Control Regulation is not applicable to most moving sources, i.e. transportation and vehicular movements. Sound from Project construction and the occasional, major equipment overhauls is regulated as construction activity.

The Hawaiʻi noise limits due to stationary sources are provided by three receiving zoning class districts and time periods and are enforceable at the facility property boundaries. For mixed zoning districts, the primary land use designation is used to determine the applicable zoning district class and maximum permissible sound level. For the purposes of identifying impact conditions, Class A use on Class C Land has been defined at the residential structure, i.e., agricultural portions of the surrounding properties were considered Class C receivers and the residences considered Class A receivers. This is considered a conservative regulatory assessment approach.

As wind energy generation projects may operate at any time during the day or night, the more stringent nighttime permissible sound level will become the controlling limit. The daytime and nighttime maximum permissible noise limits are provided in dBA according to zoning districts in Table 1. The Hawaiʻi noise limits are assumed to be absolute and independent of the existing acoustic environment; therefore, no baseline sound survey is required to assess conformity.

Table 1. Hawaiʻi Maximum Permissible Sound Levels by Zoning District

Receiving Zoning Class District	Maximum Permissible Sound Level (dBA) 1/	
	Daytime	Nighttime
Class A zoning districts include all areas equivalent to land zoned residential, conservation, preservation, public space, or similar type.	55	45
Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C zoning districts include all areas equivalent to lands zoned agriculture, county, industrial, or similar type.	70	70

1/ daytime: 7:00 a.m.to 10:00 pm; nighttime: 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
Source: HDOH 1996

The maximum permissible sound levels are assessed and at any point at or beyond the property line of the facility. Noise levels may exceed the prescribed limits up to 10 percent of the time within any 20-minute period. Sound level for impulsive noise, as measured with a fast meter response, is 10 dBA above the maximum permissible sound levels for the given receiving zoning class district. Pursuant to HAR 11-46-7 and HAR 11-48-8, a permit may be obtained for operation of an excessive noise source beyond the maximum permissible sound levels. Factors that are considered in granting of such permits include whether the activity is in the public interest and whether the best available noise control technology is being employed. The standard provides further exemptions to these limits and further guidance on application, compliance procedures, and penalties. The Hawai'i Department of Health (HDOH) is responsible for the implementation, administration, and enforcement of the statutes.

3.0 EXISTING CONDITIONS

The noise analysis area for the Project includes TMKs, or parcels, located within 1.2 miles (2 kilometers) (Figure 1) of the Project. All TMKs within the analysis area are zoned agricultural (HAR 11-46 Class C, 70 dBA) and none of these have noise sensitive uses, such as residences. Due to the absence of noise sensitive land uses and based on the review of the applicable requirements, it was determined that a baseline sound survey was not required to demonstrate Project compliance.

Existing sound levels in the analysis area were estimated using the Federal Transit Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment guidance for ambient sound levels by population density (FRA 2012). The population density was obtained from the most recent data available via the American Community Survey (U.S. Census Bureau 2010) which shows that population density is 29 people per square mile. The corresponding ambient sound level for the analysis area is estimated to be 35 dBA L_{dn} which translates to a daytime sound level of 35 dBA L_{eq} and a night-time level of 25 dBA L_{eq}.

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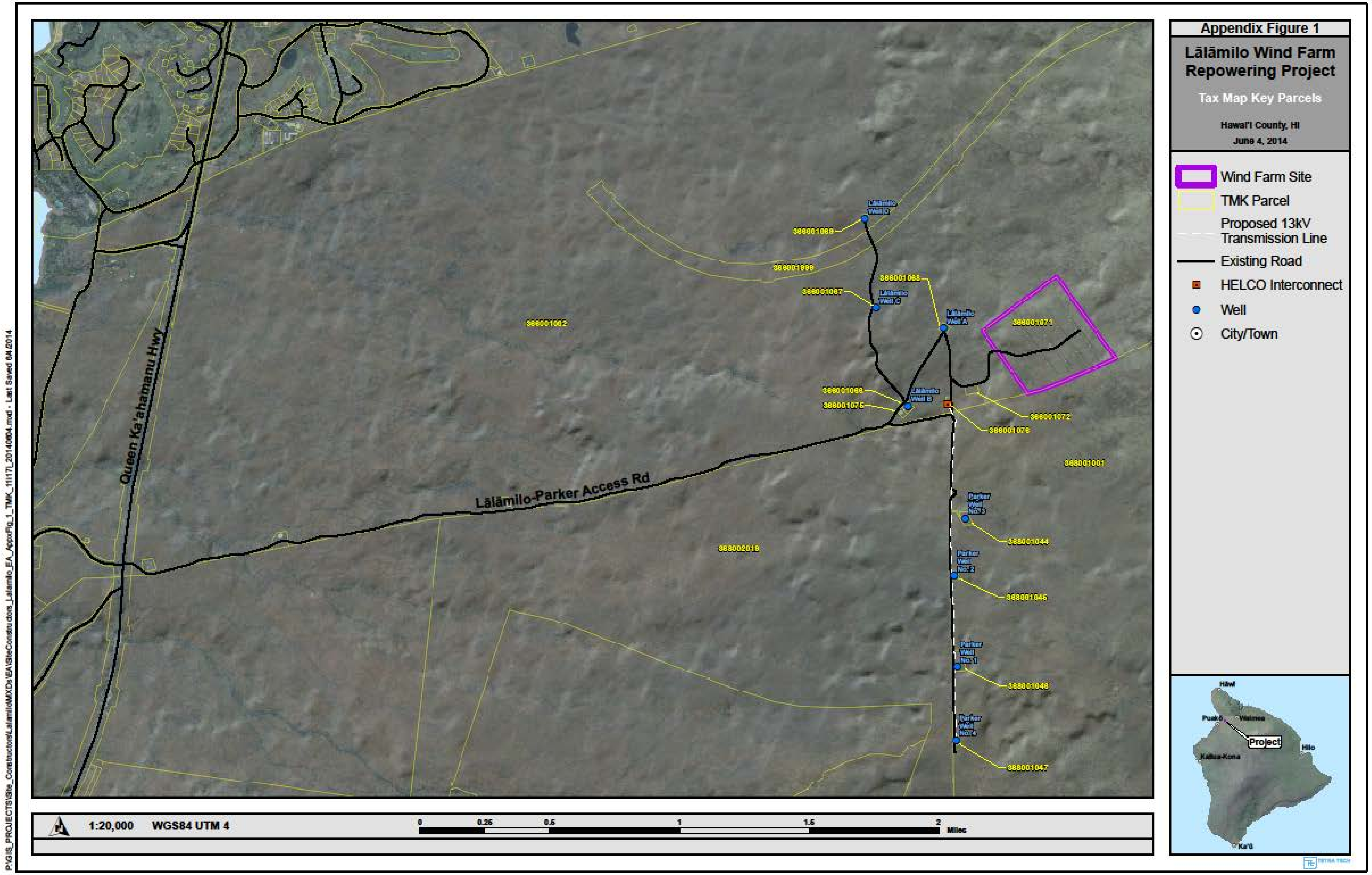

Figure 1. TMK Map

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4.0 POTENTIAL IMPACTS

Construction noise levels were not evaluated; however, because the Project would be constructed during daytime hours and because of the rural location, impacts related to construction are expected to be minimal. Modeling was conducted to determine potential noise impacts during Project operation under conditions corresponding to the turbine maximum sound power level. The modeling methodology, inputs, and results are discussed in the following subsections.

4.1 Methodology

The screening-level analysis was completed using the most recent version of DataKustic GmbH's CadnaA, the computer-aided noise abatement program. CadnaA is a comprehensive 3-dimensional acoustic software model that conforms to the Organization for International Standardization (ISO) standard ISO 9613-2 "Attenuation of Sound during Propagation Outdoors." The engineering methods specified in this standard consist of full (1/1) octave band algorithms that incorporate geometric spreading due to wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of both sources and receptors, seasonal foliage effects, and meteorological conditions.

Vestas was only able to provide sound power data for their V47 wind turbine model from a Danish test report conducted in 1996. Table 2 provides the sound power data for the V47 used in the acoustic analysis, which is assumed to correspond to the turbine's maximum sound power level.

Table 2. Vestas V47 Sound Power Level by Octave Band Center Frequency

Frequency (Hz)	Octave Band Sound Power Level (dB)								Broadband (dBA)
	63	125	250	500	1000	2000	4000	8000	
Vestas V47	78.2	86.1	89.8	95.2	97.0	92.9	87.9	69.2	100.8

Note: Vestas recommends using a 2 dBA k-factor, or uncertainty factor, in conjunction with the V47 sound power levels; therefore, the broadband sound power level used in this analysis is 102.8 dBA.
Source: Vestas 1996

Topographic site variability was accounted for by modeling sound levels over a 32.8 foot (10 meter) digital elevation model obtained from the U.S Geological Survey (USGS 2010). Ground absorption of operational sound levels from topography and vegetation in the surrounding area were taken into account using data from geographic information systems. A conservative ground absorption coefficient was selected for the modeling analysis, which corresponds to a highly reflective surface.

Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, the temperature of 68°F and 70 percent relative humidity parameters were selected as reasonably representative of the annual temperature and humidity conditions for the Project. In addition, wind conditions using ISO assume an omnidirectional wind pattern or downwind sound propagation in all directions. Because of this and the assumption used for ground absorption, the modeling approach used to assess the Project is considered to be conservative.

4.2 Acoustic Analysis Results

Typically received sound levels would be calculated at nearby noise sensitive receptors but, due to the substantial separation distance between the Project and the closest receptors, they are not expected to experience noise impacts resulting from Project operation. To show the sound propagation and attenuation from the Project throughout the analysis area, a sound contour map was created (see Figure 2).

Using the conservative prediction approach described sound levels were found to be at or below the assumed daytime sound levels (35 dBA L_{eq}) at approximately 1.0 mile (1.5 kilometers) and at approximately 1.25 miles (2 kilometers) for assumed nighttime sound levels (25 dBA L_{eq}). However, received sound levels at a given location would vary due to a number of factors such as prevailing meteorological and turbine operational conditions, shielding effects from topography, the relation of the receptor to the layout of turbines, and other sources of ambient sound. Therefore, no significant adverse impact associated with Project noise is anticipated.

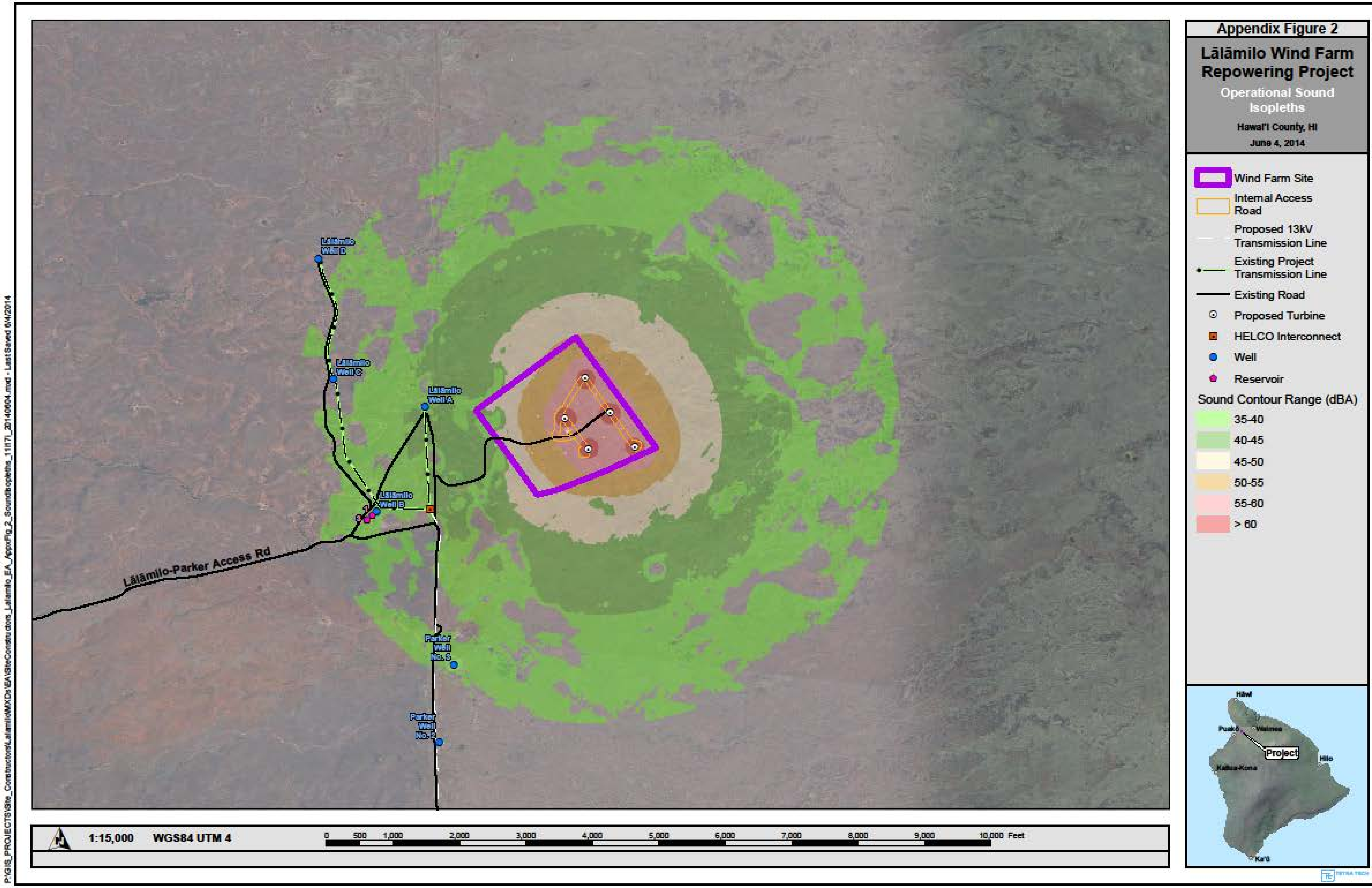

Figure 2. Operational Sound Isopleths

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