Draft Environmental Assessment

HELCO POWER LINE/ACCESS ROAD FOR THE ĀHUALOA WELL DEVELOPMENT

PREPARED FOR:
Department of Water Supply
County of Hawai‘i

PREPARED BY:
PLANNING SOLUTIONS

APRIL 2010

PROJECT SUMMARY

Project Name:	**HELCO Power Line/Access Road for the Āhualoa Well Development**
Applicant/Approving Agency:	Department of Water Supply County of Hawai‘i 345 Kekūanaō‘a Street, Suite 20, Hilo, HI 96720 Contact: Finn McCall, P.E. (808) 961-8070 ext. 255
Location:	Hāmākua District; Island of Hawai‘i
Tax Map Keys:	(3) 4-6-011:004, 006, and 44
Parcel Area	Respectively, 363.1, 3.0, and 33.9 acres
Project Site Area	Approximately 2.79 acres
State Land Use District:	Agriculture
County Zoning	Ag-40a
Proposed Action:	The Department proposes to construct an access road between an existing power line above the Hawaii Belt Road to the Department's Āhualoa Well site for the extension of a new power line to the well site.
Associated Actions Requiring Environmental Assessment:	Proposed use of State land & Hawai‘i County funds
Consultation	The State Department of Hawaiian Home Lands and the State Department of Land and Natural Resources have been consulted regarding this project. The Draft Environmental Assessment will also be sent to the individuals and agencies listed in Table 7.1 for review and comment.
Required Approvals	• Hawai‘i County Plan Approval • Grading Permit, Hawai‘i County • Construction Noise Variance (possible)
Anticipated Determination	Finding of No Significant Impact
Consultant:	Planning Solutions, Inc. 210 Ward Avenue, Suite 330 Honolulu, HI 96814 Contact: Perry White (808) 550-4483

TABLE OF CONTENTS

1.0 PURPOSE OF & NEED FOR THE PROJECT 1-1
1.1 INTRODUCTION 1-1
1.2 PURPOSE OF & NEED FOR THE PROJECT 1-1
1.2.1 Location and Existing Use of the Proposed Site 1-1
1.2.2 Āhualoa Production Well and Reservoir Facility 1-1
1.3 OBJECTIVES OF THE PROPOSED ACTION 1-2
1.4 ORGANIZATION OF THE ENVIRONMENTAL ASSESSMENT 1-2

2.0 PROPOSED ACTION & ALTERNATIVES CONSIDERED 2-1
2.1 DESCRIPTION OF THE PROPOSED ACTION 2-1
2.1.1 Design of the Proposed Action: Electrical Power Line and Access Road 2-1
2.1.1.1 Site Preparation 2-6
2.1.1.2 Road Construction 2-6
2.1.1.3 Installation of Culverts 2-6
2.1.1.4 Installation of Electrical Power Line 2-6
2.1.2 Construction Schedule 2-6
2.1.3 Project Cost 2-6
2.2 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES 2-12
2.3 ALTERNATIVES ADDRESSED IN DETAIL IN EA 2-12
2.3.1 Proposed Action: Constructing Power Line and Access Road 2-12
2.3.2 No Action Alternative 2-13
2.4 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS 2-13
2.4.1 Alternate Route 2-13
2.4.2 Upgrade Existing Distribution System 2-15
2.4.3 Delayed Action 2-15

3.0 EXISTING ENVIRONMENT & PROBABLE IMPACTS 3-1
3.1 TOPOGRAPHY, GEOLOGY, AND SOILS 3-1
3.1.1 Existing Conditions 3-1
3.1.2 Probable Impacts 3-1
3.2 HYDROLOGY AND AQUATIC BIOTA 3-2
3.2.1 Existing Conditions 3-2
3.2.1.1 Surface Water 3-2
3.2.1.2 Aquatic Biota 3-2
3.2.1.3 Groundwater 3-2
3.2.2 Potential Impacts 3-2
3.2.2.1 Construction Period 3-2
3.2.2.2 Operational Phase 3-5
3.3 CLIMATE AND AIR QUALITY 3-5
3.3.1 Existing Conditions 3-5
3.3.2 Probable Impacts 3-6
3.3.2.1 Construction Phase 3-6
3.3.2.2 Operational Phase 3-6
3.4 HAZARDOUS MATERIALS 3-6
3.5 TERRESTRIAL FLORA AND FAUNA 3-6
3.5.1 Existing Conditions 3-6
3.5.2 Probable Impacts 3-7
3.6 NOISE 3-8
3.6.1 Existing Conditions 3-8
3.6.2 Probable Impacts 3-8
3.6.2.1 Construction Phase 3-8
3.6.2.2 Operational Phase 3-8
3.7 ARCHAEOLOGICAL, HISTORIC AND CULTURAL FEATURES 3-8
3.7.1 Existing Conditions 3-8
3.7.2 Probable Impacts 3-10

3.8 NATURAL HAZARD VOLCANIC AND SEISMIC HAZARDS 3-11
3.8.1 Risk from Lava Flows 3-11
3.8.2 Flood and Tsunami Hazards 3-11
3.9 SCENIC AND AESTHETIC RESOURCES 3-11
3.9.1 Existing Conditions 3-11
3.9.2 Probable Impacts 3-11
3.10 TRANSPORTATION 3-11
3.10.1 Existing Conditions 3-11
3.10.2 Probable Impacts 3-11
3.11 LAND USE, SOCIOECONOMIC AND CULTURAL ENVIRONMENT 3-13
3.11.1 Existing Conditions 3-13
3.11.2 Probable Impacts 3-13

4.0 RELATIONSHIPS TO RELEVANT PLANS, POLICIES & CONTROLS 4-1
4.1 STATE AND COUNTY REGULATIONS 4-1
4.1.1 County of Hawai‘i General Plan 4-1
4.1.1.1 Applicable Goals, Policies, and Recommended Actions 4-1
4.1.1.2 Conformance with the 2005 *Hawai‘i County General Plan* 4-2
4.1.2 County of Hawai‘i Zoning Ordinance 4-2
4.1.3 State of Hawai‘i Land Use Law 4-3

5.0 ANTICIPATED DETERMINATION 5-1
5.1 SIGNIFICANCE CRITERIA 5-1
5.2 FINDINGS 5-1
5.2.1 Irrevocable Loss or Destruction of Valuable Resource 5-1
5.2.2 Curtails Beneficial Uses 5-2
5.2.3 Conflicts with Long-Term Environmental Policies or Goals 5-2
5.2.4 Substantially Affects Economic or Social Welfare 5-2
5.2.5 Public Health Effects 5-2
5.2.6 Produce Substantial Secondary Impacts 5-2
5.2.7 Substantially Degrade Environmental Quality 5-2
5.2.8 Cumulative Effects or Commitment to a Larger Action 5-2
5.2.9 Affects a Rare, Threatened, or Endangered Species 5-2
5.2.10 Affects Air or Water Quality or Ambient Noise Levels 5-3
5.2.11 Environmentally Sensitive Areas 5-3
5.2.12 Affects Scenic Vistas and Viewplanes 5-3
5.2.13 Requires Substantial Energy Consumption 5-3
5.3 ANTICIPATED DETERMINATION 5-3

6.0 BIBLIOGRAPHY 6-1

7.0 PARTIES CONSULTED 7-1
7.1 CONSULTATION 7-1
7.2 DISTRIBUTION 7-1

APPENDIX A BIOLOGICAL SURVEYS A-1

APPENDIX B ARCHAEOLOGICAL AND LIMITED CULTURAL ASSESSMENT B-1

LIST OF FIGURES

FIGURE 2.1 PROJECT LOCATION 2-2
FIGURE 2.2 SITE PLAN 2-3
FIGURE 2.3 PHOTOGRAPHS OF ROADWAY ROUTE 2-4
FIGURE 2.4 ROAD SECTIONS 2-7
FIGURE 2.5 CULVERT PLANS & SECTIONS 2-8
FIGURE 2.6 CULVERT DETAILS 2-10
FIGURE 2.7 HELCO POWER LINE PLAN 2-11
FIGURE 2.8 ALTERNATE ROADWAY ROUTE 2-14
FIGURE 3.1 HONOKAIA GULCH WATERSHED 3-3
FIGURE 3.2 DRAINAGE AT THE PROJECT SITE CULVERTS 3-4
FIGURE 3.3 AVERAGE MONTHLY RAINFALL NEAR PROJECT SITE 3-5
FIGURE 3.4 LAVA HAZARD ZONES 3-12
FIGURE 3.5 CENSUS TRACT NO. 219 3-14
FIGURE 4.1 STATE LAND USE DISTRICTS 4-4

LIST OF TABLES

TABLE 2.1 MAJOR COMPONENTS OF HELCO ACCESS ROAD 2-1
TABLE 2.2 PRELIMINARY PROJECT COST ESTIMATE 2-12
TABLE 3.1 BASELINE SOUND LEVELS IN DBA AT ĀHUALOA WELL ACCESS ROADWAY AND CORRIDOR 3-9
TABLE 3.2 MAXIMUM PERMISSIBLE SOUNDS LEVELS IN DBA (HAR §11-46). 3-10
TABLE 7.1 PRELIMINARY DRAFT EA DISTRIBUTION LIST 7-1

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1.0 PURPOSE OF & NEED FOR THE PROJECT

1.1 INTRODUCTION

The Hawai‘i County Department of Water Supply (DWS) is responsible for the development, operation, and maintenance of the municipal water systems throughout the Island of Hawai‘i. In order to carry out that responsibility, it is presently constructing the new Āhualoa Production Well and Reservoir, which it anticipates will be completed by the fourth quarter of 2010. While finalizing construction plans for the project, DWS determined that the original plan to supply power to the well pump via an upgrade to the existing electrical power line along Old Māmalahoa Highway is not feasible (see Section 2.4). Accordingly, DWS proposes to pay for HELCO to install and maintain a new 12.5 kV electrical power line between an existing Hawai‘i Electric Light Company (HELCO) power line and the well and reservoir site. DWS will construct a private access road within a 30-foot wide easement that it is acquiring for the purpose and dedicate both to HELCO. The new power line will provide the three-phase power required by the well pump.

1.2 PURPOSE OF & NEED FOR THE PROJECT

1.2.1 LOCATION AND EXISTING USE OF THE PROPOSED SITE

The proposed 4,240-foot long electrical power line and access road would traverse three adjacent parcels in the Hāmākua District of the Island of Hawai‘i (see Figure 2.1). The parcels are owned by (1) the State Department of Hawaiian Home Lands, which is leased to Honokaia Ranch, Inc. (TMK 4-6-011:004), (2) the State of Hawai‘i (TMK 4-6-011:006); and (3) the State Department of Land and Natural Resources (TMK 4-6-011:044). All three owners have informed DWS of their willingness to grant the power line and road easement. The access road will extend from a point across the Old Māmalahoa Highway from the Āhualoa Well facility northward to terminate to an existing Hawai‘i Electric Light Company (HELCO) power line located near the Hawai‘i Belt Road. The site is presently used for cattle grazing.

1.2.2 ĀHUALOA PRODUCTION WELL AND RESERVOIR FACILITY

On February 23, 2006, the State Office of Environmental Quality Control (OEQC) published in *The Environmental Notice* the DWS Finding of No Significant Impact (FONSI) for construction of the Āhualoa Production Well and Reservoir. The purpose of and need for the Āhualoa Production Well and Reservoir that will be served by the power line proposed here, are discussed in detail in the Final Environmental Assessment/FONSI for that project.[1] The overall goals of the Āhualoa Production Well and Reservoir are to:

- Reduce the dependency of the DWS’ Āhualoa Water System on potable water sources which will be subject to the enhanced treatment requirements mandated by the U.S. Environmental Protection Agency’s Surface Water Treatment Rule (SWTR) by developing a well in an area with known groundwater resources.
- Continue to provide DWS customers in the Āhualoa/Hāmākua and Honoka‘a areas with an adequate supply of affordable potable water to support current and future projected water use.
- Continue to comply with all applicable county, state and federal regulations regarding safe drinking water and treatment in the most cost-effective way possible.

[1] http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Hawaii/2000s/2006-02-23-HA-FEA-AHUALOA-PRODUCTION-WELL-AND-RESERVOIR.pdf

1.3 OBJECTIVES OF THE PROPOSED ACTION

DWS' objectives for the proposed project include the following:

- Supply needed power to the Āhualoa Production Well and Reservoir facility, currently under construction.
- Provide a private access road that will allow the electrical power line to be installed and maintained.

1.4 ORGANIZATION OF THE ENVIRONMENTAL ASSESSMENT

The remainder of this Environmental Assessment (EA) is organized as follows:

- Chapter 2 describes the proposed action in detail and outlines the alternatives analyzed in this EA, as well as other alternatives that were considered and rejected during earlier planning phases.
- Chapter 3 describes the existing environment and analyzes the potential for impacts on environmental, cultural, and socioeconomic resources. It also outlines strategies for minimizing and mitigating unavoidable adverse effects.
- Chapter 4 discusses the consistency of the proposed access road and electrical power line with relevant plans, policies, and controls at local, regional, state, and federal levels.
- Chapter 5 provides justification for the anticipated determination of a Finding of No Significant Impact (FONSI) by considering each individual significance criterion with respect to the proposed project.
- Chapters 6 and 7, respectively, list the references cited and parties consulted during preparation of this EA.

2.0 PROPOSED ACTION & ALTERNATIVES CONSIDERED

2.1 DESCRIPTION OF THE PROPOSED ACTION

DWS proposes to construct a new, private access road in favor of the Hawai‘i Electric Light Company (HELCO) within the Hāmākua District of Hawai‘i to permit the installation and maintenance of an electrical power line to supply power to the Āhualoa Production Well and Reservoir facility. The road will have a nominal width of 15 feet. It will extend from a point across the Old Māmalahoa Highway from the well facility (currently under construction) northward to terminate at an existing HELCO power line located near the Hawaii Belt Road (see Figure 2.1).

Figure 2.2 shows the preliminary plan for the roadway. As shown in Figure 2.2, various stretches of the road will be gravel, asphalt-concrete (AC), or concrete, depending upon the topography being traversed. The road will also pass over two small drainages that will require the installation of culverts. The total estimated lengths of each type of surface are presented in Table 2.1. Figure 2.3 shows photographs of the proposed route. As shown in this figure, the route consists mostly of open pastureland and crosses two small, intermittent drainages.

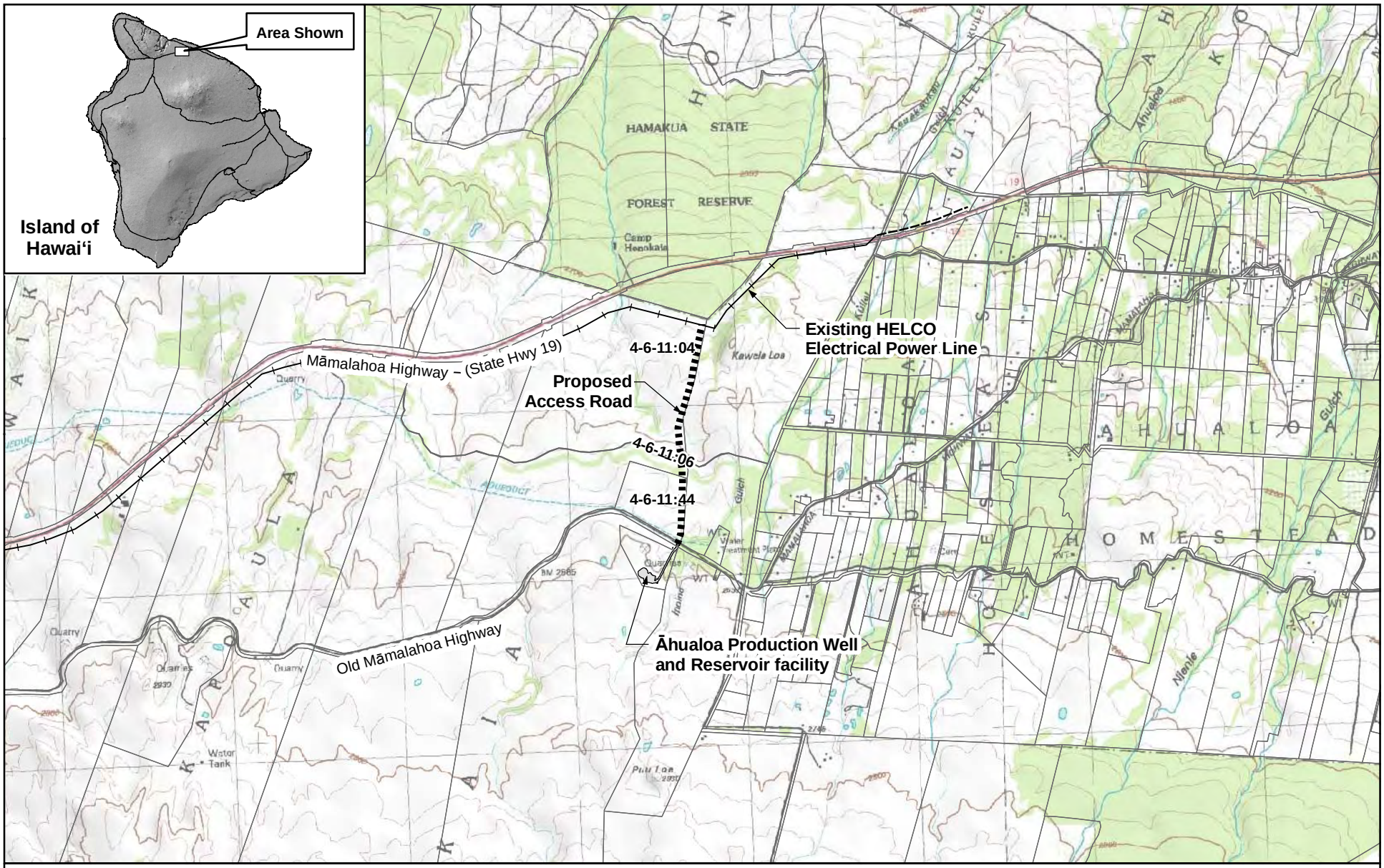
Table 2.1 Major Components of HELCO Access Road

Component	Total Length (feet)	Area (Acres)
Gravel (5 lengths)	1,580	0.54
Asphalt-Concrete (7 lengths)	1,355	0.47
Concrete (7 lengths)	1,120	0.38
Culverts (2)	185	0.06
Source: TNWRE		

2.1.1 DESIGN OF THE PROPOSED ACTION: ELECTRICAL POWER LINE AND ACCESS ROAD

The proposed 4,240-foot long roadway starts at an elevation of 2,535 feet above mean sea level (MSL) on the northern edge of the Old Māmalahoa Highway. It heads approximately north, cutting across an active cattle pasture to a point approximately 1,200 feet south of the Māmalahoa Highway (State Route 19), at an elevation of approximately 2,250 feet MSL. The northern termination of the road will be about 125 feet south of the southern boundary of the Hāmākua State Forest Reserve. This location provides access to an existing HELCO power line that can be tapped to provide electricity for the production well. The road termination includes a 50’ X 50’ concrete turn-around pad.

The lands through which the power line and access road run are made up of gently rolling hills currently being used as cattle pasturage. The access road and electrical lines will cross ‘Ino‘ino Gulch, and pass through one small stand of ‘ōhi‘a lehua trees (*Metrosideros polymorpha*) located just south of the Hāmākua State Forest Reserve boundary (David 2009; see Figure 2.3, Photo 76).



Prepared For:
TNWRE

Prepared By:
PLANNING SOLUTIONS

Sources:
-TNWRE
-USGS 7.5' Topos (ChartTiff)
-State of Hawaii GIS

Legend:

Parcel Boundaries

Scale: 2" = 1 mile

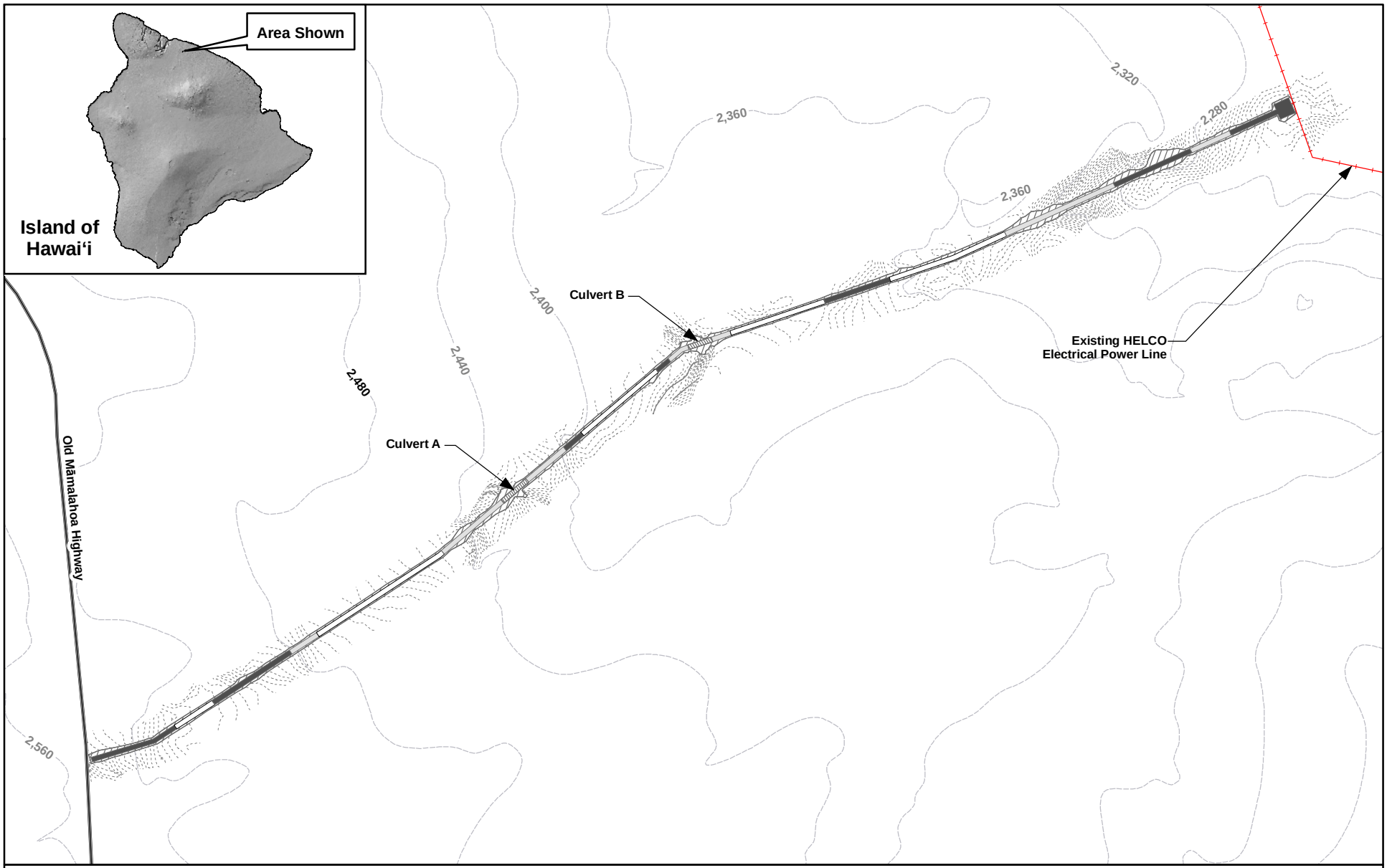
0 0.25 0.5 1
Miles

Figure 2.1:

Project Location

HELCO Access Road for the Āhualoa Well Development

Figure 2-1 Project Location 2010-04-07.mxd



Prepared For:
TNWRE

Prepared By:
PLANNING SOLUTIONS

Sources:
-TNWRE
-USGS 7.5' Topos (ChartTiff; DEM)

Legend:
- AC Pavement
- Concrete
- Culvert
- Gravel
- Limits of Grading
- USGS Contours; 40' Interval
- Surveyed Contours; 2' Interval

Scale: 1" = 400'
0 250 500 1,000
Feet

Figure 2.2:

Site Plan

HELCO Access Road for the Āhualoa Well Development

Figure 2-2 Site Plan 2010-03-23.mxd

Photo 2. Looking N from top of roadway (see Photo Key on Figure 2.3b)

Photo 27. Looking W at Culvert A drainage

Photo 30. Looking S at Culvert A drainage

Photo 35. Looking N along roadway route

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Sources:

Planning Solutions, Inc.
Photos taken October 9, 2009

Note: See key to photograph locations on Figure 2.3B.

Figure 2.3A:

Photographs of the Roadway Route

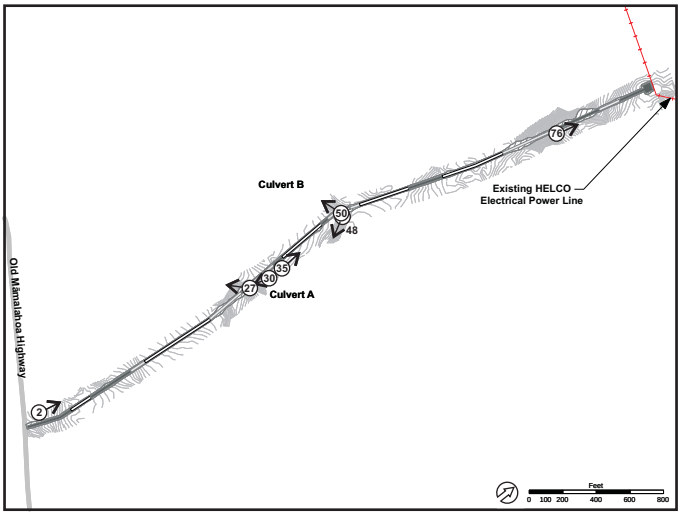
HELCO Access Road for the Âhualoa Well Development

Figure 2-3A Photos of Roadway Route 2010-03-23.cdr

Photo 48. Looking E at Culvert B drainage

Photo 50. Looking W at Culvert B drainage

Photo 76. Looking N at Existing HELCO electrical power line at end of roadway route



Key to photograph locations.

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Sources:

Planning Solutions, Inc.
Photos taken October 9, 2009

Figure 2.3B:

Photographs of the Roadway Route

HELCO Access Road for the Âhualoa Well Development

Figure 2-3 Photos of Roadway Route 2010-03-23.cdr

2.1.1.1 Site Preparation

Access road construction will include grubbing and clearing of 2.79 acres, followed by the grading required to obtain the desired ground elevations for the road surface. Grading will require the excavation of approximately 2,700 cubic yards and subsequent embankment of about 1,100 cubic yards. All grading work will conform to the applicable sections of Chapter 10 of the Hawai‘i County Code and Hawai‘i Administrative Rules (HAR) Title 11, Chapters 54 and 55. DWS will obtain National Pollutant Discharge Elimination System (NPDES) permit coverage from the State of Hawai‘i Department of Health Clean Water Branch (CWB) for storm water discharges that might occur during the construction work. All grubbed materials and excess fill will be properly handled and disposed of or re-used in conformance with County regulations.

2.1.1.2 Road Construction

The asphalt concrete (AC), gravel, and concrete sections of the road will be constructed using standard engineering practices. All sections will be underlain by a 12-inch thick aggregate sub-base. The AC portions will also include an additional 2-inch thick layer of AC pavement, and the concrete sections will include a 6-inch layer of concrete (see Figure 2.4).

2.1.1.3 Installation of Culverts

The road will include two culverts across small, intermittent drainages. These structures will include 36-inch drainpipes to handle most flow conditions (Figure 2.5) and will be reinforced by concrete rubble masonry (CRM) slope protection to keep the structure in place during flood conditions (Figure 2.6) should the road be overtopped.

2.1.1.4 Installation of Electrical Power Line

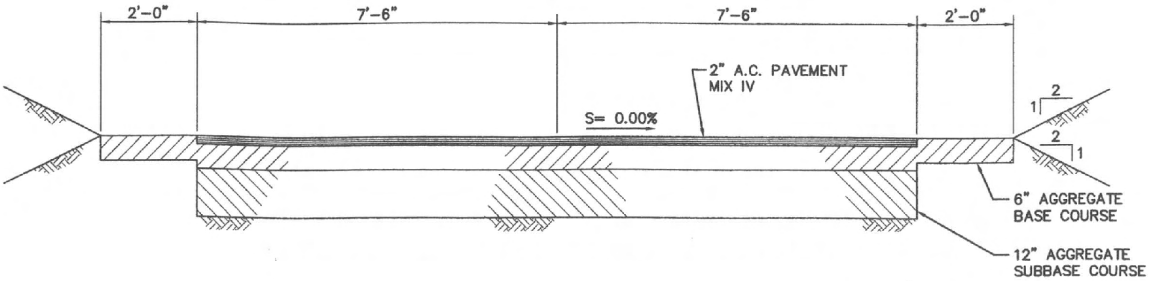
Figure 2.7 shows the preliminary plans for the electrical power line that HELCO will construct from its existing line along the northern termination of the proposed access road, along the road, and into the Āhualoa Production Well & Reservoir facility. The line will carry three-phase, 12 kV electrical power to supply the well pump and other electrical requirements at the well facility. As shown in this plan, the poles will be approximately 39 feet above grade and will support three conductors. HELCO will use 45-foot wooden poles and set them 6 feet into the ground.

2.1.2 CONSTRUCTION SCHEDULE

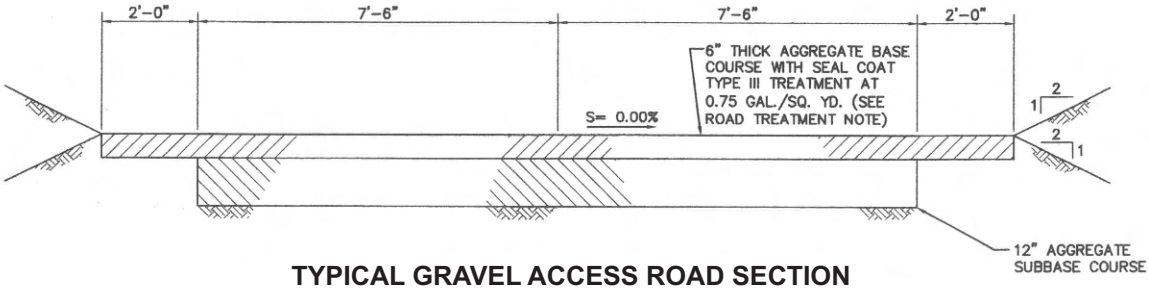
Construction of the access road and electrical power line is anticipated to start in November 2010 through February 2011.

2.1.3 PROJECT COST

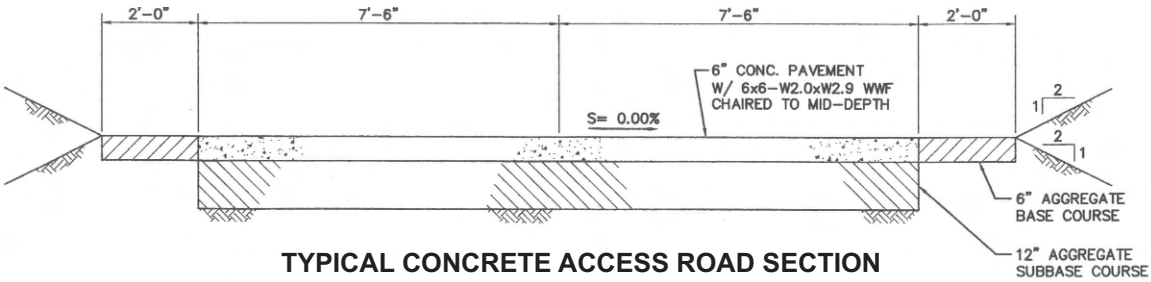
Table 2.2 presents preliminary estimates of the complete project costs. The project will be funded by the Department of Water Supply, County of Hawai‘i.



TYPICAL AC ACCESS ROAD SECTION



TYPICAL GRAVEL ACCESS ROAD SECTION



TYPICAL CONCRETE ACCESS ROAD SECTION

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

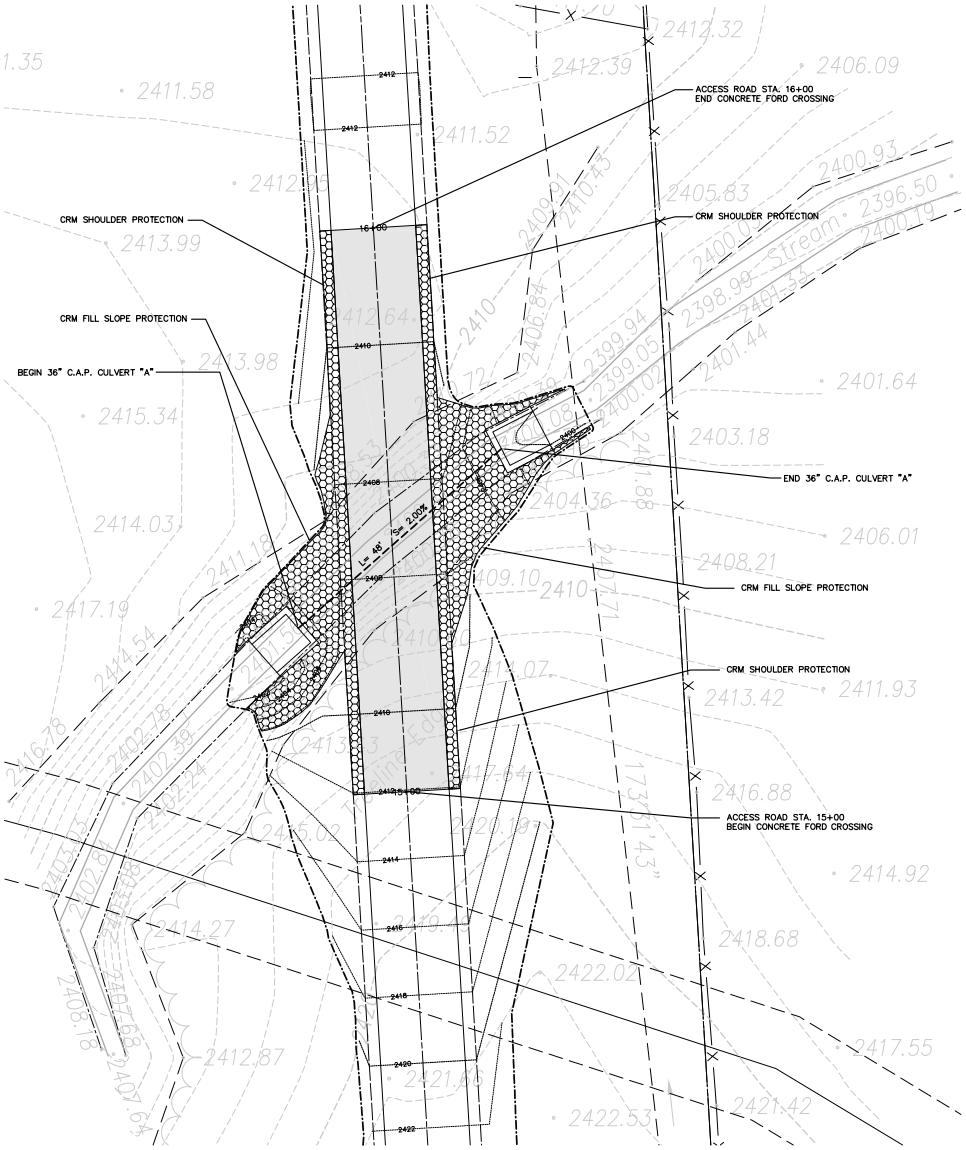
TNWRE

Figure 2.4

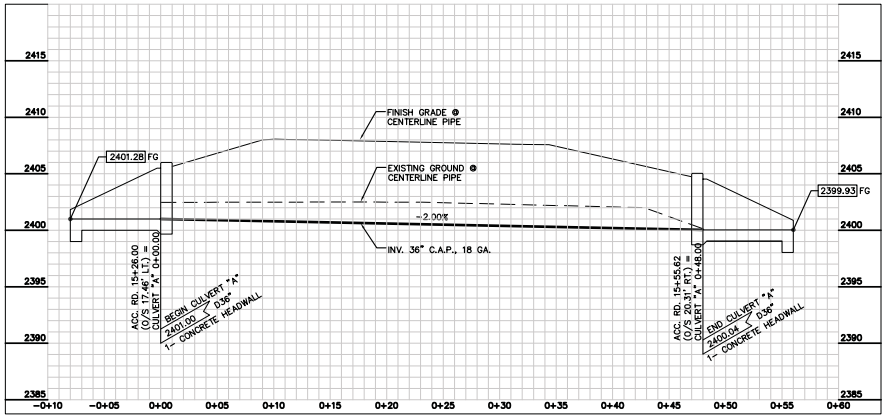
Road Sections

HELCO Access Road for the
Âhualoa Well Development

Figure 2-4 Road Sections 2010-03-24.cdr



PLAN – DRAINAGE CULVERT "A"



PROFILE – DRAINAGE CULVERT "A"

SCALE: HORIZ. – 1' = VERT. – 1'

Figure 2.5A:

Culvert "A" Plan & Section Views

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

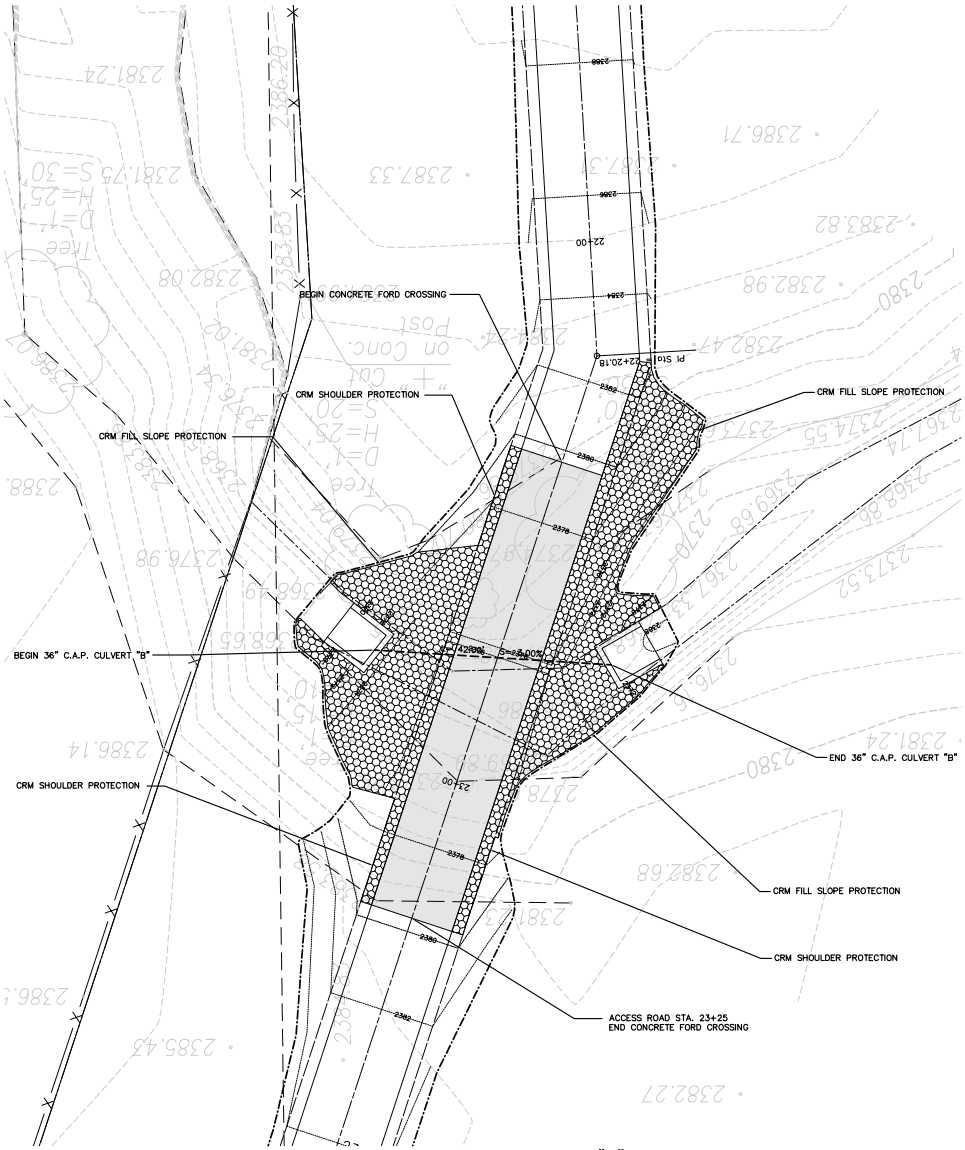
Source:

TNWRE, Sheet C-13
Job No. 2008-009

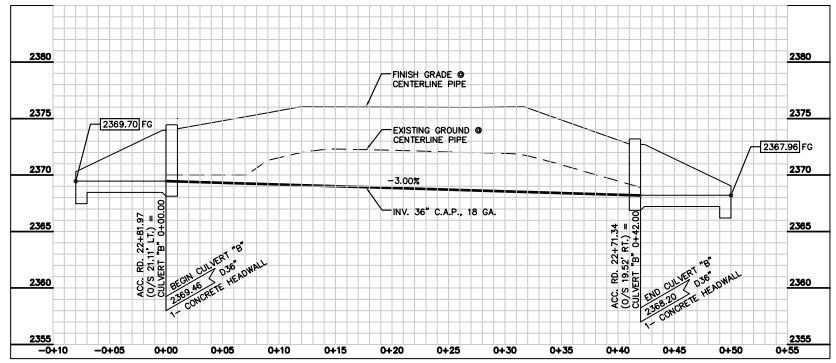
Project:

HELCO Access Road for the Âhualoa Well Development

Figure 2-5A Culvert Plan & Section Views 2010-04-02.cdr



PLAN – DRAINAGE CULVERT "B"



PROFILE – DRAINAGE CULVERT "B"

SCALE: HORIZ. – 1" = VERT. – 1"

Figure 2.5B:

Culvert "B" Plan & Section Views

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

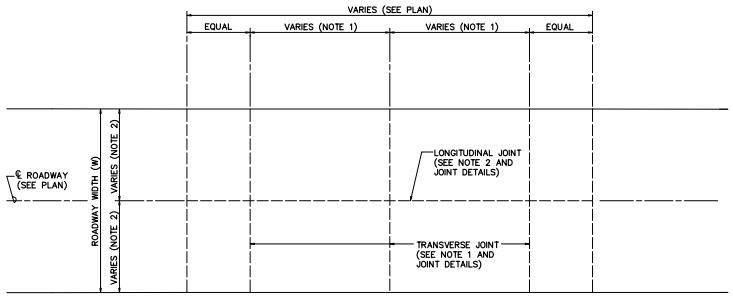
Source:

TNWRE, Sheet C-14
Job No. 2008-009

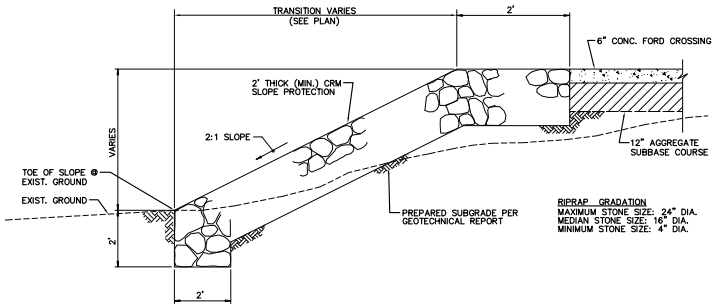
Project:

HELCO Access Road for the Âhualoa Well Development

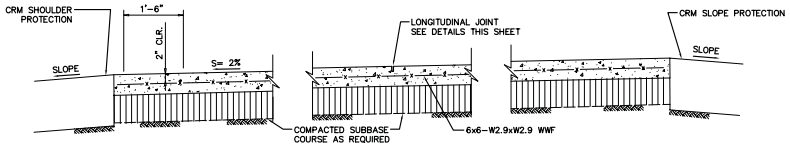
Figure 2-5B Culvert B Plan & Section Views 2010-04-02.cdr



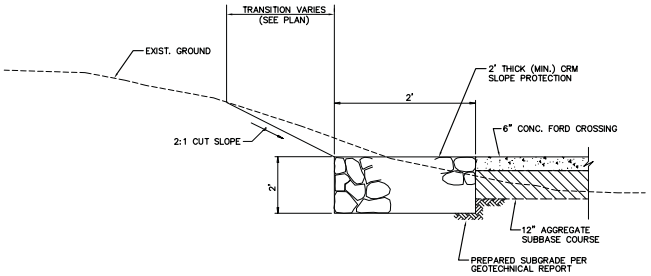
PLAN – TYPICAL FORD CROSSING
NOT TO SCALE



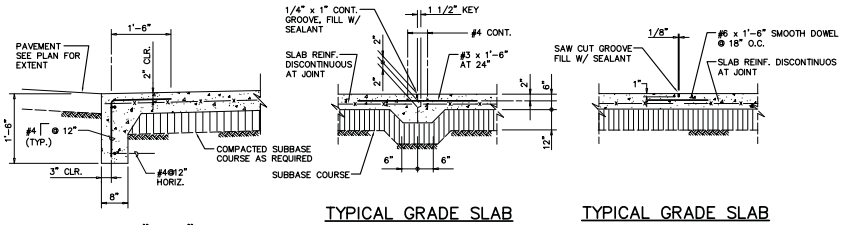
CRM FILL SLOPE PROTECTION DETAIL
NOT TO SCALE



SECTION "A–A"
NOT TO SCALE



CRM SHOULDER PROTECTION DETAIL
NOT TO SCALE



SECTION "B–B"
NOT TO SCALE

TYPICAL GRADE SLAB CONSTRUCTION JOINT DETAIL
NOT TO SCALE

TYPICAL GRADE SLAB SAWCUT JOINT
NOT TO SCALE

FORD CROSSING TYPICAL DETAILS STAS. 15+00 TO 16+00 & 22+40 TO 23+25

NOTES:

1. TRANSVERSE JOINTS SHALL BE WEAKENED PLANE CONTRACTION JOINTS (SAWCUT JOINTS) AT MAXIMUM 15 FEET ON CENTERS AND CONSTRUCTION JOINTS AT MAXIMUM 35 FEET ON CENTERS.
2. LONGITUDINAL JOINTS SHALL BE WEAKENED PLANE CONTRACTION JOINTS (SAWCUT JOINTS) AT MAXIMUM 14 FEET ON CENTERS OR CONSTRUCTION JOINTS AT SPACING GREATER THAN 14 FEET.
3. PAVEMENT ON GRADES AT 12% OR LESS SHALL BE BROOM FINISHED TRANSVERSELY AND PAVEMENT ON GRADES GREATER THAN 12% SHALL BE BRISTLE BRUSH FINISHED.
4. WEAKENED PLANE JOINTS MAY BE CONSTRUCTED BY SAWING, FORMING DUMMY GROVE OR INSERTING RIBBON OR PREMOLDED STRIP.
5. ALL JOINTS SHALL BE SLIGHTLY UNDER FILLED WITH JOINT SEALER PAVING ASPHALT, GRADE 85–100, ASSHO DESIGNATION: M20–60.
6. ALL SMOOTH DOWELS SHALL BE PAINTED AND GREASED.
7. ALL CONCRETE FOR CROSSING SHALL BE CLASS "A".
8. ON UPSTREAM SIDE OF CHANNEL TRANSITION, IF EXISTING GROUND IS ABOVE SLAB, CUT SLOPE AT 2% TO DAYLIGHT.
9. ON DOWNSTREAM SIDE OF CHANNEL TRANSITION, IF EXISTING GROUND IS ABOVE SLAB, CUT TO SLOPE AT 2% TO DAYLIGHT.

Figure 2.6:

Culvert Details

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

TNWRE, Sheet C-15
Job No. 2008-009

Project:

HELCO Access Road for the Âhualoa Well Development

Figure 2-6 Culvert Details 2010-04-02.cdr

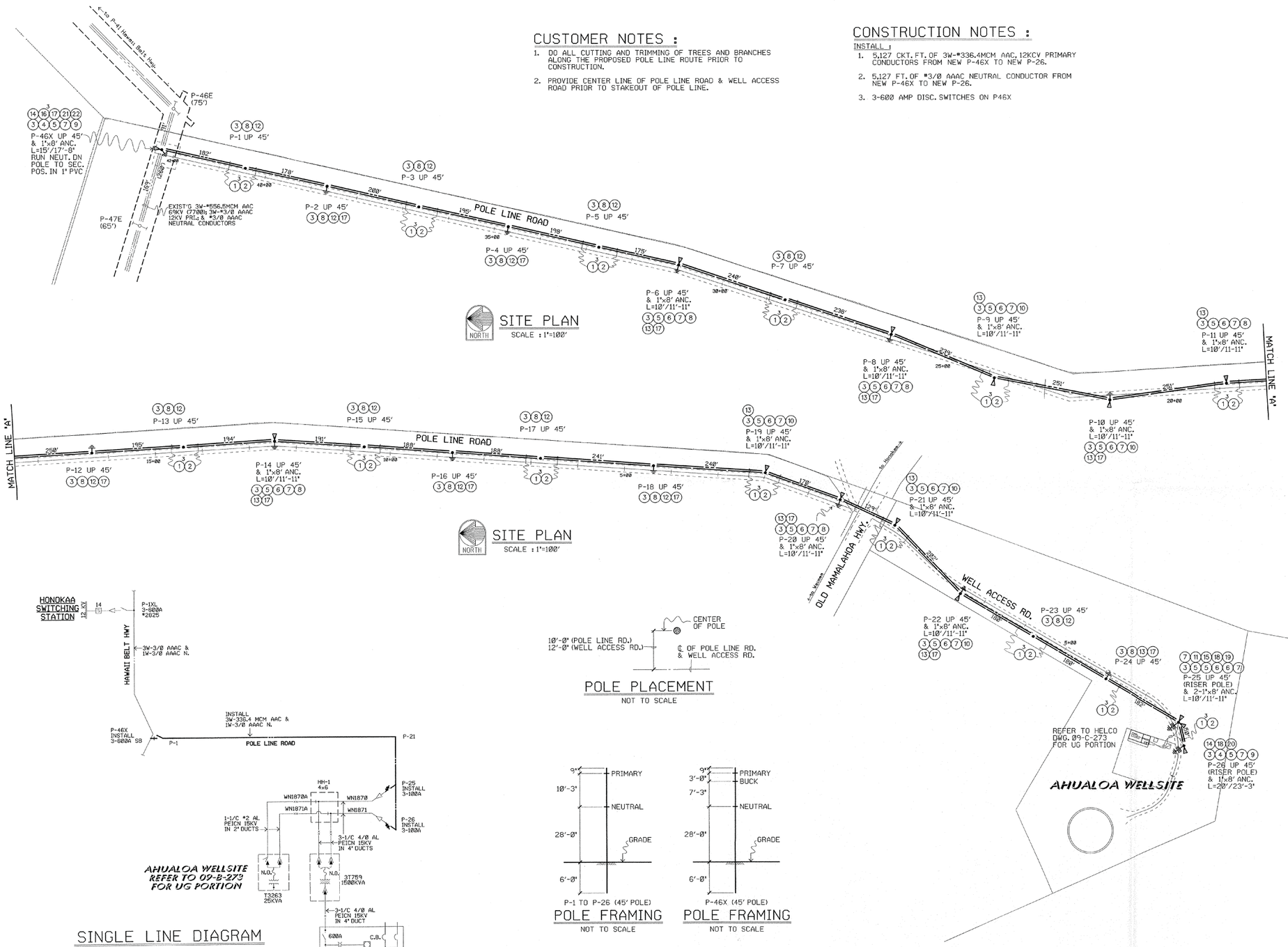
CUSTOMER NOTES :

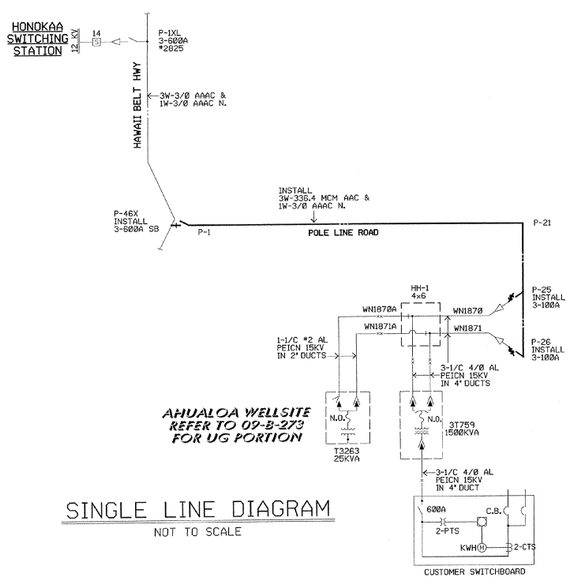
1. DO ALL CUTTING AND TRIMMING OF TREES AND BRANCHES ALONG THE PROPOSED POLE LINE ROUTE PRIOR TO CONSTRUCTION.
2. PROVIDE CENTER LINE OF POLE LINE ROAD & WELL ACCESS ROAD PRIOR TO STAKEOUT OF POLE LINE.

CONSTRUCTION NOTES :

INSTALL :

1. 5,127 CKT. FT. OF 3W-#336.4MCM AAC, 12KCV PRIMARY CONDUCTORS FROM NEW P-46X TO NEW P-26.
2. 5,127 FT. OF #3/0 AAAC NEUTRAL CONDUCTOR FROM NEW P-46X TO NEW P-26.
3. 3-600 AMP DISC. SWITCHES ON P46X





SINGLE LINE DIAGRAM

NOT TO SCALE

POLE PLACEMENT

NOT TO SCALE

P-1 TO P-26 (45' POLE)

POLE FRAMING

NOT TO SCALE

P-46X (45' POLE)

POLE FRAMING

NOT TO SCALE

Figure 2.7:

HELCO Electrical Power Line Plan

Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

Hawaii Electric Light Co., Inc. (HELCO)

Project:

HELCO Access Road for the Âhualoa Well Development

Figure 2-7 HELCO Transmission Line Plan 2010-04-01.cdr

Table 2.2 Preliminary Project Cost Estimate

Item	*Estimated Cost*
Clearing/Grubbing	$40,000
Excavation and Embankment for Access Road	$54,260
15' Wide Gravel Road with Seal Coat	$52,680
15' Wide – 2-inch thick AC Pavement	$65,250
15" Wide 6-inch Concrete pavement	$85,855
6-inch Basecourse Under Pavement	$32,625
6-inch Basecourse for Shoulders	$69,840
Ford Crossing	$60,000
Erosion & Temporary Dust Control	$25,000
Construction Stakeout	$10,000
Total Cost	**$495,510**
Source: Tom Nance Water Resource Engineering	

2.2 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES

Title 11, Chapter 200 of the Hawai'i Administrative Rules (HAR §11-200) contains the Department of Health's Environmental Impact Statement Rules. HAR §11-200-5 deals with "agency actions" such as the one that DWS is proposing. It requires that, for all agency actions that are not exempt as defined in HAR §11-200-8, the agency must consider environmental factors and available alternatives and disclose these in an environmental assessment or environmental impact statement. HAR §11-200-9 requires the proposing agency to analyze alternatives, in addition to the proposed action in the environmental assessment. HAR §11-200-10 establishes the required contents of environmental assessments. Among the requirements listed, HAR §11-200-10 (6) calls for an identification and summary of impacts <u>and alternatives considered</u> (emphasis added).

In accordance with these requirements, DWS considered a number of alternatives before determining that the proposed project is the best course of action. These included "No Action", alternate route, modify existing power line, and delayed action. DWS concluded that only two of these alternatives merit consideration in the impact analysis portion of this Draft EA. They are "No Action" (as required by Chapter 343), and the proposed action of constructing the HELCO Access Road for the Āhualoa Well as currently designed. The following two subsections describe the alternatives considered in preparation of this Draft EA and the criteria DWS used to decide whether to include them in the impact analysis presented in Chapter 4.

2.3 ALTERNATIVES ADDRESSED IN DETAIL IN EA

2.3.1 PROPOSED ACTION: CONSTRUCTING POWER LINE AND ACCESS ROAD

This alternative consists of the proposed action as described in detail in Section 2.1 above. DWS believes constructing the access road and electrical power line would enable it to provide the necessary power to the Āhualoa Well currently under construction, and thus it represents their preferred course of action.

2.3.2 NO ACTION ALTERNATIVE

The "No Action" Alternative consists of not constructing the proposed power line and access road. This alternative would incapacitate the Āhualoa Well and its facilities, which are currently under construction, as not enough power would be available to run them. Further, the "No Action" Alternative would leave the Āhualoa/Hāmākua Water System to 1) rely on the existing stream source to provide the area's potable water; and 2) continue to depend on the Haina Well and the new Honokaʻa Well to provide potable water for the Honokaʻa area. The former is acceptable under current drinking water standards, but it is not consistent with DWS' policy of shifting from surface water to groundwater sources. The latter is unacceptable because it would leave the Honokaʻa area without an adequate backup source as required by County DWS Standards. By following through on the development of the Āhualoa Production Well, DWS will be able to comply with County policies and regulations while still providing an affordable and adequate water supply to meet its customers' needs.

"No Action" would not meet the project objectives and is, therefore, not a viable alternative. It is included in this EA primarily to fulfill the legal requirements of Hawaiʻi Revised Statues Chapter 343 and HAR §11-200. It also provides a baseline against which to measure the environmental impacts of the proposed action.

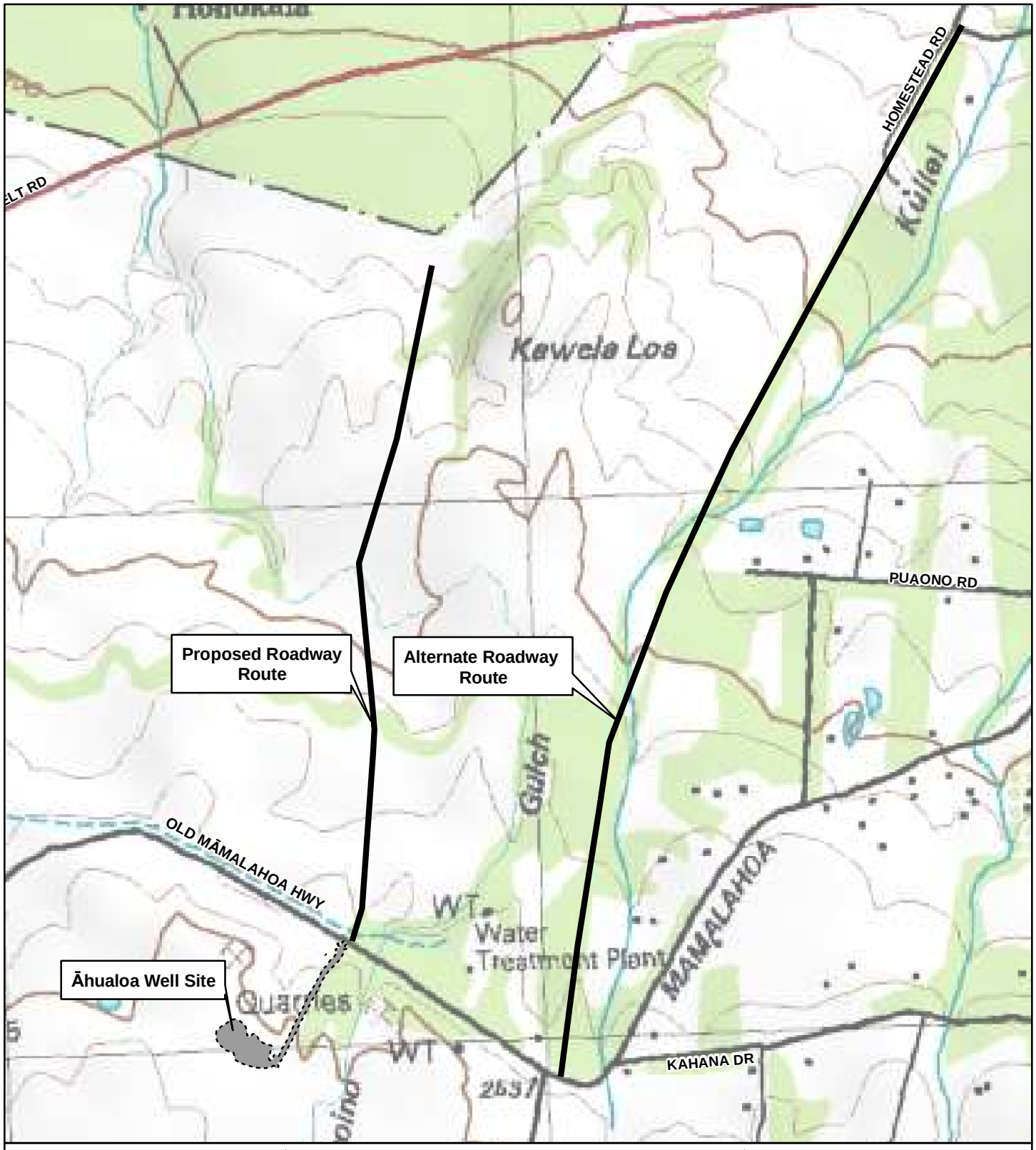
2.4 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

2.4.1 ALTERNATE ROUTE

DWS initially considered an alternate power line and access road alignment located to the east of the proposed route (see Figure 2.8). The advantage of this alternate is that it is located on a parcel that is zoned specifically for use as a roadway. However, the disadvantages are:

1. The 8,400-foot alternate route is much longer than the 4,240-foot proposed route;
2. The alternate route would require at least two crossings of the Kuilei Gulch compared to a single crossing of the smaller ʻInoʻino Gulch of the proposed route; and
3. The alternate route passes through extensive (at least 1,200 ft.) forested area and would require the removal of far more trees than the proposed route.

These disadvantages make it likely that the alternate route would be far more expensive and would lead to far more environmental impacts than the proposed route. For these reasons, DWS has decided to remove it from further consideration for this project.



Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Sources:

-State of Hawaii GIS
-TNWRE
-USGS 7.5' Topo Map (ChartTiff)

0 250 500 1,000
Feet

Figure 2.8:

Alternate Roadway Route

HELCO Access Road for the Āhualoa Well Development

Figure 2-8 Alternate Roadway Route 2010-04-09.mxd

2.4.2 UPGRADE EXISTING DISTRIBUTION SYSTEM

DWS initially planned to upgrade the existing 12.5 kV power line along Old Māmalahoa Highway adjacent to the well facility. However, detailed design studies showed that this would require replacement of several miles of existing 12.5 kV power lines along the highway using taller poles with larger conductors. In addition, the existing line passes through heavily forested areas, and replacement of the line with a taller system would also entail removal and ongoing increased maintenance of trees to keep the lines clear. For these reasons, DWS determined this alternative to be impracticable and is no longer considering it.

2.4.3 DELAYED ACTION

Delaying development of the power line and access roadway could negatively affect DWS and their customers in the Āhualoa/Hāmākua and Honoka‘a area if the well they are currently constructing cannot be provided enough electrical power. Without a functioning well at the Āhualoa Production Well site, DWS will not be able to replace the Kohākōhau Stream source serving the Āhualoa/Hāmākua area with a groundwater source that will eliminate virtually any potential that may currently exist for the introduction of surface-water contaminants into the system. DWS wants to act expeditiously to ensure the delivery of safe and reliable drinking water to its customers in Āhualoa/Hāmākua and Honoka‘a. Therefore, it does not consider delayed action a viable alternative.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

3.0 EXISTING ENVIRONMENT & PROBABLE IMPACTS

3.1 TOPOGRAPHY, GEOLOGY, AND SOILS

3.1.1 EXISTING CONDITIONS

The proposed power line and access road for the Āhualoa Production Well & Reservoir site is on the lower northern flank of Mauna Kea, the tallest mountain in the Hawaiian Chain (13,795 feet above msl). Mauna Kea's rocks overlap those of the older Kohala Mountain to the north. Mauna Kea, which began with submarine eruptions from the seafloor a little less than one million years ago, is a dormant volcano in its "post-shield" stage. The basaltic post-shield stage of volcanism began approximately 300,000 years ago; this was followed by alkalic postshield activity, which began about 60-70,000 years ago. As reported by the Global Vulcanism Program of the Smithsonian Institution (www.volcano.si.edu/world/volcano.cfm) dating of lavas on the NE flank (Puʻu Lehu, the South rift zone (Puʻu Kole), the NE flank (Puʻu Kanakaleonui), and the SE flank (near Hale Pohaku) its youngest known eruptions occurred approximately 2,500 years ago. During the late stages of its volcanic development, Mauna Kea produced a cap of differentiated lavas that almost completely buried the original shield volcano above sea level. These lava types consist of an older Hāmākua Volcanic Series and a younger Laupāhoehoe Volcanic Series (both of which are divided into upper and lower members). The geology at the project site is derived from the Laupāhoehoe lower member volcanic series, of which the youngest dated flow is about 4,400 years old (Macdonald et al. 1983).

As shown in Figure 2.2, the ground across the proposed site slopes northward. The ground elevation ranges from 2,535 feet MSL at the southern head of the road to 2,247 feet at its northern termination. The U.S. Soil Conservation Service classifies the soil along the route as Honokaʻa silty clay loam, 10 to 20 percent slopes (HTD). This soil type exhibits high permeability, slow runoff, and a slight erosion hazard. It is used mostly for pasture and woodland. The site is designated as "Other" on the Agricultural Lands of Interest to the State of Hawaiʻi (ALISH) map.

3.1.2 PROBABLE IMPACTS

The grubbing and grading for the access road will disturb approximately 2.79 acres. The grading will also require excavation of approximately 2,713 cubic yards of material and an embankment of approximately 1,100 cubic yards. The two drainages crossed by the road would be filled with culverts. The roadbed would then be finished with gravel, AC, and concrete, with the steepest sections finished in concrete, the flattest sections in gravel. The holes needed for the utility poles would be excavated during or after the construction of the access road and would be within areas already disturbed by road construction.

The land that would be disturbed does not have a high potential for agricultural use, and construction of the proposed facilities (the power line and service road) would not displace or interfere with the low-density grazing that occurs here to any sizeable extent. DWS will obtain coverage under the State of Hawaiʻi NPDES General Permit program for the facility construction (HAR §11-55, Appendix C). It will use Best Management Practices (BMPs) to minimize erosion of the area disturbed during construction and the installation of permanent erosion control structures to ensure the long-term minimization of erosion at the site. These measures will ensure that there will be no substantial impact on topography and soils from the project.

3.2 HYDROLOGY AND AQUATIC BIOTA

3.2.1 EXISTING CONDITIONS

3.2.1.1 Surface Water

The project site is within the Honokaia Gulch Watershed[2], which extends from the Kaikipau‘ula Pu‘u, a cinder cone at its top extremity (+6,647 feet msl) to the ocean (see Figure 3.1). The watershed includes an area of about 18.5 square miles and is comprised of 95.9 percent agricultural lands and 4.1 percent conservation lands (DAR 2009). Most of the area (81.7 percent) consists of grasslands, with almost all of the balance consisting of bushes and shrubs (10.1 percent) and forested land (7.4 percent). The ‘Ino‘ino Gulch, a small tributary draining into the Honokaia Gulch, will continue to receive all the storm water that passes through the project culverts. No perennial streams are included in the watershed.

As described in Section 2.1.1, the access road will cross two drainage ways in this watershed using culverts. The locations of the planned culverts and the drainage areas that would provide storm water flows to these drainages at the culvert sites are shown in Figure 3.2. Culvert A will cross a small drainage way that descends from west to east across the roadway and subsequently joins the ‘Ino‘ino Gulch. Culvert B crosses the ‘Ino‘ino Gulch at a point that descends from east to west. The drainage area that will collect storm water that passes through Culvert A is about 50 acres in size. The storm water that passes through Culvert B will be collected from an area of about 210 acres, which also includes the flow through Culvert A. As shown in Figure 2.3 (Photos 27, 30, 48, and 50), both drainage ways are well vegetated and show few signs of water flow.

3.2.1.2 Aquatic Biota

As noted above, the proposed project would not affect flow in perennial streams. The watershed is not listed as protected according to the criteria used by DAR.[3]

3.2.1.3 Groundwater

The project site overlies the Honoka‘a Aquifer, which has a potential sustainable yield of 31 million gallons per day (CWRM 2008).

3.2.2 POTENTIAL IMPACTS

3.2.2.1 Construction Period

Construction activities themselves will not substantially alter the quantity of storm water runoff.[4] However, the grading will slightly alter the pattern (i.e., discharge points) of runoff, and the soil disturbance that will occur during construction will affect the quality of the storm water runoff.

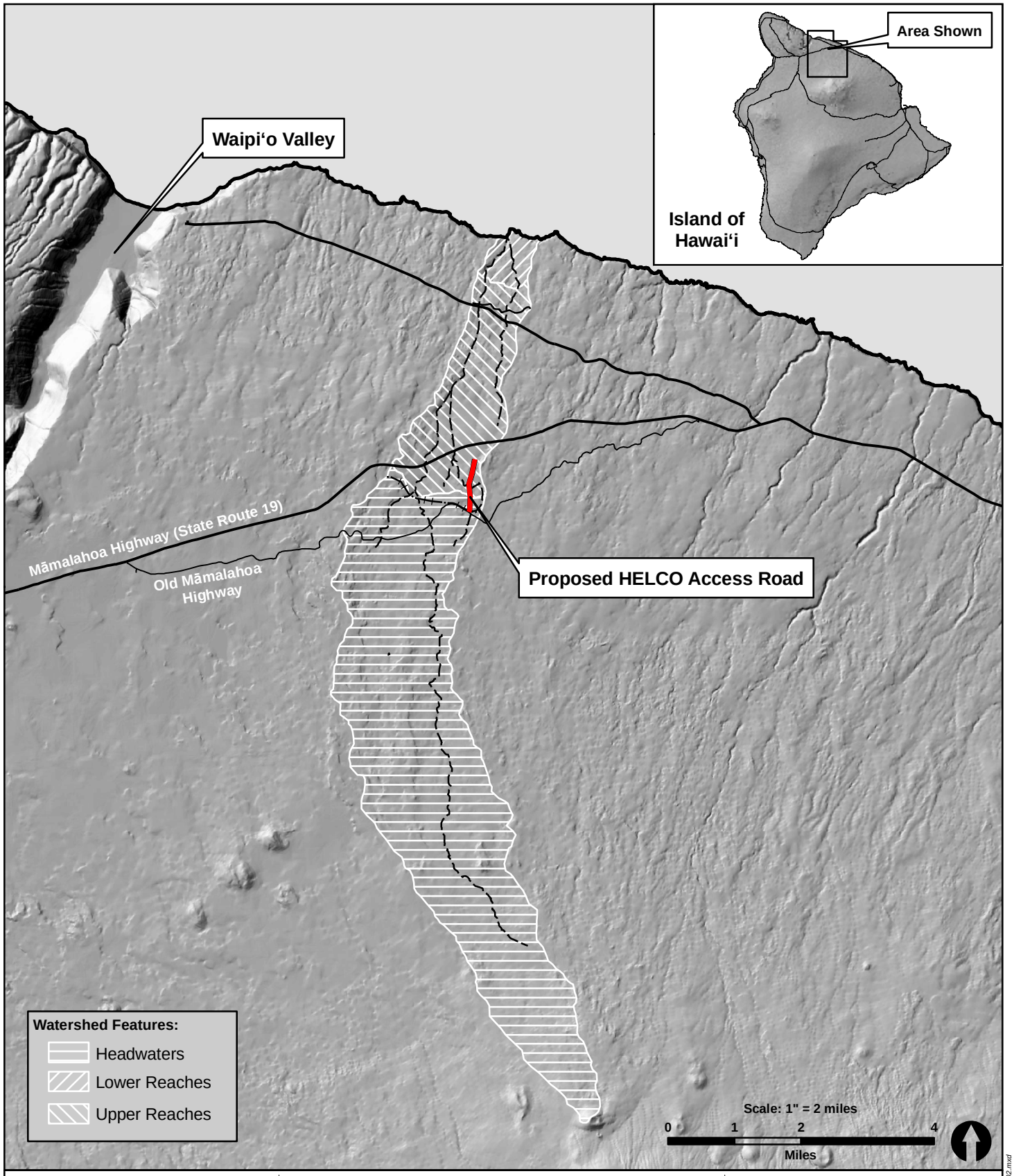
The contractor will use BMPs as necessary during construction of the proposed project to prevent eroded soil, construction debris, and other pollutants from leaving the site via runoff. Areas that have been grubbed and/or graded will be stabilized and vegetation will be replanted as quickly as possible to control erosion. Since the disturbed area is expected to be more than an acre, NPDES Construction Storm water general permit coverage[5] will be required for construction activities associated with the proposed service road. BMPs will be used to avoid, minimize, and eliminate storm water pollution, and to preclude pollution from other, non-storm water sources, and because the area affected is

[2] State DLNR Division of Aquatic Resources Watershed Code: 81055

[3] Including DAR Potential Heritage Streams, U.S. Fish & Wildlife Service High Quality Stream, Nature Conservancy Priority Aquatic Sites, and National Park Service Nationwide Rivers Inventory.

[4] As new facilities with impermeable surfaces are developed they will gradually change the volume, but these are permanent changes and are discussed with the other operational period effects.

[5] National Pollutant Discharge Elimination System administered through the Clean Water Branch of the State Department of Health (Hawai‘i Administrative Rules, 11-55, Appendix C).



Prepared For:
TNWRE

Prepared By:
PLANNING SOLUTIONS

Sources:
-TNWRE
-Division of Aquatic Resources
-State of Hawaii GIS

Drainage Ways:

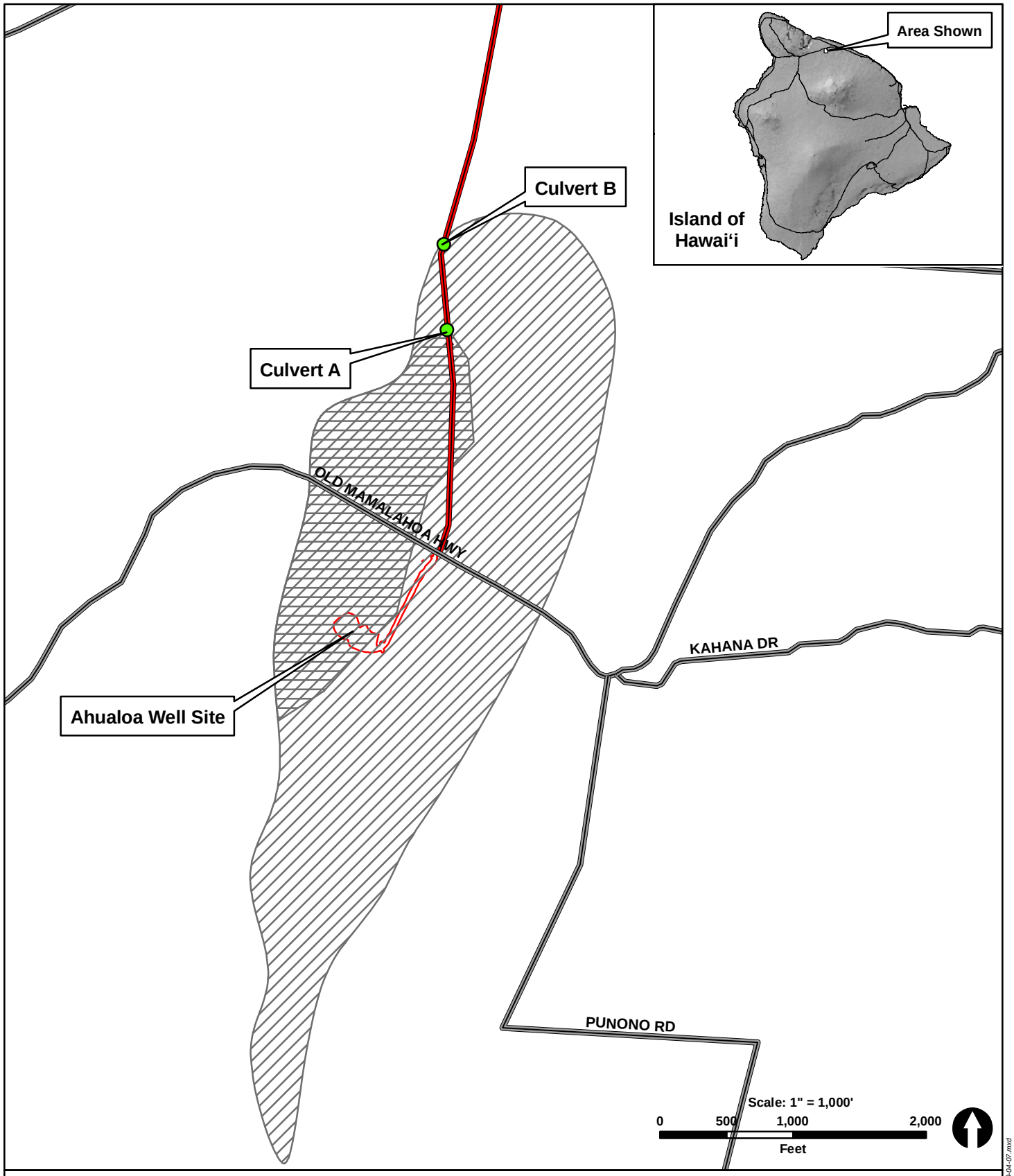
- Intermittant Streams
- Lower Hamakua Ditch
- Upper Hamakua Ditch

Figure 3.1:

Honokaia Gulch Watershed

HELCO Access Road for the Āhualoa Well Development

Figure 3-1 Honokaia Gulch Watershed 2010-04-02.mxd



Prepared For:
TNWRE

Prepared By:
PLANNING SOLUTIONS

Sources: -TNWRE
-Division of Aquatic Resources
-State of Hawaii GIS

Watershed Features:

Drains Into Culvert A & B

Drains Into Culvert B

Figure 3.2:

Drainage at Project Site Culverts

HELCO Access Road for the Āhualoa Well Development

Figure 3-2 Drainage at Project Site Culverts 2010-04-07.mxd

relatively small (~2.8 acres), construction will not cause significant impacts on surface water quality or groundwater resources.

3.2.2.2 Operational Phase

Construction of the proposed access road and electrical power line will increase the amount of impermeable surface on the project site and will, therefore, slightly increase the potential for storm water runoff. However, in compliance with NPDES requirements the project will include structural and vegetative stabilization measures that will minimize the effects of this new impermeable area. In addition, because the new impermeable area will be relatively small (~0.9 acres, see Table 2.1), and because the soil in the project area is highly permeable, the project will not have a substantial impact on the erosion from storm water runoff or on surface water quality. The project will not include the discharge of significant quantities of non-storm water pollutants or the subsurface injection of any wastewater. Thus, there will be no significant impacts on ground water resources.

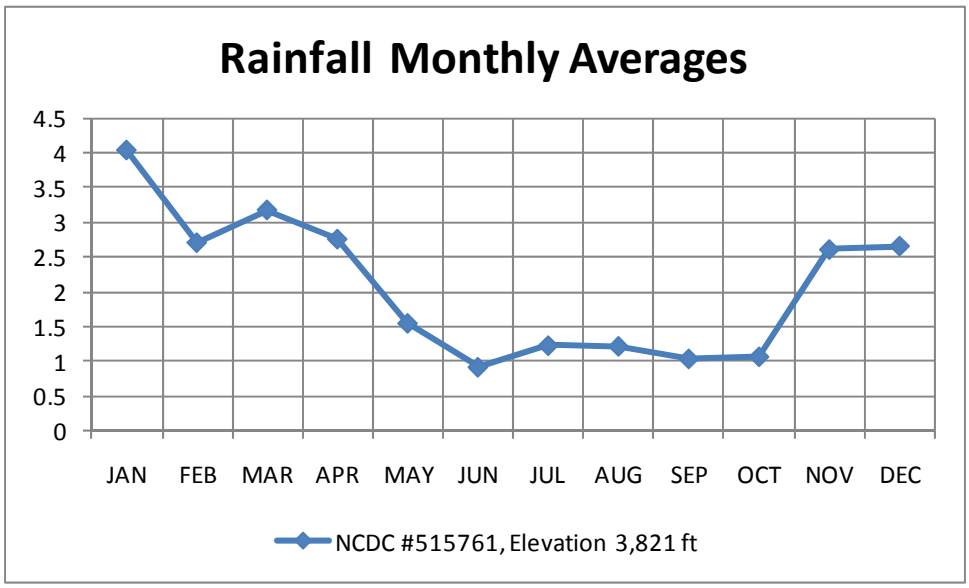
3.3 CLIMATE AND AIR QUALITY

3.3.1 EXISTING CONDITIONS

Air quality data from the Hawai‘i Department of Health’s Air Quality Branch show that the project site (and indeed the entire State of Hawai‘i) is well within air quality attainment standards for the state and the nation (DOH 2004). The occasional cars traveling along Old Māmalahoa Highway constitute the only source of anthropogenic air emissions near the project site. Sulfur dioxide concentrations occasionally spike due to “vog” (i.e., fog produced by active volcanoes), but none of the recorded levels at Hilo, which is much closer to the sources of volcanic emissions than the project site, exceeded State limits during 2004.

The National Climatic Data Center’s station at the Makahalau, situated 5.6 miles upslope to the southwest of the project site at an elevation of 3,821 feet, receives about 25 inches of rain per year. As seen in Figure 3.3, January is typically the wettest month and the months from June through October are the driest (NOAA 2002). The ten-year, one-hour rainfall maximum event is 2.5 inches (Dept. of Commerce 1962). Cloud drip is also an important source of moisture at these elevations in the Hāmākua District, where the proposed project site is located.

Figure 3.3 Average Monthly Rainfall Near Project Site



Source: NOAA (2002)

Temperatures in the area are moderate. In higher elevation areas such as the proposed project site, average daily low temperatures are typically 58-64 degrees Fahrenheit, and the average daily high temperatures are 76 to 80 degrees year round. It is unlikely that temperatures at the project site ever reach 90 degrees (NOAA 2002).

No site-specific wind data are available from the project location. However, prevailing wind maps for the island suggest that the proposed site is partially protected from the prevailing northeast trade winds. Wind direction at the site remains generally constant throughout the day, traveling upslope from the east-northeast at speeds of 0.5 to 1 meters per second (Juvik & Juvik 1998).

3.3.2 PROBABLE IMPACTS

3.3.2.1 Construction Phase

Construction of the proposed access road will require grading and excavation, which have the potential to generate fugitive dust; installation of the poles and conductors for the power line involves little work that could generate fugitive dust. The project site's moist climate and relative protection from strong trade winds reduce the potential for airborne dust during construction. Potential adverse effects will be further minimized by the dust control measures the contractor will implement in accordance with Hawai‘i Administrative Rules Title 11, Chapter 59 and Chapter 60.

The operation of internal combustion engines that power the construction equipment will add small amounts of pollutants to the atmosphere during the few months that site-work is underway. The amounts are small, however, and do not have the potential to affect the local or regional air quality substantially. As discussed in Section 3.2.2, the construction impacts on storm water runoff will be minimized through implementation of BMPs.

3.3.2.2 Operational Phase

Normal operation of the proposed project will not produce on-site air emissions. The increase in impermeable surface will slightly modify the storm water runoff patterns in the immediate vicinity of the access road, but due to the structural BMPS that are included in the project, these modifications do not have the potential to lead to significantly increased levels of erosion or surface runoff in the general area.

3.4 HAZARDOUS MATERIALS

No structures exist on or near the site, and its long-term use as pastureland has not required application of fertilizers or other chemicals. Hence, no hazardous materials are believed to be present. Uncontrolled releases of oil products or other potentially hazardous materials will be prevented in the construction operation through the implementation of BMPs required for NPDES permit coverage. HELCO operates and maintains its power system maintenance vehicles in a way that minimizes the potential for petroleum product releases or other releases of hazardous materials. Thus, the construction and operation of the access road and power line does not have the potential to release significant amounts of hazardous materials.

3.5 TERRESTRIAL FLORA AND FAUNA

3.5.1 EXISTING CONDITIONS

A biologist from Rana Productions, Ltd. conducted a survey of botanical and faunal resources along the 4,240-foot long access roadway and power line corridor on October 9 and 10, 2009 (see Appendix A for report). A total of 40 species of plants were recorded on the site. Two species, *hapu`u* (*Cibotium chamissoi*), and *‘ōhia* (*Metrosideros polymorpha*), are endemic to the Hawaiian Islands and three others, *uluhe* (*Dicranopteris linearis*), *pala‘ā* (*Sphenomerus chinensis*) and manyspike flatsedge (*Cyperus polystachyos*) are indigenous. The remaining 35 species recorded are all

considered to be alien, naturalized species. No species currently listed, or proposed for listing under either the federal or State of Hawai‘i endangered species statutes was recorded on the site.

During the course of the avian survey, the biologist recorded 34 individual birds of eight separate species representing eight families. All eight species detected are considered to be alien to the Hawaiian Islands. No species currently proposed or listed under either the state of Hawai‘i or the federal endangered species statutes was detected during the time spent on the subject property.

Avian diversity and densities recorded were low, though in line with what one would expect in an active cattle pasture in the Hāmākua District. Sky Larks (*Alauda arvensis*), was the most frequently detected avian species and accounted for slightly more than 28 percent of the total number of birds recorded.

Four mammalian species were detected during the course of this survey. Several cows (*Bos taurus*) were seen in adjoining pastures, as were several horses (*Equus c. caballus*). Dogs (*Canis f. familiaris*) were heard barking from areas outside of the study site. Additionally, track, sign and scat of cows, horses and pigs (*Sus s. scrofa*) were encountered within the study site. The skeletal remains of one Small Indian mongoose (*Herpestes a. auropunctatus*) was found in a cavity on the rocky edge of ‘Ino‘ino Gulch, and skeletal remains of at least two cows were also encountered within the study area.

3.5.2 Probable Impacts

Although not recorded during the survey, the Hawaiian Hawk (*Buteo solitarius*) or *‘io*, which is listed as an endangered species under both federal and state of Hawai‘i endangered species statutes, may be present at the project site. It is possible that the endangered Hawaiian Hawk forages over the pasture through which the proposed access road and power line corridor runs. This species is relatively common within the general Hāmākua area (Klavitter 2000, David 2009). It is not expected that the proposed development will result in deleterious impacts to Hawaiian Hawks. This opinion reflects the fact that the trees that may be cleared within the proposed corridor are not suitable nest trees for Hawaiian Hawks. Individual foraging hawks may be temporarily disturbed by construction activity. Such potential disturbance to foraging Hawaiian Hawks is not likely to be significant, as there are miles of suitable foraging habitat surrounding the very small project site.

The survey report notes that the vegetation on the project site are potentially suitable roosting habitat for the Hawaiian Hoary bat (*Lasiurus cinereus semotus*), which is listed as an endangered species under both federal and state of Hawai‘i endangered species statutes. It concluded that while no bats were observed during the course of the survey, the possibility exists that bats may occasionally be present in the general project area. Hawaiian hoary bats are seen in the general project area on a seasonal basis (David 2009). The clearing and grubbing phases of construction may temporarily displace individual bats. At the same time, the report noted that as bats use multiple roosts within their home territories, the significance of such displacement is likely to be minimal because in most instances the bats will simply relocate to one of the other trees in the neighborhood.

The one situation when some potential for adverse impacts exists is if vegetation used as roosts are disturbed during the pupping season. There are two reasons for this. First, Hawaiian hoary bats are thought to be less able to vacate a roost tree rapidly during the pupping season when adult females are caring for their pups; in such instances it is conceivable that the bat would not leave the tree quickly enough to avoid harm if tree removal began while the parent was present. Second, if tree removal were to begin during the brief periods when parents may leave their pups alone, it is possible that the young could be inadvertently harmed. All chance of harming bats can be avoided by not clearing woody vegetation taller than 15 feet during the pupping season, between April 15 and August 15.

The plants that are present in the affected area are primarily introduced and invasive species. DWS will take appropriate preventative measures as recommended in the report to avoid impacting the Hawaiian hoary bat by prohibiting vegetation clearing between April 15 and August 15. As a result, the proposed action is not expected to have any substantial direct impacts on flora or fauna.

3.6 NOISE

3.6.1 EXISTING CONDITIONS

Table 3.1 summarizes quantitative measurements taken on the power line/access road route next to Māmalahoa Highway and, for comparison, the previous measurements made on the Āhualoa production well site. The higher levels observed near Māmalahoa Highway reflect the relatively higher frequency of passing vehicles on this road, compared with those that normally occur on the Old Māmalahoa Highway.[6] Other sources of sound included birds and the rustling of wind through trees and other vegetation in the area.

3.6.2 PROBABLE IMPACTS

3.6.2.1 Construction Phase

Occasional operation of diesel-powered equipment will occur on the site during the 4-month construction period. Noise from the loudest un-muffled equipment of this sort can be as high as 80 to 85 dBA measured at a distance of 50 feet. The nearest noise-sensitive site, a residence, is approximately 1/2 mile from closest point along the proposed roadway routs; natural noise attenuation will reduce peak construction noise levels to just over 50 dBA by the time it reaches that home. Noise levels on other, more distant properties would be lower. This noise would be present only for a short time during daytime hours.

Hawai‘i Administrative Rules (HAR) §11-46 defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to (i) stationary noise sources and (ii) equipment related to agricultural, construction, and industrial activities. These are reproduced in Table 3.2. The noise limit for “Class C Districts” [which §11-46-3(3) defines as “...all areas equivalent to lands zoned agriculture, country, industrial, or similar type.”] is 70 dBA at any time. The limits are applicable at the property line.

Because construction noise will be below 70 dBA at the property line of the nearest residence, no noise permit will be needed for the construction work.

3.6.2.2 Operational Phase

Once construction is completed, the proposed improvements themselves will not be a source of noise. Hence, the only source of post-construction noise will be the insignificant low levels of buzzing or vibrations emitted from the power lines.

3.7 ARCHAEOLOGICAL, HISTORIC AND CULTURAL FEATURES

3.7.1 EXISTING CONDITIONS

Rechtman Consulting, LLC conducted a visual inspection of the entire proposed access road and power line corridor on October 9, 2009. His report is included as Appendix B. Based on 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, he concludes that the archaeological expectations for the current study are limited. It is remotely possible that Pre-contact sites, including trails, temporary habitations, gardens, or resource procurement areas may have been present within the current project area. However, the extensive land use for cattle ranching throughout the late nineteenth and twentieth centuries has significantly altered the landscape. Ranching related features in the project area may include boundary markers, walls, roads, fences or enclosures.

[6] As the measurements were made during the daytime, when traffic on the roadway tends to be higher, average sound levels at this location are believed to be lower than those shown in the table.

Table 3.1 Baseline Sound Levels in dBA at Āhualoa Well Access Roadway and Corridor

Station Description	***Baseline Sound Levels in dBA[1]***		
	Leq[2]	***MaxP[3]***	***MaxL[5]***
Āhualoa Production Well Site (9/22/05)	47.8	98.8	53.3
Access Road Near Old Māmalahoa Hwy. (10/9/09)	69.5	107.8	91.0

[1]A person's ability to hear a sound depends greatly on its frequency. Young, healthy people can hear frequencies as low as about 20 Hertz (Hz) and as high as about 20,000 Hz (one hertz is equivalent to one wave per second, or cycle, per second). People hear sounds best when the predominant sound energy is between 1,000 and 6,000 Hz. To measure sound on a scale that reflects the way people perceive it, more weight must be given to the frequencies that people hear more easily. The U.S. EPA recommends the A-weighting scale for environmental noise because it is convenient to use, accurate for most purposes, and is used extensively throughout the world.

[2] Equivalent Sound Level (Leq). This variable is the root-mean square (RMS) average of the time-varying sound energy measured during the 10-minute measurement interval. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns.

[3] Maximum Sound Level (Lmax). This is the maximum sound level (1-second integrated value) recorded during the measurement interval.

[4] Maximum Peak Level (MaxP). This is the instantaneous maximum sound level measured during the measurement interval.

Source: Planning Solutions, Inc. Sound levels were recorded continuously over a ten-minute period using a Brüel & Kjær Type 2239A Integrating meter. The meter was set to integrate data every second using the A-weighting scheme.

No archaeological resources of any kind were observed on the surface during the course of Rechtman's survey of the project area, and he concluded that the likelihood of encountering subsurface archaeological resources is extremely remote given the geology of the area and the history of ranching on the parcels. Also, with the exception of a few easily avoidable *'ōhi'a lehua* trees, there were no resources (landforms, vegetation, etc.) of a traditional cultural nature observed within the project area.

Likewise, consultation with knowledgeable community members revealed no information regarding significant cultural places or practices which may have occurred within the current project area. Between November 23–25, 2009 phone interviews were conducted with five individuals from the Honokaia 'Ohana group. Those interviewed included Allison Mayeda, Allen H.N. Lindsey, Dolores Ramos, Angela Thomas, and Diana Terukina. These individuals were contacted for possible information regarding any significant past and/or present cultural practices or places within the current project area. Of those interviewed, both Allen Lindsey and Dolores Ramos recall the current project area as being pasture lands as long as they could remember.

On, November 30 2009, a phone interview was conducted with Yvonne L.K. Deluz and her husband Jacinth Deluz, Jr. Jacinth grew up in Ahualoa during the 1950s and as long has he remembers the current project area has been ranch land. Another phone interview was conducted on November 30 2009, with Corky Bryant, who is the livestock manager for Parker Ranch (including the cattle in the pasture in the current project area). Mr. Byrant also recalls the current study parcel as being ranch land.

Table 3.2 Maximum Permissible Sounds Levels in dBA (HAR §11-46).

Zoning Districts	*Daytime (7 a.m. to 10 p.m.)*	*Nighttime (10 p.m. to 7a.m.)*
Class A	55	45
Class B	60	50
Class C	70	70

Notes:

(a) The maximum permissible sound levels apply to any excessive noise source emanating within the specified zoning district, and at any point at or beyond (past) the property line.

(b) Noise levels may not exceed the maximum permissible sound levels for more than ten per cent of the time within any twenty minute period, except by permit or variance issued under sections 11-46-7 and 11-46-8.

(c) For mixed zoning districts, the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level.

(d) Measurements values are for "A" weighting network and "slow" meter response unless otherwise stated. Sound level meters and calibrators must conform to American National Standard, ANSI S1.4-1983, specifications. The maximum permissible sound level for impulsive noise is ten dBA above the maximum permissible sound levels shown and is measured using the "Fast" meter response.

(e) The limits do not apply to the operation of emergency generators, provided the best available control technology is implemented.

(f) For the purpose of the regulations, the following definitions apply:

"*Construction activities*" means any or all activities, including but not limited to those activities necessary or incidental to the erection, demolition, assembling, renovating, installing, or equipping of buildings, public or private highways, roadways, premises, and parks.

"*Construction equipment*" means any device designed and intended for use in construction, including but not limited to any air compressor, pile driver, bulldozer, pneumatic hammer, steam shovel, derrick, crane, tractor, grader, loader, power saw, pump, pneumatic drill, compactor, on-site vehicle, and power hand tool.

"*Construction site*" means any or all areas, necessary or incidental for the purpose of conducting construction activities.

(g) Class A zoning districts include all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.

Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.

Class C zoning districts include all areas equivalent to lands zoned agriculture, country, industrial, or similar type.

Source: Hawaii Administrative Rules, Title 11, Chapter 46, Community Noise Control

The other individuals interviewed had no information regarding significant cultural places or practices which may have occurred within the current project area.

3.7.2 PROBABLE IMPACTS

Given the findings of his site survey and consultation with knowledgeable community members, Rechtman concluded that development of the proposed project will not significantly impact any known historic properties or any cultural resources and practices of a traditional and customary nature.

3.8 NATURAL HAZARD VOLCANIC AND SEISMIC HAZARDS

3.8.1 RISK FROM LAVA FLOWS

There are no Hawaiian traditions documenting eruptions of Mauna Kea, and it probably has not been active during the last 2,000 years. Occasional earthquakes originate beneath it, emphasizing the possibility that it may someday erupt again (Macdonald et al. 1983).

The U.S. Geological Survey has divided the island into zones based on the probability of coverage by future lava flows; Zone 1 represents the greatest hazard and Zone 9 the least. As shown in Figure 3.4, the proposed project site is in Zone 8, which signifies an area with a relatively low probability of lava flows (Juvik & Juvik 1998).

3.8.2 FLOOD AND TSUNAMI HAZARDS

The proposed project site is in an area designated as Zone X on the Flood Insurance Rate Map (FIRM) by the Federal Emergency Management Agency. Zone X signifies an area that has been determined to be outside the 500-year floodplain. The site is not located within a designated Flood Hazard Safety Area (FHSA). Virtually no overland flow enters the site from surrounding areas.

3.9 SCENIC AND AESTHETIC RESOURCES

3.9.1 EXISTING CONDITIONS

As discussed above and shown in Figure 2.3, the project site currently consists mostly of open pastureland with occasional stands of trees.

3.9.2 PROBABLE IMPACTS

The completed road and power line will be visible from passing traffic along the Old Māmalahoa Highway, but will not be visible from any nearby residences. No special views or scenic resources will be affected. Thus, the impact on scenic and aesthetic resources will be a minor degradation of the currently rural landscape in the immediate vicinity of the project site.

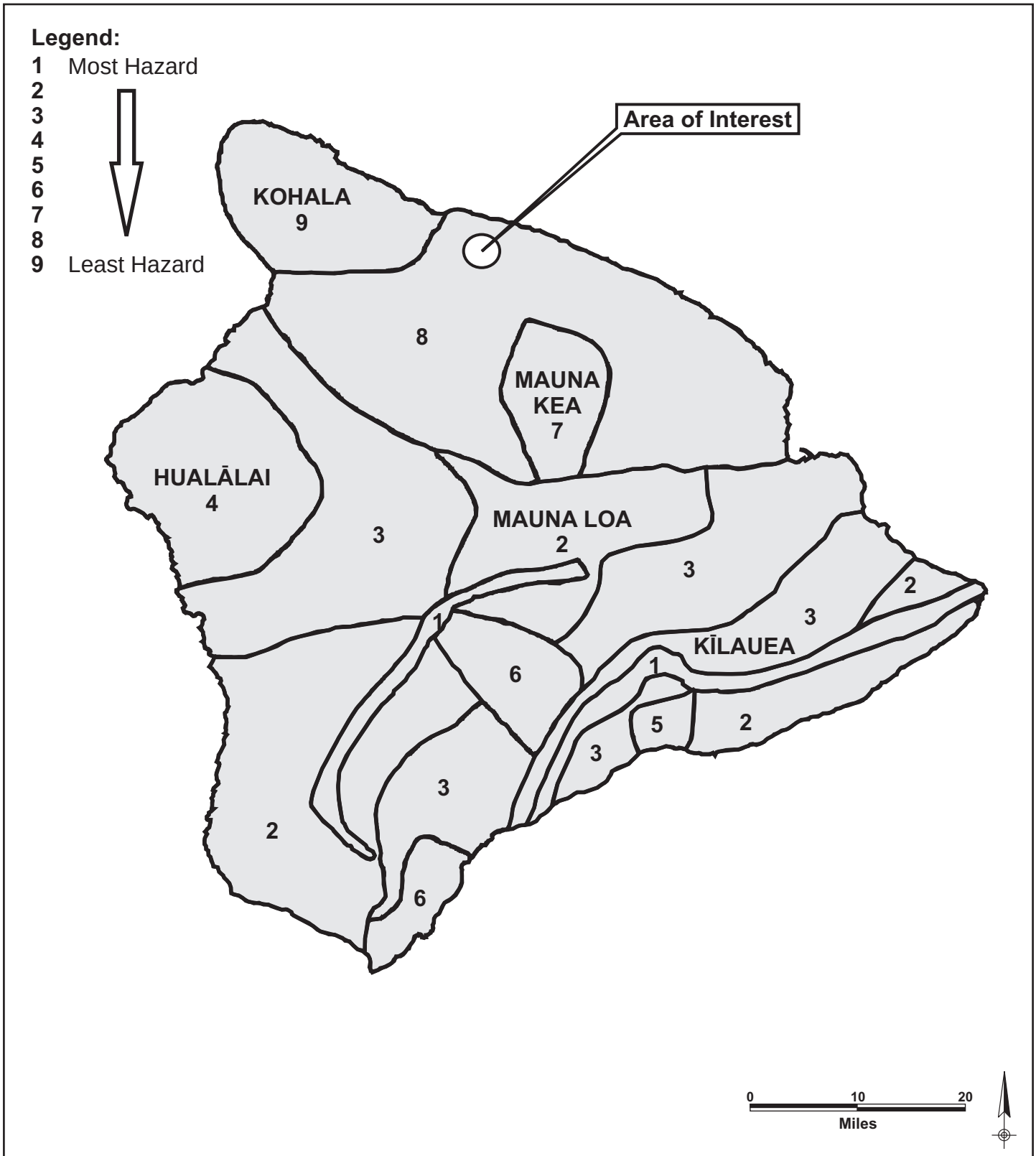
3.10 TRANSPORTATION

3.10.1 EXISTING CONDITIONS

Access to the site is via Old Māmalahoa Highway, a two-lane paved road that was formerly the main road between Honoka‘a and Waimea. With the construction of the main Māmalahoa Highway, the Old Highway has experienced less use and is primarily used by residents living along it and heavy trucks traveling to and from an active quarry west of the project site; most through traffic uses the main highway.

3.10.2 PROBABLE IMPACTS

Construction Period. Construction vehicles have previously used the road in order to construct homes and DWS facilities located there without difficulty. Trucks and passenger cars will bring workers, equipment, and building materials to the site, slightly increasing traffic on Old Māmalahoa Highway. The number will be small, generally less than 10 to 20 vehicle-trips per day; that, together with the very low existing traffic volumes means that roadway capacity will be more than adequate to accommodate these movements. Heavy trucks may occasionally slow other vehicles traveling in the



Prepared For:
County of Hawai'i
Department of Water Supply

Prepared By:
PLANNING SOLUTIONS

Source:
--Dept. of Interior USGS
--County of Hawai'i Office of Planning

Note: The island of Hawaii is divided into zones according to the degree of hazard from lava flows. Zone 1 is the area of the greatest hazard, Zone 9 of the least.

Figure 3.4:

Island of Hawai'i Lava Hazard Zones

HELCO Access Road for the Âhualoa Well Development

Figure 3-4 Lava Hazard Zones 2010-03-25.cdr

same direction, and there is limited room in some areas for vehicles traveling in opposite directions to pass one another. Consequently, the construction traffic will increase the required travel time. However, the short distance over which this will occur, the small number of vehicles that will be affected, and the limited duration of the construction work mean that the impact will be small. Site construction does not entail work in the existing road right-of-way, eliminating that as a potential source of adverse effects.

Operational Period. The proposed project will not require manned operation, but only occasional monitoring and maintenance for the power line. Service vehicles will park along the proposed access road and will not interfere with traffic. Consequently, the proposed project will have virtually no effect on traffic in the area.

3.11 LAND USE, SOCIOECONOMIC AND CULTURAL ENVIRONMENT

3.11.1 EXISTING CONDITIONS

As noted above, the site is all pastureland. The surrounding land is government owned and is presently used for cattle grazing. The nearest dwelling is more than 2,500 feet to the east of the proposed project site. There are no other commercial or industrial activities in the immediate area.

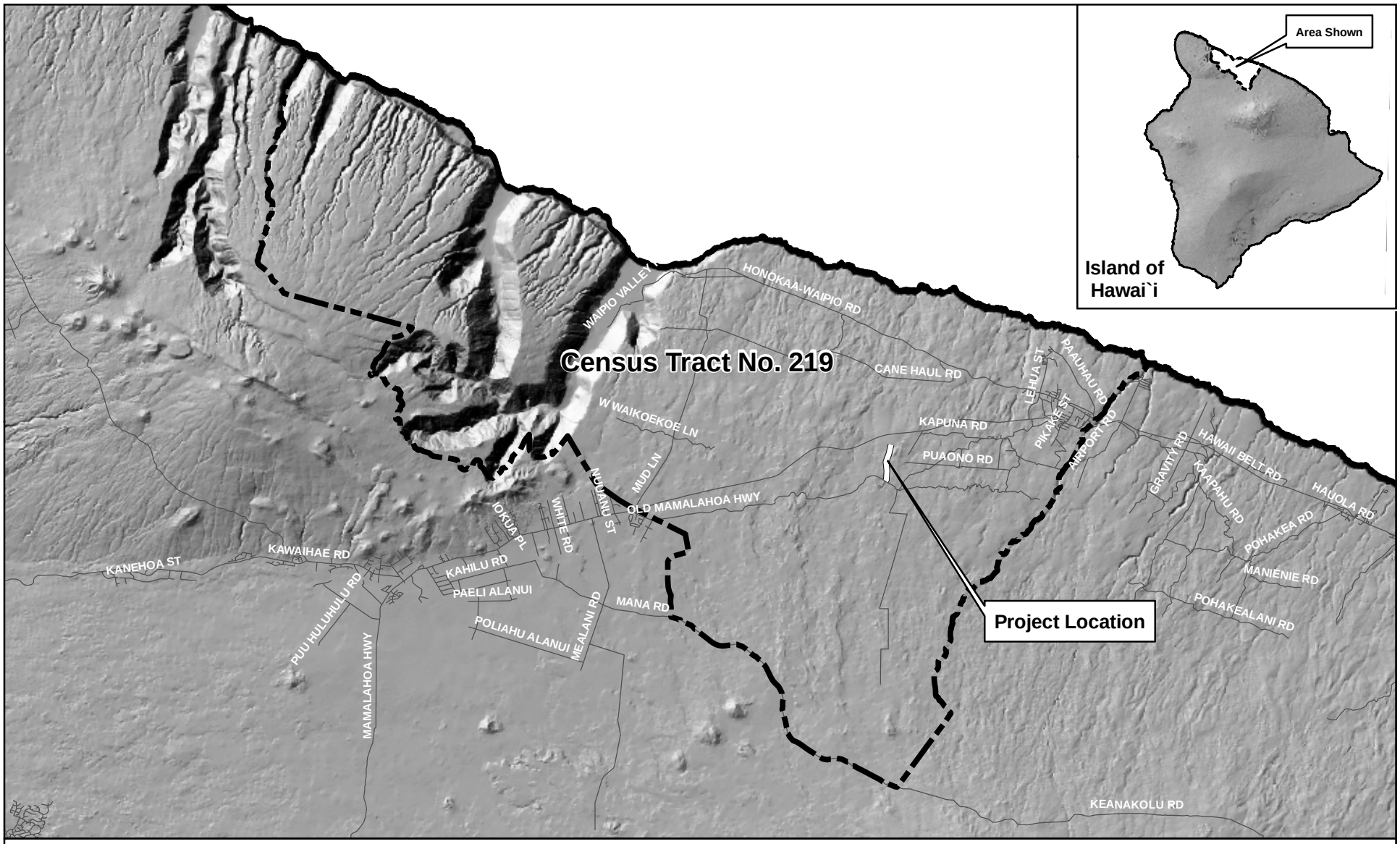
The proposed project is contained within Census Tract 219, which includes Honoka‘a town and Āhualoa Homesteads (see Figure 3.5). The 2000 population of Census Tract 219 was 3,895 people. These constituted 1,316 households. The area reported a median household income of $40,086 in 2000, which is a bit lower than the statewide median household income in 2000, which was $49,820. Unemployment in that year was at 6.6 percent of the civilian labor force, which was comparable to the statewide average of 6.3 percent. The average commuting time of working residents was 32 minutes each way, suggesting that some probably commute to Hilo for work. Educational attainment in the project area was comparable to the State average in 2000, with approximately 18 percent of residents in Census Tract 219 holding at least a bachelor’s degree compared to 17.8 percent of state residents.

More than 30 percent of employed residents were working in the “Arts, entertainment, recreation, accommodation and food services” sector, and another 11 percent were in retail, which is a reflection of the Hāmākua Coast’s value as a tourist destination. About 6 percent of the working population was employed in agriculture and another 6 percent in construction. As noted above, the area is experiencing moderate growth, some of which has come about in the form of existing property owners subdividing their larger agricultural parcels for residential use.

3.11.2 PROBABLE IMPACTS

As noted above, the site is currently used as pasture for cattle. Thus, the proposed project represents a new use of the land. However, it is a use that is not incompatible with the surrounding rural landscape. Other DWS facilities already exist a short distance down the road. As discussed in other sections, the project will not create significant visual impacts, traffic, or noise, and is well away from sensitive land uses. The project will also not affect recreational activities in the area.

The proposed access road and power line will make it possible for DWS to supply needed power to the Āhualoa Production Well. This will allow the Department to meet current system demands and provide a reliable backup source for the Haina Well and the planned Honoka‘a Well. It will also provide potable water to accommodate the population growth that is anticipated to occur in the area. Aside from the temporary construction employment and expenditures that it would create, the project will not in and of itself stimulate or otherwise promote population growth or economic activity.



Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

-State of Hawaii GIS

Legend:

Census Tract Boundary

Roadways

0 1.25 2.5 5

Miles

Figure 3.5:

Census Tract No. 219

HELCO Access Road for the Āhualoa Well Development

Figure 3-5 Census Tract No 219 2010-04-07.mxd

4.0 RELATIONSHIPS TO RELEVANT PLANS, POLICIES & CONTROLS

4.1 STATE AND COUNTY REGULATIONS

4.1.1 COUNTY OF HAWAIʻI GENERAL PLAN

4.1.1.1 Applicable Goals, Policies, and Recommended Actions

The Department of Water Supply operates and maintains twenty-three separate water systems in the County of Hawaiʻi, including the ones in the Honokaʻa and Āhualoa-Hāmākua areas. As discussed in Section 1.3, DWS has a policy of shifting potable water systems from surface water sources to groundwater sources. One of the reasons for this is the high costs associated with treating surface water sources such as the Kohākōhau Stream. The County of Hawaiʻi acknowledged these costs in the Revised General Plan of 2001:

> *Surface water or a groundwater source under the influence of surface water is required to be treated and quality monitored to ensure compliance with the SDWA [Safe Drinking Water Act], whereas groundwater need only be chlorinated. As such, the maintenance of surface water systems are much more expensive and labor intensive.*

The General Plan further notes that:

> *Surface water flows depend on weather conditions. During extremely dry weather conditions, the flow may drop below the required rate. During high rainfall periods the water may be turbid.*

The 2001 Draft Revision to the *Hawaiʻi County General Plan* contains goals and policies concerning the development and operation of essential water supply facilities. The General Plan recognizes that water supply facilities are needed to support the patterns of development that the General Plan seeks to achieve. It makes planning for the location of utility facilities such as wells, reservoirs, and pumping stations an integral part of the land planning process.

The *Draft 2001 General Plan* makes it the goal of the County to address the following water supply issues:

- Ensure that properly regulated, adequate, efficient and dependable public and private utility services are available to users.
- Maximize efficiency and economy in the provision of public utility services.
- Design public utility facilities that fit into their surroundings or are concealed from public view.

To achieve those goals, the *2001 Draft General Plan* makes it County policy to:

- Design public utility facilities so that they complement adjacent land uses and operate them so as to minimize pollution or disturbance.
- Encourage the use of properties or easements owned by public or private utility companies or agencies as supplemental open space and recreational areas.
- Provide utilities and service facilities that minimize total cost to the public and effectively service the needs of the community.
- Design utility facilities to minimize conflict with the natural environment and natural resources.
- Improve existing utility services to meet the needs of users.
- Develop capital improvement programs and plans for public utilities that are consistent with the General Plan.

- Correlate water system improvements with the County's desired land use development pattern.
- Design and build all water systems to Department of Water Supply standards.
- Improve and replace inadequate systems.
- Adequately protect water sources to prevent depletion and contamination from natural and manmade occurrences or events.
- Install water system improvements first in areas that have established needs and characteristics, such as occupied dwellings, agricultural operations and other uses, or in areas adjacent to them if there is need for urban expansion.
- Develop a coordinated effort by County, State and private interests to identify sources of additional water supply and implement it to ensure the development of sufficient quantities of water for existing and future needs of high growth areas and agricultural production.
- Promote the use of ground water sources to meet State Department of Health water quality standards.
- Seek State and Federal funds to assist in financing projects to bring the County into compliance with the Safe Drinking Water Act.

The *Draft 2001 Hawai‘i County General Plan* identifies a number of actions to implement these policies in the Hāmākua District. Several of these are relevant to the proposed project that will directly affect the operation of the Āhualoa Production Well and Reservoir that is currently under construction. Specifically, it directs DWS to:

- Improve existing storage, transmission, and distribution facilities.
- Replace old, sub-standard, or deteriorating lines and storage facilities.
- Investigate groundwater sources in the Honoka‘a and Kukuihaele areas.

4.1.1.2 Conformance with the 2005 *Hawai‘i County General Plan*

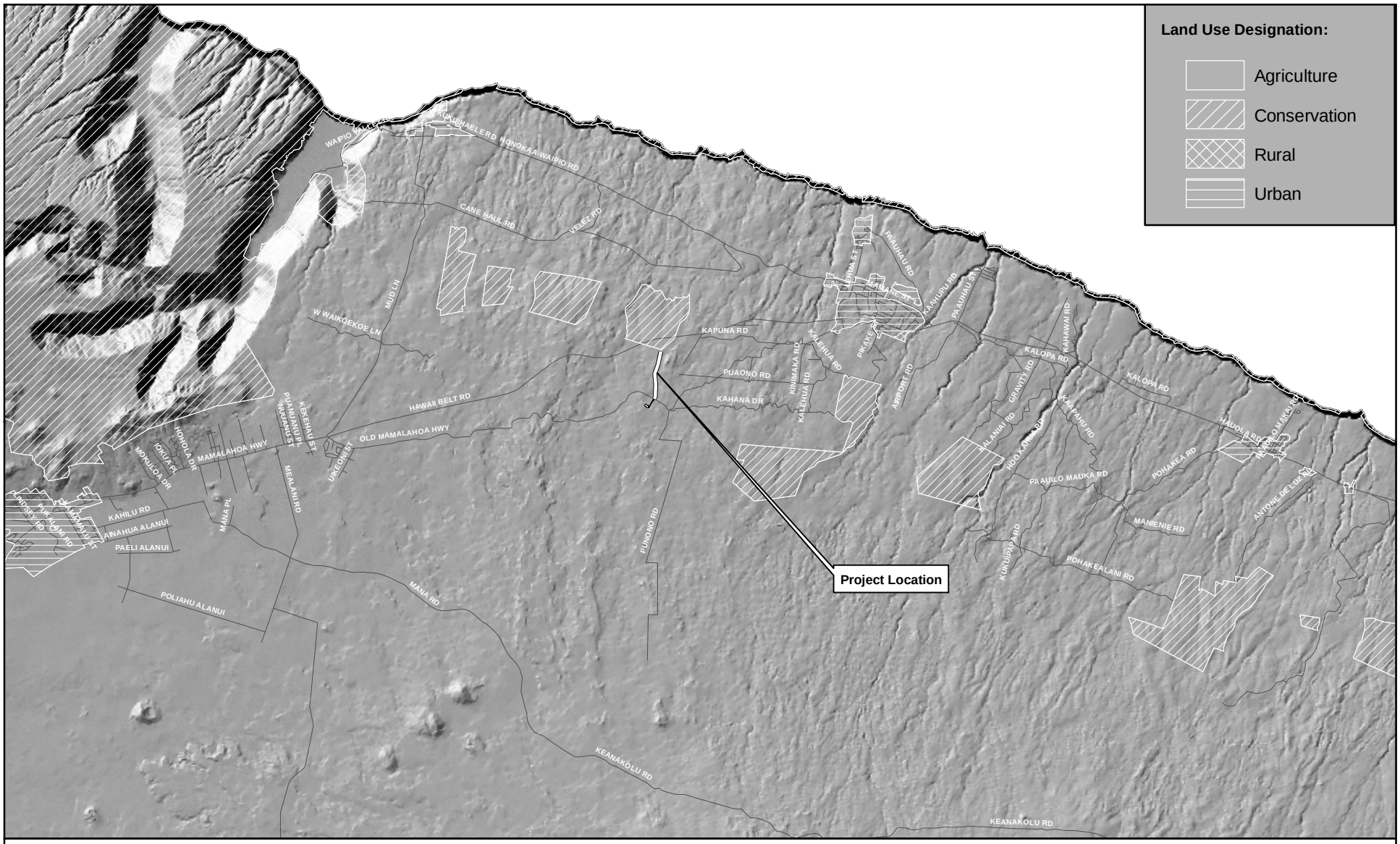
The proposed HELCO Access Road for the Āhualoa Well Development is consistent with the General Plan’s policies of encouraging the use of ground water sources in order to facilitate compliance with DOH standards and seeking Federal funding in support of this objective. The proposed project will provide the electrical power needed to operate the Āhualoa Production Well and Reservoir currently under construction. Moreover, the well, reservoir, and related facilities are compatible with surrounding land uses and compliant with all applicable design standards. As discussed in Chapter 4, the proposed project is not expected to adversely affect the physical or social environment, and its location upland of the areas it is intended to serve will facilitate the efficient delivery of clean groundwater. In sum, it will allow DWS to continue to meet the needs of the people of the Hāmākua District in a safe and cost-effective manner while complying with all applicable requirements for potable water sources.

4.1.2 COUNTY OF HAWAI‘I ZONING ORDINANCE

The County zoning of the parcels containing the proposed access road and electrical power line is Agriculture with a minimum site size of 40 acres (Ag-40a). Section 25-4-11 of the County of Hawai‘i Zoning Code states that “any substation used by a public utility for the purpose of furnishing telephone, gas, electricity, water, radio, or television” and “public uses, structures and buildings” are permitted uses within any district, provided that a plan approval is obtained. The proposed project is a public utility structure, and thus is considered a permitted use in the Ag-40a District. DWS will submit an Application for Plan Approval to the County Department of Planning to obtain the necessary director’s approval for the project.

4.1.3 STATE OF HAWAIʻI LAND USE LAW

The site is in the State Agriculture District as seen in Figure 4.1. HRS Chapter 205 §205-4.5 (7) lists public utility facilities such as those that are proposed as permissible uses within the State Agricultural District.



Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

-State of Hawaii GIS

Legend:

Roadways

0 1 2 4

Miles

Figure 4.1:

State Land Use Districts

HELCO Access Road for the Āhualoa Well Development

Figure 4-1 State Land Use Districts 2010-04-01.mxd

5.0 ANTICIPATED DETERMINATION

5.1 SIGNIFICANCE CRITERIA

Hawaii Administrative Rule §11-200-11.2 establishes procedures for determining if an environmental impact statement (EIS) should be prepared or if a finding of no significant impact is warranted. §11-200-11.2 (1) provides that proposing agencies should issue an environmental impact statement preparation notice (EISPN) for actions that it determines may have a significant effect on the environment. Hawaii Administrative Rules §11-200-12 lists the following criteria to be used in making that determination:

In most instances, an action shall be determined to have a significant effect on the environment if it:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*
2. *Curtails the range of beneficial uses of the environment;*
3. *Conflicts with the State's long-term environmental policies or goals as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;*
4. *Substantially affects the economic or social welfare of the community or State;*
5. *Substantially affects public health;*
6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*
7. *Involves a substantial degradation of environmental quality;*
8. *Is individually limited but cumulatively has considerable effect on the environment or involves a commitment for larger actions;*
9. *Substantially affects a rare, threatened, or endangered species, or its habitat;*
10. *Detrimentally affects air or water quality or ambient noise levels;*
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;*
12. *Substantially affects scenic vistas and viewplanes identified in county or state plans or studies; or,*
13. *Requires substantial energy consumption.*

5.2 FINDINGS

The potential effects of constructing and operating the proposed HELCO Access Road for the Āhualoa Well Development described earlier in this document were evaluated using these significance criteria. The findings with respect to these criteria are summarized in subsections 5.2.1 through 5.2.13.

5.2.1 IRREVOCABLE LOSS OR DESTRUCTION OF VALUABLE RESOURCE

The proposed project would be constructed on pastureland that is under State jurisdiction. It does not involve the loss of any significant cultural or natural resources.

5.2.2 CURTAILS BENEFICIAL USES

Construction and operation of the proposed project will not curtail beneficial uses of the site. The development will remove a very small portion of the existing pastureland from use for cattle grazing, but will not substantially affect the current usage of the property.

5.2.3 CONFLICTS WITH LONG-TERM ENVIRONMENTAL POLICIES OR GOALS

The proposed project is consistent with the County of Hawai‘i’s General Plan (see Section 4.1) and with the State’s long-term environmental policies and goals as expressed in Chapter 344, Hawaii Revised statutes and elsewhere in State law.

5.2.4 SUBSTANTIALLY AFFECTS ECONOMIC OR SOCIAL WELFARE

The proposed project is intended to provide enough electrical power to the Āhualoa Production Well and Reservoir currently under construction. This action would ensure the continuing supply of water to existing residents of the Hāmākua District. It will not have a substantial adverse effect on economic or social welfare except insofar as it allows DWS to assure its customers that they are receiving the best quality water at the lowest cost, consistent with the maintenance of environmental quality.

5.2.5 PUBLIC HEALTH EFFECTS

The proposed project will not adversely affect air or water quality. Neither will it generate solid waste or produce other emissions that will have a significant adverse effect on public health. Construction noise has the potential to exceed noise standards at the property line, but the potential adverse effects of this can be mitigated by the noise abatement and attenuation measures that the County will require of the construction contractor, if necessary.

5.2.6 PRODUCE SUBSTANTIAL SECONDARY IMPACTS

The proposed project will not produce significant secondary impacts. It is not designed to foster population growth or to promote economic development. Instead, it is intended to meet current potable water demands, allowing for moderate growth that is already projected.

5.2.7 SUBSTANTIALLY DEGRADE ENVIRONMENTAL QUALITY

The proposed project will not have substantial long-term environmental effects. Noise from construction activities is the only impact of note, and it will be of limited duration. So long as adequate measures are taken to control the intensity of the construction noise and the time of day during which it will occur, any effects on nearby residents can be managed.

5.2.8 CUMULATIVE EFFECTS OR COMMITMENT TO A LARGER ACTION

Development of the proposed project is not a commitment to a larger action and is not intended to facilitate substantial population growth. It will provide enough power to operate the Āhualoa Production Well and Reservoir, which is currently under construction. The Āhualoa Well will in turn be able to provide potable water to accommodate moderate growth for the area and will act as the required backup source for the Haina and Honoka‘a wells.

5.2.9 AFFECTS A RARE, THREATENED, OR ENDANGERED SPECIES

The proposed project will be constructed on active cattle pastureland that is primarily colonized by invasive species. It will not utilize a resource needed for the protection of rare, threatened, or endangered species.

5.2.10 AFFECTS AIR OR WATER QUALITY OR AMBIENT NOISE LEVELS

Construction and operation of the proposed project will not have a measurable effect on air or water quality. Neither will they have a long-term effect on noise levels. The project does have the potential to increase noise levels during the construction phase. Adequate mitigation measures will be taken if necessary to limit these to reasonable levels.

5.2.11 ENVIRONMENTALLY SENSITIVE AREAS

There are no environmentally sensitive areas or resources in the immediate vicinity of the proposed project. While the Island of Hawai‘i as a whole is subject to certain geologic hazards, such as earthquakes, tsunami, and lava flows, the project site is in an area that has a relatively low frequency of lava flows and is above the tsunami evacuation zone. All structures will be constructed consistent with the Hawai‘i Uniform Building Code for Earthquake Zone 4.

5.2.12 AFFECTS SCENIC VISTAS AND VIEWPLANES

The appearance of the proposed project will be similar in nature to the facilities already existing at the site. They will not significantly alter the visual character of the site or change views across it.

5.2.13 REQUIRES SUBSTANTIAL ENERGY CONSUMPTION

Energy supplied by the planned power line for operation of the Āhualoa Production Well & Reservoir will be more than offset by the energy currently used to deliver water to the service area using trucks. This will result in a substantial decrease in energy consumption for the delivery of water to the service area customers.

5.3 ANTICIPATED DETERMINATION

In view of the foregoing, the DWS concludes that the proposed project will not have a significant adverse impact on the environment. Consequently, it anticipates issuing a Finding of No Significant Impact for the proposed action.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

6.0 BIBLIOGRAPHY

CWRM (State of Hawai‘i Commission on Water Resource Management). 1995. Ground Water Hydrologic Units. In Water Data Section of CWRM web site. URL: http://www.state.hi.us/dlnr/cwrm/data/maps.htm

CWRM (State of Hawai‘i Commission on Water Resource Management). 2008. *Island of Hawai‘i, Hydrologic Units*. URL: http://hawaii.gov/dlnr/cwrm/mapsillustrations/gwhu_hawaii.pdf

County of Hawai‘i (2001) County Of Hawai‘i General Plan Revision. County of Hawai‘i Planning Department, December 21, 2001.

DAR (State Dept. of Land & Natural Resources, Division of Aquatic Resources) 2009. *Atlas of Hawaiian Watersheds & Their Aquatic Resources.* URL: http://www.hawaiiwatershedatlas.com/

David, R. E. (2009). Unpublished Field Notes – Island of Hawai‘i: 1985-2009.

−−−, (2009). *Biological Surveys Conducted Along the Proposed Āhualoa Well Power Line Access Roadway, Hāmākua District, Island of Hawai‘i.* Prepared by Reginald E. David, Rana Biological Consulting, Inc.

DBEDT (State of Hawai‘i Department of Business, Economic Development, and Tourism) (2004) 2004 Data Book. URL: http://www3.hawaii.gov/DBEDT/index.cfm?section=READ_Databook1075.

Department of Commerce (1962) *Rainfall Frequency Atlas of the Hawaiian Islands.* Technical Paper No. 48. U.S. Government Printing Office, Washington, D.C. 52 p.

DOH (State of Hawai‘i Department of Health) , (2005b). Facilities, Sites, or Areas in which HEER has an Interest. URL: http://www.state.hi.us/health/environmental/hazard/pdf/heersitelist.xls

−−−, (2004) 2004 Annual Summary: Hawai‘i Air Quality Data. http://www.hawaii.gov/health/environmental/air/cab/cabmaps/pdf/databook2004.pdf

−−−, (2000b) Classification of Hawaii State Waters. URL: http://www.state.hi.us/health/eh/cwb/wqmaps/wqstand.htm

EPA (Environmental Protection Agency). (2004). 2004 Edition of the Drinking Water Standards and Health Advisories. URL: http://www.epa.gov/waterscience/drinking/standards/dwstandards.pdf

Federal Register. (1999a). Department of the Interior, Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 – December 3, 1999

_____. (1999b). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Recycled Petitions, and Annual Description of Progress on Listing Actions. Federal Register, 64 No. 205 (Monday, October 25, 1999): 57534-57547.

_____. (2001). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Notice of Findings on Recycled Petitions. Federal Register, 66 No. 5 (Monday, January 8, 2001): 1295 – 1300.

_____. (2002). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidate or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Recycled Petition; Annual Description of Progress on Listing Actions. Federal Register, 67 No. 114 (Thursday, June 13, 2002): 40657-40679.

−−−, (2004). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing

as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 69 No. 86 (Tuesday, May 4, 2004): 24876-24904.

Juvik, S.P., J.O. Juvik, and T.R. Paradise. (1998). Atlas of Hawai‘i, Third Edition. University of Hawai‘i Press, Honolulu, 333 p.

Klavitter, J. L. 2000. Survey methodology, abundance, and demography of the endangered Hawaiian Hawk: Is de-listing Warranted? Unpublished Master of Science Thesis. University of Washington.

Macdonald, G.A., A.T. Abbott, and F.L. Peterson. (1983). Volcanoes in the Sea: The Geology of Hawai‘i. 2nd Edition. Honolulu: University Press, 517 p.

NOAA (National Oceanic and Atmospheric Administration) (2002) CLIMATOGRAPHY OF THE UNITED STATES NO. 81: Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling, Degree Days1971 - 2000 . 51 Hawai‘i. 21 p.

Planning Solutions, Inc. (2006). *Āhualoa Production Well & Reservoir Final Environmental Assessment & Finding of No Significant Impact.* Prepared for Department of Water Supply, County of Hawai‘i.

Sato, H.H., W. Ikeda, R. Paeth, R. Smythe, and M. Takehiro, Jr. (1973) Soil Survey of the Island of Hawaii, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service in cooperation with the University of Hawai‘i Agricultural Experiment Station.

State of Hawai‘i (2001) Hawaii Statewide GIS Program. Office of Planning, Department of Business, Economic Development and Tourism. URL: http://www.hawaii.gov/dbedt/gis/

USGS (United States Geological Survey) (1997). Volcanic and Seismic Hazards on the Island of Hawai‘i. Compiled by USGS Staff Kathie Watson. URL: http://pubs.usgs.gov/gip/hazards/earthquakes.html

USGS National Water Information System (2004). URL: http://nwis.waterdata.usgs.gov/hi/nwis/si

7.0 PARTIES CONSULTED

7.1 CONSULTATION

In the development of this Draft EA, DWS consulted with the State of Hawai‘i Department of Hawaiian Home Lands and the State Department of Land and Natural Resources.

7.2 DISTRIBUTION

Copies of this *Draft EA* are being mailed to the organizations specified in the office of Environmental Quality Control’s Distribution List for Draft EAs (see Table 7.1). Notice of the *Draft EA* will be printed in the *Environmental Notice* published by the State Office of Environmental Quality Control. The public will have 30 days from the publication date to comment on the proposed project in accordance with HRS Chapter 343.

Table 7.1 Preliminary Draft EA Distribution List

Federal Agencies	
Environmental Protection Agency, Pacific Islands Contact Office	District Engineer, U.S. Army Engineer District, Honolulu
U.S. Department of Agriculture, Natural Resources Conservation Service	U.S. Fish & Wildlife Service, Pacific Island Eco-Region
District Chief, Geological Survey, Department of the Interior	
State Agencies	
Office of Environmental Quality Control (4 copies)	Department of Health (3 copies)
Department of Agriculture	Department of Human Services
Dept of Accounting and General Services	Department of Labor and Industrial Relations
Department of Business and Economic Development & Tourism (DBEDT)	Department of Land and Natural Resources (5 copies)
DBEDT – Energy Division	DLNR Historic Preservation Division
DBEDT – Office of Planning	Department of Transportation
Department of Defense	Hawaii Housing Finance & Development Corporation
Department of Education	Office of Hawaiian Affairs
Department of Hawaiian Home Lands	UH Environmental Center
County of Hawai‘i	
Department of Environmental Management	Fire Department
Department of Parks and Recreation	Office of Housing and Community Development
Department of Public Works	Planning Department
Department of Research and Development	Police Department
Utilities	
Hawaiian Electric Light Company	Hawaiian Telcom
The Gas Company (Hilo)	
Libraries and Depositories	
Hawai‘i State Library Hawai‘i Documents Center	Hilo Public Library
University of Hawai‘i, Hilo Campus Library	Honoka‘a Public Library
Legislative Reference Bureau	
Neighbors	
Condo Master, Ahualoa Manor	Peter B. Sparks
Sadako Okunami	Kenneth Michael Emley
Gregory Carvalho	AK Kawela LLC
Source: Compiled by Planning Solutions, Inc.	

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX A BIOLOGICAL SURVEYS

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Biological Surveys Conducted Along the Proposed Āhualoa Well Power Line Access Roadway, Hāmākua District, Island of Hawai‘i.

Prepared by:

Reginald E. David
Rana Biological Consulting, Inc.
P.O. Box 1371
Kailua-Kona, Hawai‘i 96745

Prepared for:

Planning Solutions, Inc.
210 Ward Street
Suite 330, Ward Plaza
Honolulu, Hawaii 96814-4012

November 6, 2009

Table of Contents

Table of Contents 2
Introduction 3
General Project and Site Description 5
Botanical Survey Methods 6
Botanical Survey Result 6
Avian Survey Methods 8
Avian Survey Result 8
Mammalian Survey Methods 9
Mammalian Survey Results 9
Discussion 9
- *Botanical Resources* 9
- *Avian Resources* 10
- *Mammalian Resources* 11

Potential Impacts to Protected Species 12
- *Hawaiian Hawk* 12
- *Hawaiian Petrel and Newell's Shearwater* 12
- *Hawaiian Hoary Bat* 12

Conclusions 12
Recommendations 12
Glossary 13
Literature Cited 14

Figures & Tables

Figure 1. Site Plan 4
Figure 2. Āhualoa well, power line access road site, showing pastureland habitat present on the site 5

Table 1. Plants Recorded Along the Āhualoa Well Power Line Access Road Corridor 6
Table 2. Avian Species Detected Along the Āhualoa Well Power Line Access Road Corridor 8

Introduction

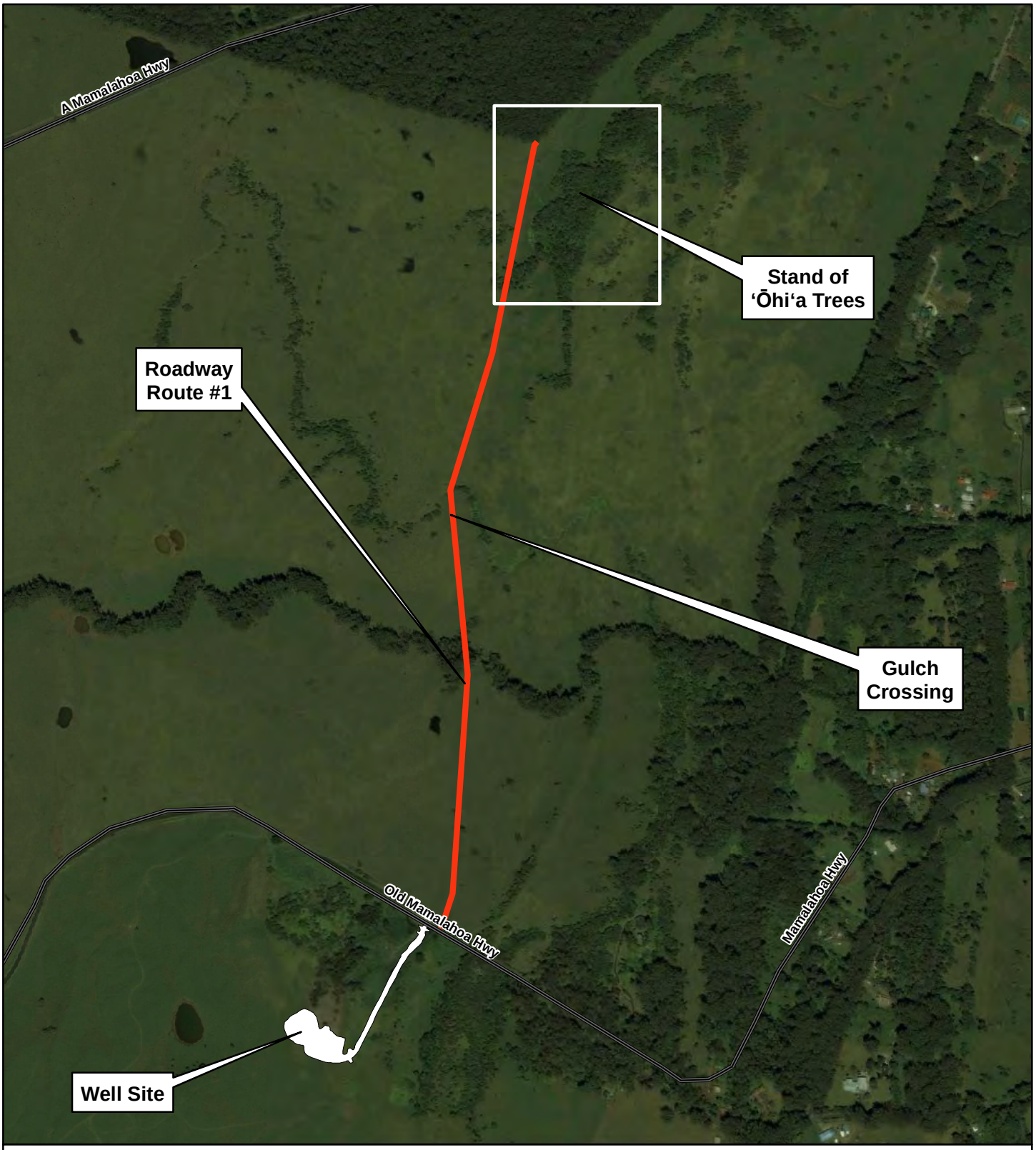
The County of Hawai‘i Department of Water Supply (DWS) proposes to construct an electrical distribution line and associated access road to service the proposed Āhualoa production well which will, when operational replace the present surface water source (Kohākōhau Stream) serving the Āhualoa/Hāmākua water area and will also supplement the potable water supply for the Honoka‘a area. Biological surveys were conducted on the well site in 2005 (David 2005).

To provide electrical power to this facility, DWS needs more power than is available from the existing transmission system that runs along the Old Māmalahoa Highway adjacent to the well site. DWS has determined that it is not practical to upgrade this existing system and that the most efficient way to provide the needed system capacity is to install a new overhead distribution power line to link with an existing Hawaiian Electric Light Company (HELCO) transmission system. The purpose of the proposed access road is to provide access for the installation and maintenance of this new power line. DWS will seek an easement of approximately 30-ft. width along the planned route (Figure 1).

This report summarizes the findings of the botanical, avian and mammalian surveys that were conducted on the project site on October 9 and 10, 2009, as part of the environmental disclosure process. The primary purpose of the surveys was to determine if there were any botanical, avian or mammalian species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai‘i’s endangered species programs on, or within the immediate vicinity of the proposed electrical line and associated access road. Federal and State of Hawai‘i listed species status follows species identified in the following referenced documents (Division of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2009).

Avian phylogenetic order and nomenclature follows *The American Ornithologists’ Union Check-list of North American Birds 7th Edition* (American Ornithologists’ Union 1998), and the 42nd through the 50th supplements to *Check-list of North American Birds* (American Ornithologists’ Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008, Chesser et al., 2009). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai‘i* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al., 1974).

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.



Prepared For:

TNWRE

Prepared By:

PLANNING SOLUTIONS

Source:

-State of Hawaii GIS
-TNWRE
-Google Earth

0 200 400 800 1,200
Feet

Figure 1:

Ahualoa Access Road Project Site

Ahualoa Access Road

Ahualoa Google 2009-11-03.mxd

General Project and Site Description

The roughly 1340-meter (4,250-foot) long corridor starts at an approximate elevation of 775-meters (2154-feet) above mean sea level (ASL) on the northern edge of the Old Māmalahoa Highway and heads north cutting across an active cattle pasture to a point located approximately 300-meters south of the Māmalahoa Highway (State Route 190), along the southern boundary of the Hāmākua State Forest Reserve at an elevation of approximately 690-meters (2265-feet) ASL (Figure 1).

The lands through which the proposed project runs are made up of gently rolling hills currently being used as cattle pasturage. The vegetation on the site is predominately alien with the bulk of the site covered with a co-dominant mix of Kikuyu grass (*Pennisetum clandestinum*), and manyspike flatsedge (*Cyperus polystachyos*) (Figure 2). The access road and electrical lines will cross ‘Ino‘ino Gulch, and pass through one small stand of *‘ōhia* (*Metrosideros polymorpha*) located just south of the Hāmākua State Forest Reserve boundary (Figure 1).

Figure 2 – Āhualoa well, power line access road site, showing pastureland habitat present on the site

Botanical Survey Methods

A reconnaissance level botanical survey was conducted along the proposed right-of-way, primarily to characterize the vegetation present and to determine whether any botanical species currently listed or proposed for listing under either federal or State of Hawai‘i endangered species statutes were present on the site. A species list was kept of all species recorded; these data are presented in Table 1.

Botanical Survey Results

A total of 40 species of plants were recorded on the site (Table 1). Two species, *hapu`u* (*Cibotium chamissoi*), and *‘ōhia* (*Metrosideros polymorpha*), are endemic to the Hawaiian Islands and three others, *uluhe* (*Dicranopteris linearis), pala‘ā* (*Sphenomerus chinensis*) and manyspike flatsedge (*Cyperus polystachyos*) are indigenous. The remaining 35 species recorded are all considered to be alien, naturalized species. No species currently listed, or proposed for listing under either the federal or State of Hawai‘i endangered species statutes was recorded on the site.

Table 1 - Plants Recorded Along the Āhualoa Well Power Line Access Road Corridor

Scientific Name	***Common Name***	***ST***
FERNS & FERN ALLIES		
DICKSONIACEAE		
Cibotium chamissoi Kaulf.	*hapu`u*	End
CYATHEACEAE		
Dicranopteris linearis (Burm. f.) Underw.	*uluhe*	Ind
LINDSAEACEAE		
Sphenomerus chinensis (L) Maxon	*pala‘ā*	Ind
NEPHROLEPIDACEAE		
Nephrolepis multiflora (Roxburgh) Jarrett ex Morton	common sword fern	N
FLOWERING PLANTS		
DICOTYLEDONES		
ASTERACEAE (COMPOSITAE)		
Bidens pilosa L.	beggar’s-tick	N
Conyza bonariensis (L.) Cronq.	hairy horseweed	N
Emilia fosbergii Nicolson	Flora’s paintbrush	N
Senecio madagascariensis Poir	Madagascar ragwort	N
Senecio mikanioides Otto ex Walp.	German ivy	N
Sphagneticola trilobata (L.) Pruski	wedelia	N
Taraxacum officinale W.W. Weber ex Wigg.	common dandelion	N

Table 1 Continued

Scientific Name	***Common Name***	***ST***
BRASSICACEAE		
Lobularia maritime (L.) Desv.	sweet alyssum	N
CASUARINACEAE		
Casuarina equisetifolia L.	Common ironwood	N
EUPHORBIACEAE		
Chamaesyce hirta L.	garden spurge	N
Euphorbia heterophylla L.	*kaliko*	N
FABACEAE		
Desmodium cf. *incanum* DC	Spanish clover	N
Melilotus alba Medik.	white sweet clover	N
Mimosa pudica L.	sensitive plant	N
LAURACEAE		
Persea americana Mill	avocado	N
MYRTACEAE		
Eucalyptus sp.	eucalyptus	N
Metrosideros polymorpha Gaud.	*ʻōhia*	End
Psidium cattleianum Sabine	strawberry guava	N
Psidium guajava L.	common guava	N
Syzygium cumini (L.) Skeels	Java plum	N
PRIMULACEAE		
Anagalis arvensis L.	scarlet pimpernel	N
	MONOCOTYLEDONES	
CYPERACCEAE		
Carex longii Mackenzie	Long's sedge	N
Cyperus polystachyos	manyspike flatsedge	Ind
ORCHIDACEAE		
Arundina graminifolia (D. Don) Hochr.	bamboo orchid	N
POACEAE (GRAMINEAE)		
Andropogon virginicus L.	broomsedge	N
Chloris radiata (L.) Sw.	radiate fingergrass	N
Dactylis glomerata L.	cocksfoot	N
Melinus minutiflora P. Beauv.	molasses grass	N
Paspalum cf. *dilatatum* Poir	dallis grass	N
Pennisetum clandestinum Chiov.	Kikuyu grass	N
Melinus rupens (Willd.) Zizka	Natal redtop	N
Paspalum conjugatum Bergius	Hilo grass	N
Urochloa maxima (Jacq.) Webster	Guinea grass	N
ZINGIBERACEAE		
Hedychium cornorarium Koenig	white ginger	N
Hedychium flavescens N. Carey ex. Roscoe	yellow ginger	N
Hedychium gardnerianum Sheppard ex Ker-Gawl	*kahili* ginger	N

Key to table 1

ST	Status
End	Endemic – native and unique to the Hawaiian Islands
Ind	Indigenous – native to the Hawaiian Islands, but also found elsewhere naturally
N	Naturalized – an alien species now naturalized in the Hawaiian Islands

Avian Survey Methods

A record was kept of all avian species detected while within the project site on both October 9 and 10, 2009. Additionally, five eight-minute point counts were sited approximately 300 meters (980 feet) apart along the right-of-way on October 10, 2009. Count stations were each counted once. Field observations were made using Leitz 10 X 42 binoculars, and by listening for vocalizations. Time not spent counting stations was used to search the study site for species and habitats that were not detected during count sessions.

Avian Survey Results

During the course of the avian survey, I recorded 34 individual birds of eight separate species representing eight families (Table 2). All eight species detected are considered to be alien to the Hawaiian Islands. No species currently proposed or listed under either the state of Hawai‘i or the federal endangered species statutes was detected during the time spent on the subject property.

Avian diversity and densities recorded were low, though in line with what one would expect in an active cattle pasture in the Hāmākua District. Sky Larks (*Alauda arvensis*), was the most frequently detected avian species and accounted for slightly more than 28 percent of the total number of birds recorded.

Table 2 - Avian Species Detected Along the Āhualoa Well Power Line Access Road

Common Name	***Scientific Name***	***ST***	***RA***
	PHASIANIDAE - Pheasants & Partridges		
	Meleagridinae - Turkeys		
Wild Turkey	*Meleagris gallopavo*	A	0.60
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Zebra Dove	*Geopelia striata*	A	1.20
	PASSERIFORMES		
	ALAUDIDAE - Larks		
Sky Lark	*Alauda arvensis*	A	2.60
	TIMALIIDAE - Babblers		
Hwamei	*Garrulax canorus*	A	0.20

Table 2 continued.

Common Name	***Scientific Name***	***ST***	***RA***
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	0.60
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	0.40
	CARDINALIDAE - Cardinals & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	0.60
	FRINGILLIDAE - Fringilline and Carduleline Finches & Allies		
	Carduelinae - Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	0.60

Key to table 2

ST Status
A Alien – Introduced to the Hawaiian Islands by humans
RA Relative Abundance –Number of birds detected divided by the number of count stations (5)

Mammalian Survey Methods

All observations of mammalian species were of an incidental nature. With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *‘ōpe‘ape‘a* as it is known locally, all terrestrial mammals currently found on the Island of Hawai‘i are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the study area.

Mammalian Survey Results

Four mammalian species were detected during the course of this survey. Several cows (*Bos taurus*) were seen in adjoining pastures, as were several horses (*Equus c. caballus*). Dogs (*Canis f. familiaris*) were heard barking from areas outside of the study site. Additionally, track, sign and scat of cows, horses and pigs (*Sus s. scrofa*) were encountered within the study site. The skeletal remains of one Small Indian mongoose (*Herpestes a. auropunctatus*) was found in a cavity on the rocky edge of ‘Ino‘ino Gulch, and skeletal remains of at least two cows were also encountered within the study area.

Discussion

Botanical Resources

A total of 39 species of plants was recorded on the site, two of which are endemic to the Hawaiian Islands, and three are indigenous. The two endemic species, *hapu`u*, and *‘ōhia* are relatively common endemic species, and very few will be impacted by this action. The three indigenous species, *uluhe, pala‘ā,* and manyspike flatsedge are relatively common as well. The

remaining 35 species recorded are all considered to be alien to the Hawaiian Islands. No species currently listed, or proposed for listing under either the US Federal or State of Hawai‘i endangered species statutes was recorded on the site.

Avian Resources

Avian diversity and densities were low, though in keeping with the vegetation currently found on the site. The findings of the avian survey were consistent with the findings of at least two other faunal surveys conducted on lands in close proximity to the subject property in the recent past (David 2005a, 2005b).

All of the eight avian species detected during the course of this survey are considered to be alien to the Hawaiian Islands. No species currently proposed or listed under either the state of Hawai‘i or the federal endangered species statutes was detected during the time spent on the subject property.

Hawaiian Hawk. Although not recorded during the course of this survey, it is possible that the endangered Hawaiian Hawks (*Buteo solitarius*) forage over the pasture through which the proposed right-of-way runs. This species is relatively common within the general Hāmākua area (Klavitter 2000, David 2009).

Hawaiian Hawks are currently found in nearly all habitats on the island that still have some large tree components. They are regularly seen foraging in the general project area. Hawk densities are highest in mature, forests dominated by native species, with grassy under-stories. This habitat, with high amounts of forest edge, supports large populations of game birds and the four species of introduced rodents known from the island, all of which are prey items for the hawk. Additionally, this type of habitat also provides numerous perches and nesting sites suitable for this species (Klavitter 2000).

The Hawaiian Hawk, or *‘io*, is the only extant *falconiforme* in Hawai‘i. It is currently endemic to the Island of Hawai‘i. Sub-fossil remains indicate that it was also formerly found on Moloka‘i and Kaua‘i (Olson & James 1997). Several incidental unconfirmed sightings of this species exist from Kaua‘i (Dole 1879, Beaglehole, 1967) and Maui (Banko 1980c). This species was first mentioned in the western literature by Cook and King in 1784 and was scientifically described by Peale in 1848 from a specimen collected in “Kealakekua” (Medway 1981, Peale 1848).

Current population estimates based on John Klavitter’s research conclude that there are currently 1,450 Hawaiian Hawks living in the wild. That number, in his estimation, is equal to or higher than the number present in pre-contact times (Klavitter 2000). The Hawaiian Hawk breeding season starts in late March, chicks hatch in May, and begin to fledge in July (Griffin et al. 1998). Although hawks use resources in most forest habitats, they usually nest in *‘ōhi‘a* trees (*Metrosideros polymorpha*). Of 112 nests found during the 1998 and 1999 nesting seasons, 82 percent of the nests were located in *‘ōhi’a trees* (Klavitter 2000). There are no appropriate nesting trees present on the project site for this species. The USFWS published a proposed rule to delist

the Hawaiian Hawk in the *Federal Register* on August 6, 2008. The proposal is still open (*Federal Register* 2008).

<u>*Hawaiian Petrel and Newell's Shearwaters.*</u> Although not recorded during the course of this survey, it is possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*), or *ua'u*, and the threatened Newell's Shearwater (*Puffinus auricularis newelli*), or *'a'o*, over-fly the project area between the months of May and November (Banko 1980a, 1980b, Day et al. 2003a, Harrison 1990). There is no suitable nesting habitat within or close to the proposed project site for either of these pelagic seabird species.

Hawaiian Petrels were once common on the Island of Hawai'i (Wilson and Evans 1890–1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as at the mid to high elevations of Mount Hualālai. It has, within recent historic times, been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Mount Hualālai (Banko 1980a, Banko et al. 2001, Cooper and David 1995, Cooper et al. 1995, Day et al. 2003, Harrison 1990, Hue et al. 2001, Simons and Hodges 1998).

Newell's Shearwaters, another pelagic seabird species were formerly common on the Island of Hawai'i (Wilson and Evans 1890–1899). This species breeds on Kaua'i, Hawai'i and Moloka'i in extremely small numbers. Newell's Shearwater populations have dropped precipitously since the 1880s (Banko 1980b, Day et al., 2003b). This species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern.

Mammalian Resources

The findings of the mammalian survey are in keeping with the habitat present at the site, and the current management of the property.

<u>*Hawaiian Hoary Bat*</u>. Although, no Hawaiian hoary bats were detected during the course of this survey, it is probable that bats do occasionally use resources within the general project area. Hawaiian hoary bats are regularly seen in the general project area on a seasonal basis (David 2009).

Recent research on this species has shown it to be present on the Island of Hawai'i on a seasonal basis in almost all areas on the Island where dense vegetation and tree cover is present. The research also indicates that the bat is a human commensal species often associated with tree farms and other agricultural efforts. They are also attracted to outdoor lights, which attract volant insects on which this species forages (Bonaccorso et al. 2004, 2007).

Although no rodents were recorded during the course of this survey, it is probable that the four established alien *muridae* known from the Island of Hawai'i roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mice (*Mus musculus domesticus*), use resources on the project area.

Potential Impacts to Protected Species

Hawaiian Hawk

The principal potential impact that the proposed project poses to Hawaiian Hawks would occur during the clearing and grubbing phase of the project, when an active Hawaiian Hawk nest tree could be removed. It is not expected that the development of the proposed well access road and electrical lines will result in deleterious impacts to Hawaiian Hawks, as there are no suitable nest trees within the proposed disturbance corridor. Individual foraging hawks may be temporarily disturbed by construction activity. Such potential disturbance to foraging Hawaiian Hawks is not likely to be significant, as there are miles of suitable foraging habitat surrounding the very small project site.

Hawaiian Petrel and Newell's Shearwater

Development of this site as proposed could have the potential to adversely affect Hawaiian Petrels and Newell's Shearwaters only if it involved an increase in outdoor lighting. As no such lighting is planned, there appears to be little risk to these species.

Hawaiian Hoary Bat

The principal potential impact that the development of the proposed well and reservoir poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they themselves forage. Very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.5 meters (15-feet), during the pupping season, between April 15 and August 15, the period in which bats are potentially at risk from vegetation clearing.

Conclusions

The modification of the current habitat on the Āhualoa site is not expected to result in significant impacts to any botanical, avian or mammalian species currently listed as threatened, endangered or proposed for listing under either the Federal, or State of Hawaiʻi endangered species programs. Furthermore, the development of the site is not expected to have a significant deleterious impact on native faunal resources found within the Hāmākua District.

Recommendations

While the risk that project-related activities could adversely affect Hawaiian bats is small, it is present if suitable roosting site vegetation clearing is conducted during the pupping season. The risk to this protected species can be completely eliminated by avoiding such work between April 15 and August 15.

Glossary

Alien - Introduced to Hawai‘i by humans.
Commensal – Animals that share humans’ food and lodgings, such as rats and mice.
Diurnal – Daytime.
Endangered – Listed and protected under the ESA as an endangered species.
Endemic – Native and unique to the Hawaiian Islands.
Falconiforme – Diurnal birds of prey – 271 species worldwide.
Indigenous - Native to the Hawaiian Islands, but also found elsewhere naturally.
Mauka – Upslope, towards the mountains.
Muridae – Rodents, including rats, mice and voles, one of the most diverse mammalian families
Naturalized – A plant or animal that has become established in an area that it is not indigenous to
Nocturnal – Nighttime, after dark.
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened - Listed and protected under the ESA as a threatened species.
Volant – Flying, capable of flight - as in flying insect.

ASL – Above mean sea level.
DWS – Hawai‘i County Department of Water Supply.
ESA – Endangered Species Act of 1973, as amended.
USFWS – U.S. Fish & Wildlife Service

Literature Cited

American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. AOU. Washington D.C. 829pp.

_____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 119:897-906.

_____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 120:923-931.

_____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 121:985-995.

_____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 122:1031-1031.

_____. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 123:926-936.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007 Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 124:1109-1115.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, D. F. Stotz, and K. Winker. 2008 Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 125:758-768.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 126:1-10.

Banko, W. E. 1980a. Population Histories- Species Accounts Seabirds: Hawaiian Dark-rumped Petrel (‘Ua‘u). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Department of Botany, Technical Report #5B.

_____. 1980b. Population Histories- Species Accounts Seabirds: Newell’s Shearwater (‘A‘o). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Department of Botany, Technical Report #5A.

Banko, W. E. 1980 c. Population Histories- Species Accounts Forest Birds: Hawaiian Hawk ('Io). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Department of Botany, Technical Report #6A.

Banko, P. C., R. E. David, J. D. Jacobi, and W. E. Banko. 2001. Conservation Status and Recovery Strategies for Endemic Hawaiian Birds, *In:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 359-376).

Beaglehole, J. C., ed.1967. The journals of Captain James Cook on his voyages of discovery. Vol. 3, The voyage of the Resolution and Discovery 1776-1780. 2 pts. Hakluyt Society Extra Series, no. 36 Cambridge University Press.

Bonaccorso, F. J., C. M. Todd and, A. C. Miles. 2005. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Opeʻapeʻa, *Lasiurus cinsereus semotus*. 1 September 2004 to 31 August 2005.

_____. 2007. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Opeʻapeʻa, *Lasiurus cinsereus semotus*. April 1, 2007.

Cook, J. and J. King. 1784. *A Voyage to the Pacific Ocean. Undertaken, by the Command of his Majesty, for making Discoveries in the Northern Hemisphere. To determine The Position and Extent of the West Side of North America; its Distance from Asia; and the Practicability of a Northern Passage to Europe. Performed under the direction of Captains Cook, Clerke, and Gore, In His Majesty's Ships the Resolution and Discovery. In the Years 1776, 1777, 1778, 1779, and 1780.* 3 vols. London.

Cooper, B. A. and R. E. David. 1995. Radar and Visual Surveys of Seabirds in the HELCO SSP Unit 71, Puna, Hawaii, During July 1995. Prepared for R. M. Towill Corporation & Hawaii Electric Light Co.

Cooper, B.A., R.E. David, and R.J. Blaha. 1995. Radar and Visual Surveys of Endangered Seabirds and Bats in the Pohakuloa Training Area, Hawaiʻi, During Summer 1995. Prepared for R.M. Towill Corporation and the U.S. Army Corps of Engineers, Pacific Division (POD).

David, R. E. 2005a. A Survey of Avian and Terrestrial Mammalian Species TMK: 4-6-11:03, 11, 12 & 13, Honokaia, Hāmākua District, Island of Hawaiʻi. Prepared for AECOS Inc and the State of Hawaiʻi Department of Hawaiian Home Lands (DHHL).

David R. E. 2005b. A Survey of Botanical and Faunal Resources on the Proposed Āhualoa Well Project Site, TMK: (3)4-6-11:42, Hāmākua District, Island of Hawaiʻi. Prepared for: Planning Solutions, Inc and The Hawaiʻi County Department of Water Supply (DWS).

David, R. E. 2009. Unpublished Field Notes – Island of Hawaiʻi: 1985-2009.

Day, R. H., B. Cooper, and R. J. Blaha. 2003a. Movement Patterns of Hawaiian Petrels and Newell's Shearwaters on the Island of Hawaiʻi. Pacific Science, 57, 2:147-159.

Day, R. H., B. Cooper, and T. C. Telfer. 2003b. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The Auk 120: 669-679.

Department of Land and Natural Resources. (DLNR). 1998. Indigenous Wildlife, Endangered and Threatened Wildlife and Plants, and Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Dole, S. B. 1879. List of birds of the Hawaiian Islands. P.p. 41-58 *in* T. G. Thrum (comp.). Hawaiian almanac and annual for 1879. Honolulu.

Federal Register. 2005. Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

Federal Register. 2008. Endangered and Threatened Wildlife and Plants; Withdrawal of Proposed Reclassification of the Hawaiian Hawk or Io (*Buteo solitarius*) From Endangered to Threatened; Proposed Rule To Remove the Hawaiian Hawk From the Federal List of Endangered and Threatened Wildlife. Federal Register, 73, No. 152 (August 6, 2008): 45680-45689.

Griffin, C. R., P. W. C. Paton, and T. S. Baskett. 1998. Breeding Ecology and Behavior of the Hawaiian Hawk. Condor, 100:654-662.

Harrison, C. S. 1990. *Seabirds of Hawaii: Natural History and Conservation*. Cornell University Press, Ithica, N.Y. 249 pp.

Henshaw, H.W. 1902. *Complete list of birds of the Hawaiian Possessions with notes on their habits*. Thrum, Honolulu. 146 pp.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai‘i. , *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper’s Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 234-242).

Klavitter, J. L. 2000. Survey methodology, abundance, and demography of the endangered Hawaiian Hawk: Is de-listing Warranted? Unpublished Master of Science Thesis. University of Washington.

Medway, D.G. 1981. The contribution of Cook's third voyage to the ornithology of the Hawaiian Islands. Pac. Sci. 35: 105-175.

Olson, S.L., and H.F. James. 1997. Prehistoric status and distribution of the Hawaiian Hawk (*Buteo solitarius*), with the first fossil record from Kauai. Bishop Museum Occasional Papers 49:65-69.

Peale, T. R. 1848. *United Exploring Expedition. Vol. 8, Mammalia and Ornithology.* Philadelphia, Lea and Blanchard. 338 pp.

Pukui , M. K., S. H. Elbert, and E. T. Mookini. 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai‘i. 289 pp.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places.* Bishop Museum, Honolulu. 908 pp.

Tomich, P.Q. 1986. *Mammals in Hawaii*. Bishop Museum Press. Honolulu, Hawaii. 37 pp.

U.S. Fish & Wildlife Service (USFWS) 2005. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

_____. 2009. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do

Wagner, W.L., D.R Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai‘i*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawai‘i*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai‘i. Revised edition. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wilson, S. B., and A. H. Evans. 1890-1899. *Aves Hawaiiensis: The birds of the Sandwich Islands*. R. H. Porter, London.

APPENDIX B ARCHAEOLOGICAL AND LIMITED CULTURAL ASSESSMENT

THIS PAGE WAS INTENTIONALLY LEFT BLANK

RC-0652

An Archaeological and Limited Cultural Assessment of a Planned Access Road Route across TMKs: 3-4-6-11:004, 006, and 044

Honokaia Ahupuaʻa
Hāmākua District
Island of Hawaiʻi

DRAFT VERSION

PREPARED BY:

Robert B. Rechtman, Ph.D.,
Matthew R. Clark, B.A.,
and
Ashton K. Dircks Ah Sam

PREPARED FOR:

Planning Solutions, Inc.
210 Ward Ave., Suite 330
Honolulu, HI 96814

November 2009

RECHTMAN CONSULTING, LLC
507-A E. Lanikaula St. Hilo, Hawaii 96720
phone: (808) 969-6066 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

RC-0652

An Archaeological and Limited Cultural Assessment of a Planned Access Road Route across TMKs: 3-4-6-11:004, 006, and 044

Honokaia Ahupuaʻa
Hāmākua District
Island of Hawaiʻi

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

At the request of Planning Solutions, Inc., on behalf of the County of Hawai‘i Department of Water Supply, Rechtman Consulting, LLC conducted an archaeological and limited cultural assessment of a roughly 1.3 kilometer (4,400-ft.) long access road corridor in Honokaia Ahupua‘a, Hāmākua District, Island of Hawai‘i. The purpose of the proposed access road is to provide access for the installation and maintenance of a new power line. The Department of Water Supply will seek an easement of approximately 9 meters (30-ft.) width along the planned route, which follows a fence line along the eastern boundary of TMKs: 3-4-6-11:004 and 044 between Old Māmalahoa Hwy and the existing HELCO transmission system *mauka* of HWY 19. The access corridor also crosses the State-owned easement parcel that once contained the Upper Hāmākua Ditch (TMK:3-4-6-11:006).

This study was undertaken in accordance with Hawai‘i Administrative Rules 13§13–284, 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§13–276. According to 13§13-284-5 when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawai‘i Planning Department. The current study also assessed potential cultural impacts, and was prepared in support of an Environmental Assessment compliant with HRS Chapter 343.

Based on 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, the archaeological expectations for the current study are limited. It is remotely possible that Precontact sites, including trails, temporary habitations, gardens, or resource procurement areas may have been present within the current project area. However, the extensive land use for cattle ranching throughout the late nineteenth and twentieth centuries has significantly altered the landscape. Ranching related features in the project area may include boundary markers, walls, roads, fences or enclosures. The Upper Hāmākua Ditch once crossed the project area, but use of that ditch for irrigation purposes was discontinued in 1948 (Wilcox 1996), and it is no longer present within the survey corridor.

Matthew R. Clark, B.A., under the direction of Robert B. Rechtman, Ph. D., conducted a visual inspection of the entire access road corridor on October 9, 2009. As a result of the pedestrian survey, no archaeological resources of any kind were observed on the surface of the project area, and the likelihood of encountering subsurface archaeological resources is extremely remote given the geology of the area and the history of ranching on the parcels. Also, with the exception of a few easily avoidable *‘ōhi‘a* trees, there were no resources (landforms, vegetation, etc.) of a traditional cultural nature observed within the project area. Likewise, consultation with knowledgeable community members revealed no information regarding significant cultural places or practices which may have occurred within the current project area.

Given the negative findings of the current study, it is concluded that development of the proposed access road route will not significantly impact any known historic properties or any cultural resources and practices of a traditional and customary nature. It is therefore recommended that no further historic preservation work or mitigation is needed.

CONTENTS

INTRODUCTION 1
BACKGROUND STUDIES 6
Prior Archaeological Studies 6
Culture-Historical Background 7
CURRENT PROJECT EXPECTATIONS 18
ARCHAEOLOGICAL FIELDWORK 18
DISCUSSION OF CULTURAL PROPERTIES AND PRACTICES 20
CONCLUSION AND RECOMMENDATIONS 20
REFERENCES CITED 21

FIGURES

1. Project area location. 2
2. Tax Map Key (TMK):3-4-6-11 showing the proposed access road route. 3
3. Aerial view of the current project area. 4
4. Planned route of the access road across TMK: 3-4-6-11:044, view to north. 5
5. Planned route of the access road near its northern termination across TMK: 3-4-6-11:004, view to northeast. 5
6. Portion of an 1859 map of a tract of Government land in Hāmākua, Hawaiʻi prepared by S. C. Wiltse. 14
7. 1873 map of Kawela and Honokaia Ahupuaʻa prepared by S. C. Wiltse. 16
8. Concrete marker along the boundary between Honokaia and Kawela *ahupuaʻa*, overview to east. 19
9. Tree line that marks the former route of the Upper Hāmākua Ditch, view to south. 19

INTRODUCTION

At the request of Planning Solutions, Inc., on behalf of the County of Hawai‘i Department of Water Supply (DWS), Rechtman Consulting, LLC conducted an archaeological and limited cultural assessment of a roughly 1.3 kilometer (4,400-ft.) long access road corridor in Honokaia Ahupua‘a, Hāmākua District, Island of Hawai‘i (Figure 1). DWS is installing a new municipal water supply well on a site approximately 6.4 kilometers (4 miles) *mauka* of the community of Honoka‘a. To provide electrical power to this facility, DWS needs more power than is available from the existing transmission system that runs along the Old Māmalahoa Highway adjacent to the well site. DWS has determined that it is not practical to upgrade this existing system and that the most efficient way to provide the needed system capacity is to install a new over head distribution power line to link with an existing HELCO transmission system. The purpose of the proposed access road is to provide access for the installation and maintenance of this new power line. DWS will seek an easement of approximately 9 meters (30-ft.) width along the planned route.

The planned route of the access road follows a fence line along the eastern boundary of TMKs: 3-4-6-11:004 and 044 between Old Māmalahoa Hwy and the existing HELCO transmission system *mauka* of HWY 19 (Figures 2 and 3). The access corridor also crosses the State-owned easement parcel that once contained the Upper Hāmākua Ditch (TMK: 3-4-6-11:006). The corridor runs from an elevation of 2,530 feet above sea level to an elevation of 2,250 feet above sea level. The terrain is gently sloping open grassland with a few large *‘ōhi‘a lehua* (*Metrosideros polymorpha*) and eucalyptus (*Eucalyptus* sp.) trees present (Figures 4 and 5). Soils in the vicinity of the project area consist predominately of Honoka‘a silty clay loam with pockets of rough broken land and Maile silt loam (Fong et al. 2005). These soils have formed from Pleistocene lavas of the upper member Hāmākua Volcanic Series that are overlain by chemically weathered Pahala Ash (MacDonald and Abbot 1970). The area receives 2,000 to 3,000 millimeters of rain annually and temperatures range throughout the year from 50 to 80 degrees Fahrenheit (Armstrong 1973). The project area lands are currently used as cattle pasture, and have been since the late 1800s.

This survey was undertaken in accordance with Hawai‘i Administrative Rules 13§13–284, 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§13–276. According to 13§13-284-5 when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawai‘i Planning Department. The current study was prepared in support of an Environmental Assessment compliant with HRS Chapter 343.

This report contains background information outlining the project area’s physical and cultural contexts, a presentation of previous archaeological/cultural work conducted in the vicinity of the current study parcels, and current survey expectations based on the information obtained from the previous work. Also presented are an explanation of the project’s methods and the findings of the archaeological field survey and a discussion of cultural properties and practices relevant to the current project area.

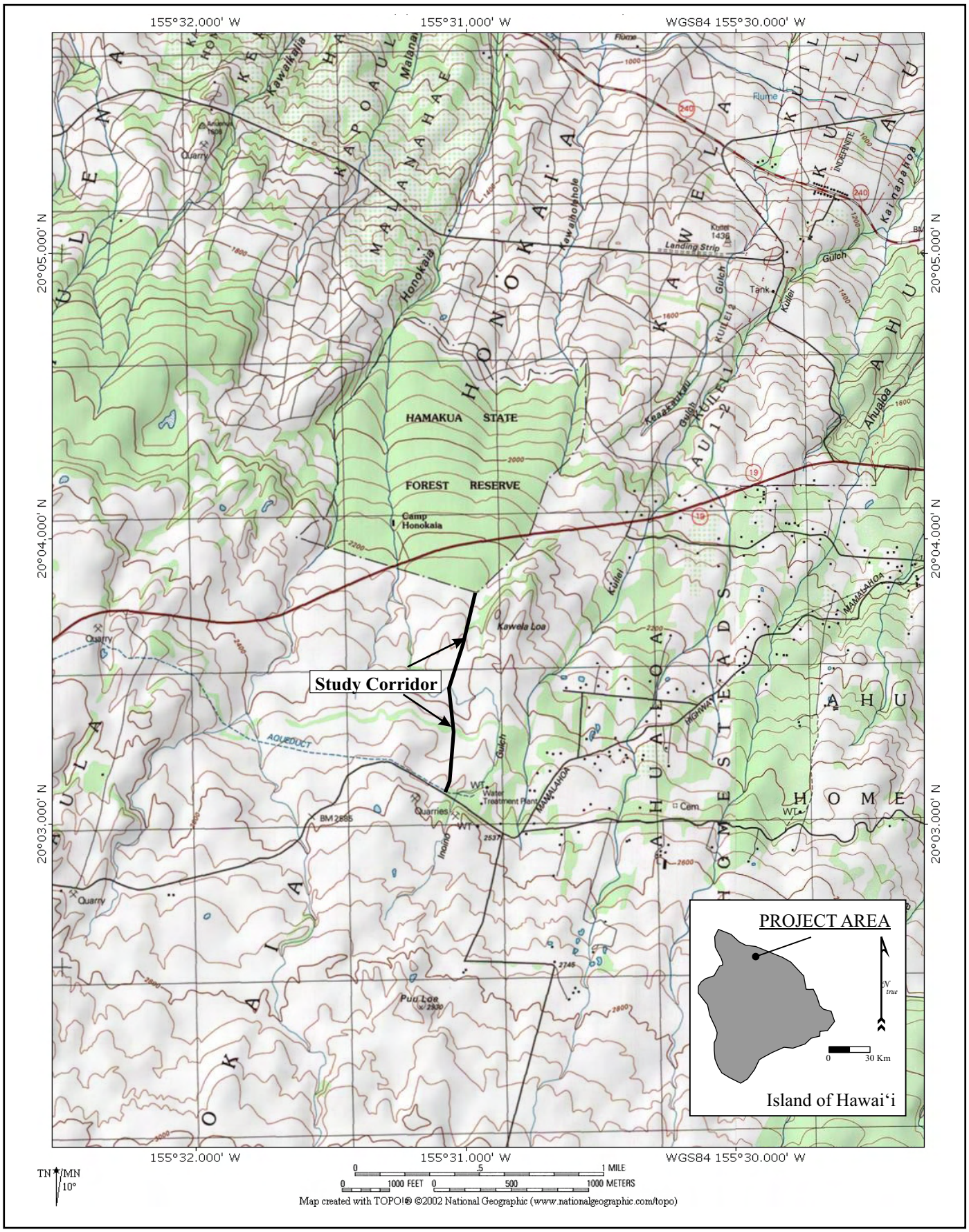


Figure 1. Project area location.

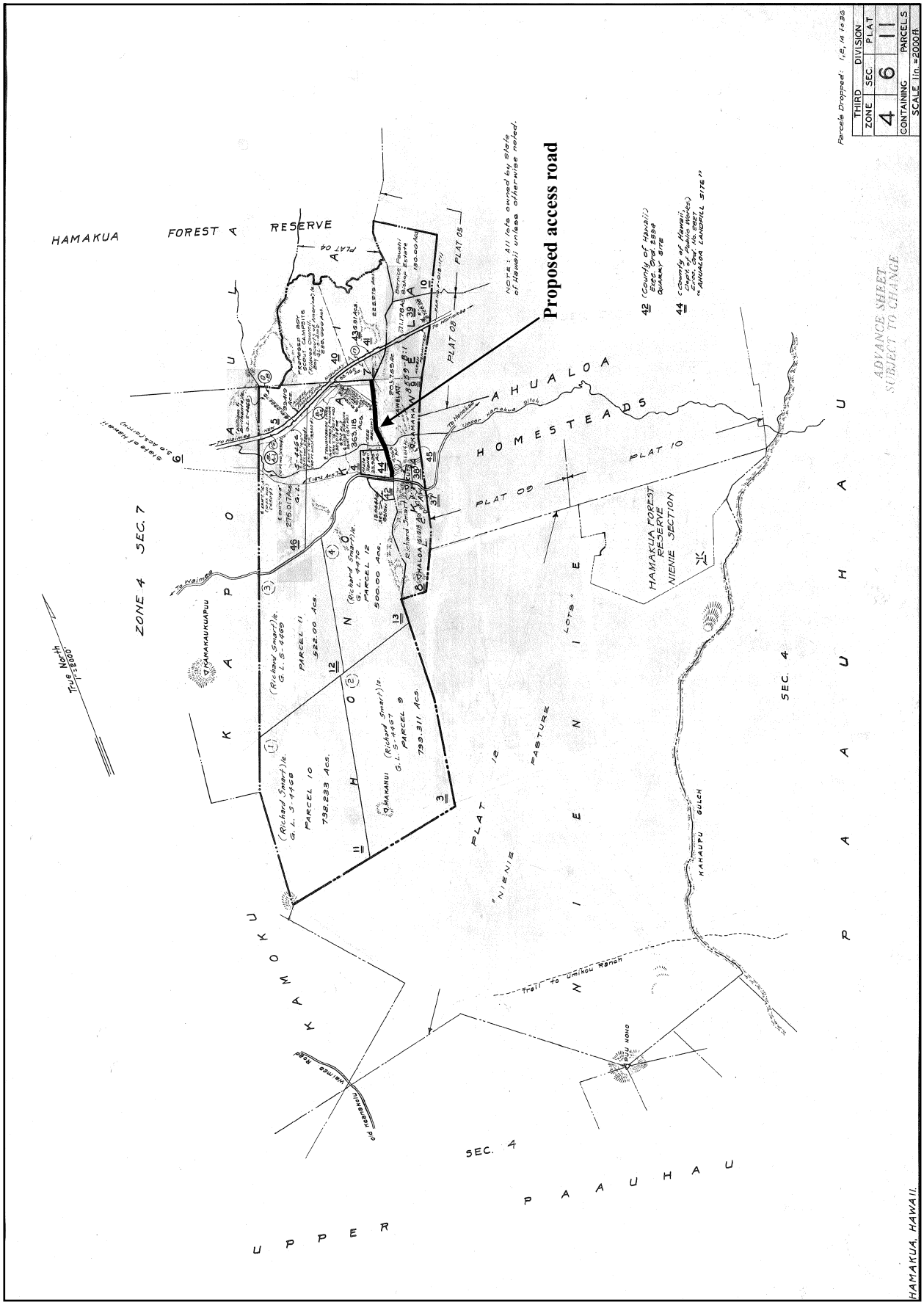


Figure 2. Tax Map Key (TMK): 3-4-6-11 showing the proposed access road route.

Figure 3. Aerial view of the current project area (from Google Earth).

Figure 4. Planned route of the access road across TMK: 3-4-6-11:044, view to north.

Figure 5. Planned route of the access road near its northern termination across TMK: 3-4-6-11:004, view to northeast.

BACKGROUND STUDIES

This section of the report describes and synthesizes prior archaeological, cultural, and historical studies that are relevant to the current project area; and provides a brief culture-historical background.

Prior Archaeological Studies

In *A Regional Synthesis of the Hāmākua District, Island of Hawai‘i*, Dr. Ross Cordy (1994) summarizes the general Precontact and early Historic land use patterns for the subregion of East Hāmākua, which includes Honokaia Ahupua‘a and the current project area. The summary is based on a review *Māhele* records and a detailed examination of archival historical information. Cordy (1994) defines four general envirionmental zones within East Hāmākua: (1) the Sea-shore, (2) The Seaward Upland Slopes, (3) the ‘Ōhi‘a-Koa Forest Zone, and (4) The Gulches. The current project area falls near the transition between The Seaward Upland Slopes and the the ‘Ōhi‘a-Koa Forest Zone.

The Seaward Upland Slopes was the primary farming and residential zone of East Hāmākua. House sites in this zone were common between the sea cliffs and the cross-island trail (near the present day HWY 19). Garden plots (*mala*, *kihapai*, and *kula*), which were generally non-irrigated, tended to be located in close proximity to the houselots. In the *mauka* regions of this zone some scattered fields were present that were not associtated with permanent residences. Dryland taro was the dominant crop of The Seaward Upland Slopes, but sweet potatoes and bananas were also commonly grown (Cordy 1994).

In the ‘Ōhi‘a-Koa Forest Zone the Precontact and early Historic peoples of East Hāmākua utilized the natural resources of the forest. Activities in this zone included gathering bark to make fishing nets, collecting *māmaki* to make *kapa*, and catching birds for their feathers. At lower elevations within the ‘Ōhi‘a-Koa Forest Zone small plantings of supplemental crops such as bananas and taro were also present. Habitation in this zone occured at caves and campsites that were occupied for short durations of time (Cordy 1994).

Cleghorn (1999) identified four small caves (Caves 1, 2, 3, and 4) in the ‘Ōhi‘a-Koa Forest Zone during an archaeological inventory survey at Inoino Bridge along the Old Māmalahoa Highway (TMKs: 3-4-6-11:037 and 038) (see Figure 2). The caves, which were all recorded under the SIHP designation Site 21405, are located in Kawela Ahupua‘a along its boundary with Honokaia Ahupua‘a, near the southern termination of the current project area. Each of caves contained stone constructions including platforms, walls, and alignments. Cleghorn (1999) suggests that the platforms within three of the caves, based on their formal attributes, could contain Precontact human burials. However, no excavations or structural dismantling was performed during the survey to determine if human remains were indeed present within the stone structures. Cleghorn (1999) also recorded the Historic Inoino Bridge across Inoino Gulch, which was replaced by a new Inoino Bridge subsequent to the completion of the study.

Fong et al. (2005) conducted a literature review, field check and cultural impact evaluation for approximately 2,500 acres of DHHL Lands at Honokaia Ahupua‘a (TMKs:3-4-6-11: 003, 011, 012, and 013), located across the Old Māmalahoa Highway from the southern termination of the current project area (see Figure 2). The literature review included a study of archival sources, historic maps, Land Commission Awards (LCAw.), and previous archaeological studies relative to Honokaia. These resources were used to construct a history of land use within the *ahupua‘a*. The land use history is summarized below in the Culture-Historical Background section of this report.

The field inspection, which included limited pedestrian survey and aerial survey, was conducted by two archaeologists over a span of three days. The inspection was intended to identify any surface archaeological features present within the 2,500 acres and to assess the potential impacts to any such features so that sensitive areas that might require further investigation or mitigation prior to any development could be dealt with. As a result of the field check a single archaeological site — a Historic wall, possibly a dam or gulch crossing — was recorded, but was not considered significant and was not assigned an SIHP site number. Two other structures, a corral and a quarry, were noted within the survey area, but were determined to lack archaeological or historical significance, as both were less than fifty years old. Site 21405, previously recorded by Cleghorn (1999) within Inoino Gulch, was also relocated and inspected, and a fifth cave (Cave 5) containing two rough, mounded walls was identified at the site. As a result of the inspection it was determined that all five of the caves were located

just beyond the boundaries of their study area. Given the absence of significant sites within the project area Fong et al. (2005) concluded that the development of the area would have no effect on historic resources.

Their evaluation of the impact of the proposed project on cultural resources and practices was based on the findings of the literature review and field check in combination with consultation with knowledgeable individuals in the community. Although an attempt was made by Fong et al. (2005) to contact several individuals, organizations, and agencies regarding traditional cultural properties at the DHHL Honokaia Lands, only one response was elicited, and no traditional cultural properties were identified. The community consultation conducted by Fong et al. (2005) is examined further in the Discussion of Cultural Properties and Practices section of this report.

Culture-Historical Background

The current project area is situated in Honokaia Ahupuaʻa along the northeast facing shores of Hawaiʻi Island in the district of Hāmākua, one of six traditional districts on the island. Although the boundaries of the Hāmākua District are strictly political, the lands encompassed by it possess a unique environment that played a large role in determining the boundaries and shaping its history from the time of Polynesian settlement to the modern day. Understanding this environment is important for understanding the history of the current project area.

> Hāmākua district is a windward district in the truest sense. It has ca. 29 miles of shoreline, primarily focused on Mauna Kea's eastern slopes with exposed cliffs rough seas, and narrow reef formations. Above the sea cliffs, the gentle slopes have a thick soil cover and abundant rainfall, and lush vegetation, with the upper slopes from 1,000-6,000 feet in an ʻōhiʻa-koa rain forest. The slopes are cut by deep (up to 300-foot), narrow stream gulches cloaked with kukui and pandanus. Yet Hāmākua is more than these slope and gulch lands. It also includes the extremely large, deep valleys of Waipiʻo and Waimanu which have cut over a millennia into the older Kohala Mountain, valleys which, as will be seen, dominated the history of the district and the island. Hāmākua also extended inland, encompassing the high elevation māmane-naio forests of Mauna Kea and the subalpine, oft snow-covered, summit itself. The district continued across the foggy and cold upland plateau or Saddle with its terrain a mixture of bare lava and soils, and with its vegetation a mixture of ʻōhiʻa and māmane-naio forests. This plateau had important nesting grounds of ʻuʻua and nēnē. And, Hāmākua virtually spanned the island-reaching to and looking down into the upper edges of Kona. (Cordy 2000:21).

It was to this general environmental setting that the first Polynesians in Hawaiʻi arrived. Over generations they shaped and utilized the natural environment to provide all they needed for sustenance and survival. In the process they created a uniquely Hawaiian culture that was wholly adapted to the environment. The brief generalized cultural sequence that follows below provides a time frame for the peopling of Hawaiʻi, the development of Hawaiian culture, the expansion and intensification of the Hawaiian population, and the resulting stresses on it from the earliest Precontact settlers to the time of European Contact. This cultural sequence is based largely on Kirch's (1985) model.

A Generalized Model of Hawaiian Prehistory

The Settlement or Colonization Period is believed to have occurred in Hawaiʻi between A.D. 300–600 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 *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the ʻ*aumakua* concept; various superstitions; and the concept of *mana*. Initial settlement likely occurred along the wetter, windward side of the islands especially in the deeper valleys with permanently flowing streams and easy access to marine resources (such as at Waipiʻo Valley in the vicinity of the current project area).

The Development Period (A.D. 600–1100) 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 (*ko‘i*) 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 Hawai‘i produced quality basalt for adze production. Mauna Kea on the island of Hawai‘i in the Hāmākua District was a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *‘ulu maika* stones and *lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period (A.D. 1100–1650) 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. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dry land areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985).

It was during the Expansion Period that a second major migration settled in Hawai‘i, this time from Tahiti in the Society Islands. According to Kamakau (1976) the *kahuna* Pā‘ao settled in the islands during the 13th century. Pā‘ao was the keeper of the god Ku‘ka‘ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pā‘ao was expelled from his homeland by Lonopele. He prepared for a long voyage, and set out across the ocean in search of a new land. On board Pā‘ao’s canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ‘ā‘īpu‘upu‘u*), the chief Pilika‘aiea (Pili) and his wife Hina‘aukekele, Nāmau‘u o Malaia, the sister of Pā‘ao, and the prophet Makuaka‘ūmana (Kamakau 1991). In 1866 Kamakau told the following story of their arrival in Hawai‘i:

> Puna on Hawai‘i Island was the first land reached by Pā‘ao, and here in Puna he built his first *heiau* for his god Aha‘ula and named it Aha‘ula [Waha‘ula]. It was a *luakini*. From Puna, Pā‘ao went on to land in Kohala, at Pu‘uepa. He built a *heiau* there called Mo‘okini, a *luakini*.
>
> It is thought that Pā‘ao came to Hawai‘i in the time of the *ali‘i* La‘au because Pili ruled as *mo‘i* after La‘au. You will see Pili there in the line of succession, the *mo‘o kū‘auhau*, of Hanala‘anui. It was said that Hawai‘i Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawai‘i Island had been without a chief for a long time, and the chiefs of Hawai‘i were *ali‘i maka‘āinana* or just commoners, *maka‘āinana*, during this time. (1991:100)
>
> . . . There were seventeen generations during which Hawai‘i 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 Hawai‘i. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawai‘i Island. (1991:101–102)

The Pili line’s initial ruling center was likely in Kohala, but Cartwright (1933) suggests that Pili resided in and ruled from Waipi‘o Valley in the Hāmākua District. Ethnohistorical traditions (Fornander 1880) indicate that valley was associated with at least nine successive Pili line rulers of Hawai‘i Island, from Kaha‘imoele‘a to Umi (from roughly AD 1460 to 1620). Prior to the establishment of these Pili rulers, Waipi‘o was the residential base for powerful local rulers dating back to at least the A.D. 1200s (Cartwright 1933).

The concept of the *ahupua‘a* was established during the A.D. 1400s (Kirch 1985), 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).

All of the island's districts were dived into *ahupuaʻa*. Honokaia Ahupuaʻa is one of 87 *ahupuaʻa* located in East Hāmākua, a region that extends along the coast for roughly 21 miles from the upper slopes above Waipiʻo Valley to the North Hilo border (Cordy 1994). The *ahupuaʻa* of this region were mostly small — 0.1-0.4 miles wide, extending 2.5-4.0 miles inland — but a few, such as Honokaia, were wider at the coast and extended further inland. Honokaia extends 7.5 miles inland to a point where it is cut off by Nienie Ahupuaʻa. There were only two very large *ahupuaʻa* in the Hāmākua District (Pāʻauhau and Kaʻohe *ahupuaʻa*) that included nearly all of the inland areas. The *ahupuaʻa* of East Hāmākua cross-cut the major terrestrial resource zones so that the residents had access to agricultural lands and forest resources. They also included off-shore fishing territories for the procurement of marine resources (Cordy 1994).

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-hou 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 the Expansion 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). Waipiʻo was one of the most important religious and chiefly centers on the Island of Hawaiʻi, and a number of large *heiau* were maintained in the valley throughout the Precontact Period (Cordy 1994).

Liloa and his son ʻUmi were two of the most renowned rulers of the Pili line. Both were from Hāmākua and had their ruling centers in Waipiʻo (Cordy 1994). ʻUmi, who is often credited with uniting the island of Hawaiʻi under one rule, had a chiefly father (Liloa) and a mother (Akahi) who was a commoner (Kamakau 1992). Liloa met Akahi when he secretly left the valley to visit his other Hāmākua lands. As a young boy ʻUmi was raised in the countryside by his mother, but he soon moved to Waipiʻo to reside with his father and learn the chiefly ways (Kamakau 1992). Waipiʻo remained a leading chiefly center until the end of ʻUmi's reign around ca. 1620 (Cordy 1994).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. Sometime between A.D. 1736 and 1758, during the reign of Kalaniʻōpuʻu, Kamehameha I was born in the *ahupuaʻa* of Kokoiki, North Kohala near Moʻokini Heiau [there is some controversy about his birth year, see Kamakau 1992:66–68]. It has been related that at the time of his birth an army was encamped on the leeward Kohala shore preparing for an attack on Maui (Kamakau 1964; Tomonari-Tuggle 1988). 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] (Kamakau 1992). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

This period was one of continual conquest by the reigning *aliʻi*. In A.D. 1775 Kalaniʻōpuʻu and his forces, who had already conquered Hana in eastern Maui, raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, 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).

History After Contact

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniʻōpuʻu, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. The following January [1779], Cook and Kalaniʻōpuʻu met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail intending to leave the Hawaiian Islands; however, a severe storm off the Kohala coast damaged a mast and he was forced to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

Around A.D. 1780 Kalani‘ōpu‘u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Kū‘kā‘ilimoku to Kamehameha. Many chiefs, concerned about their land claims, which Kiwalao did not seem to honor, preferred Kamehameha as the next ruler. Encouraged by these chiefs Kamehameha usurped Kiwalao’s authority during a sacrificial ritual in Ka‘ū. He then withdrew to his home district of Kohala where he farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). After Kalani‘ōpu‘u died in A.D. 1782 civil war broke out, Kiwalao was killed, and Kamehameha became the ruler of Hawai‘i Island. The wars between Maui and Hawai‘i continued until A.D. 1795 (Kuykendall and Day 1976; Handy and Handy 1972). Several battles were fought in the Hāmākua District during this period, and many of the religious structures in Waipi‘o Valley were destroyed (Hazlett et al. 2007).

In 1793-1794 Captain George Vancouver, who had previously visited Hawai‘i with Cook in 1778-1779, returned leading his own expedition. It was Vancouver who first introduced cattle to the Island of Hawai‘i, giving 17 head to King Kamehameha as a gift (Barrére 1983). Kamehameha placed a *kapu* on the cattle, and they were driven to the upland plain of Waimea to increase and multiply (Vancouver in Kuykendall 1938). Archibald Menzies, a naturalist and surgeon with the Vancouver expedition, wrote the following description of the Hāmākua District in 1793 as he sailed off the coast:

> The land we passed in the forenoon rose in a steep bank from the water side and from thence the country stretched back with an easy acclivity for about four or five miles, and was laid out into little fields, apparently well cultivated and interspersed with the habitations of the natives. Beyond this the country became steeply rugged and woody, forming mountains of great elevation. (Menzies 1920:51)

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. There was a continued trend toward craft and status specialization, intensification of agriculture, *ali‘i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although Western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the end of the 1700s, Hawai‘i saw the beginnings of a market system economy (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Hawai‘i’s culture and economy continued to change drastically as capitalism and industry established a firm foothold during the Historic Period. 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 that led to population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

By 1796 Kamehameha, with the aid of foreign weapons and advisors, had conquered all of the island kingdoms except Kaua‘i. In 1810, when Kaumuali‘i of Kauai gave his allegiance to Kamehameha, the Hawaiian Islands were unified under a single rule (Kuykendall and Day 1976). Kamehameha would go on to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but continued to enforce the rigid *kapu* system.

Kamehameha I died in 1819 at Kamakahonu in Kailua-Kona. With the passing of Kamehameha, his heir Liholiho was given the name of Kamehameha II. Ka‘ahumanu, the favorite wife of Kamehameha, announced the last commands of Kamehameha I:

> O heavenly one! I speak to you the commands of your grandfather. Here are the chiefs; here are the people of your ancestors; here are your guns; here are your lands. But we two shall share the rule over the land. Liholiho consented and became ruling chief over the government (Kamakau 1992: 220):

Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of *'ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs changed:

> 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 (*'ainoa*) 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-ali'i, 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 was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about by 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'kā'ilimoku, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was defeated.

With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. By December of 1819 Kamehameha II had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

With the end of the *kapu* system changes in the social and economic patterns began to affect the lives of the common people. Liholiho moved his court to O'ahu, lessening the burden of resource procurement for the chiefly class on the residents of Hawai'i Island. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early Western visitors. Introduced foods often grown for trade included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845).

In October of 1819, seventeen Protestant missionaries had set sail from Boston to Hawai‘i. They arrived in Kailua-Kona on March 30, 1820 to a society 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 adopt their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali‘i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). In 1823 the Reverend William Ellis, one of the early missionaries, wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 2004:405-406)

Prior to the stop over in Kawaihae, Ellis and his party (fellow missionaries Mr. Thurston, Mr. Bishop, and Mr. Goodrich) had passed through the Hāmākua District. Ellis described the area near the Hilo/Hāmākua border thusly:

> The high land over which we passed was generally woody, though the trees were not large. The places that were free from wood, were covered with long grass and luxurient ferns. The houses mostly stood singly, and were scattered over the face of the country.
>
> A rich field of potatoes or taro, five or six acres sometimes in extent, or large plantations of sugar-cane and bananas, ocassionlly bordered our path. But though the soil was excellent, it was only partially cultivated. The population also appeared less than what we had seen inhabiting some of the most desolate parts of the island. (Ellis 2004:352)

While in Hāmākua, Ellis also elaborated on the Hawaiian methods of marking boundaries:

> The geographical divisions of Hawaii, and other islands of the group are sometimes artificial, and a stone image, a line of stones somewhat distant from each other, a path, or a stone wall, serves to seperate the different districts or larger divisions from each other. They are, however, more frequently natural, as in the present instance, where a water course, winding through the center of the valley, marked the boundary of these two divisions. The boundary of the smaller districts, and even the different farms, as well as the large divisons, are definitely marked, well understood, and permanent.
>
> Each division, district, village, and farm, and many of the sites of houses, have a distinct name, which is often significant of some object or quality distinguishing the place. (Ellis 2004: 352-353)

At Kapulena (to the northwest of the current project area) Ellis’ party split into two groups; Ellis and Thurston continued northwest following the coast to Waipi‘o Valley, and Bishop and Goodrich proceed inland to Waimea, passing nearby the current project area:

> On Monday morning Messers. Bishop and Goodrich commenced their journey to Waimea. Having procured a man to carry their baggage, they left Kapulena, and taking an inland direction, passed over a pleasent country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants. (Ellis 2004:357)

By the mid-nineteenth century, the ever-growing population of Westerners in Hawai‘i forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership, and in 1848 the *Māhele ‘Āina* became the vehicle for determining ownership of native lands. This change in land tenure was promoted primarily by the missionaries and Western businessmen in the island kingdom. Generally these individuals were hesitant to enter business deals on leasehold land. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. During the *Māhele*, all lands in the Kingdom of Hawai‘i were placed in one of three categories: (1) Crown Lands (for the occupant of the throne); (2) Government Lands; and (3) *Konohiki* Lands (Chinen 1958:vii and Chinen 1961:13). 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. As a result of the *Māhele* Honakaia Ahupua‘a was retained as Crown Lands.

All lands awarded during the *Māhele* were subject to the rights of the native tenants therein; those individuals who lived on the land and worked it for their subsistence and the welfare of the chiefs (Sinoto and Kelly 1970). Native tenants could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed at the time of the *Māhele*. The Kuleana Act of December 21, 1849 provided the framework by which native tenants could apply for and receive fee-simple interest in their *kuleana* lands from the Land Commission. The Board of Commissioners over saw the program and administered the lands as Land Commission Awards (LCAw.). Not all lands that were claimed were awarded. A review of the Waihona ‘Aina Database indicates that in Honokaia Ahupua‘a sixteen *kuleana* parcels were claimed, but only twelve were awarded. The awarded parcels ranged from 1.0 to 17.5 acres in size. All of the awarded LCAw. were located well *makai* of the current project area within 3 or 4 kilometers of the coast (Fong et al. 2005). The fact that Honokaia was Crown Land likely limited the number of land commission claims made for the area.

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 throughout the Islands on these newly available lands. In 1850 John Palmer Parker, founder of the Parker Ranch, purchased two acres at a place called Mānā (Grant No. 358), *mauka* of the current project area in Kamoku Ahupua‘a. This land became the nucleus of Parker Ranch (Bergin 2004). The ranch slowly expanded from this center, acquiring and leasing many of the lands of the Kohala and Hāmākua Districts. By the end of the nineteenth century a large portion of Honokaia Ahupua‘a, including the current project area, had been leased by Parker Ranch for cattle grazing purposes (Bergin 2004).

A map of a tract of Hāmākua Government land (Nienie Ahupua‘a) prepared in 1859 by the surveyor S. C. Wiltse shows the relationship between J. P. Parker’s Mānā lands and Honokaia Ahupua‘a (Figure 6). The Parker lands are located in the upper right hand portion of the map. A peach tree is shown marking the corner of that land. The *mauka* line of an “unbroken *‘ōhi‘a* and fern forest” is depicted just to the northeast of the Parker lands, passing by the southwestern corner of Honokaia Ahupua‘a. Along the eastern edge of Honokaia a trail labeled “Honokaia Trail” is shown following the boundary of the *ahupua‘a* to the *mauka* boundary of Kawela Ahupua‘a, where it cuts across that land division. The current project area is located near the bottom of the map *makai* of where the trail cuts across Kawela.

The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region. McEldowney (1983) discusses changes in land use and land ownership before and after the *Māhele*, with the eventual displacement of the Hawaiian community as cattle ranching became fully established in the Waimea area. An 1848 description of the population is as follows: “it can scarcely be said that there is any native population at all” (McEldowney 1983:432). The change in land use and ownership was very deliberate and strategic. Once land became a monetary commodity, Hawaiians were often forced off their house lots (and livelihoods) simply because they lacked the cash with which to make the purchase (of land) or pay the property tax.

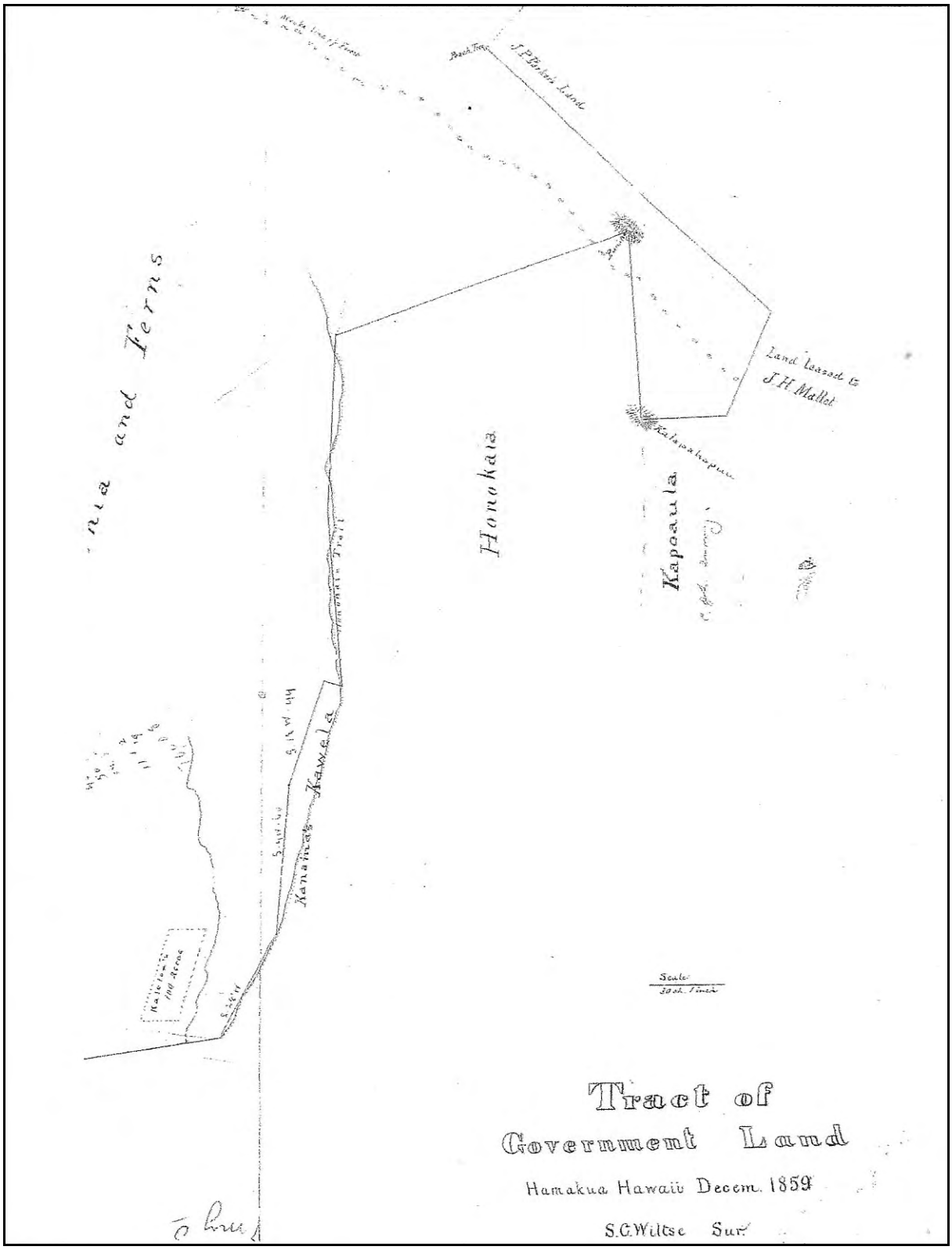


Figure 6. Portion of an 1859 map of a tract of Government land in Hāmākua, Hawai‘i prepared by S. C. Wiltse (in Fong et al. 2005:13)

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of the *ahupua‘a* that were awarded during 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, many of whom had also been claimants for *kuleana* during the *Māhele*. The boundary testimonies were collected primarily between 1873 and 1885 and were usually given in Hawaiian, but transcribed in English as they occurred. Boundary testimony for Honokaia Ahupua‘a was provided to the Boundary Commission by Makaenaena on April 18, 1873. Makaenaena, who was "born before collecting of sandalwood by Boki" (ca. 1829; Kuykendall 1938), may have been about fifty years old at the time of his testimony. In his description Makaenaena not only names several places in the immediate vicinity of the current project area, but provides insights regarding Precontact land use within the *ahupua‘a*. Makaenaena had previously accompanied the Government Surveyor S. C. Wiltse in March of 1873 while he surveyed the boundary between Kawela and Honokaia *ahupua‘a* (Figure 7). Makaenaena's testimony is as follows:

> Makaenaena K. sworn, says:
>
> I was born at Kawela Hamakua, Island of Hawaii, before the time of collecting sandalwood on the mountains. Have always lived on Kawela and Honokaia. I am a kamaaina of these lands. My father Moopua (now dead) showed me these boundaries when I went with him to catch birds. If we caught birds on other lands, the Luna of those lands, would take the birds away from us, and so he pointed out the boundaries to me. Honokaia is bounded on the makai side by the Sea; on the South East side by Kawela and Au 1st, mauka by Kamoko, North West side by Kamoko, Kapoaula and Malanahae. There were always in old times fisheries belonging to Honokaia extending out to sea a short distance. The boundary at the shore between Honokaia and Kawela is a large rock in the Sea called Pohakulelehu: From this point the boundary between these two lands runs mauka to a grove of Puhala trees called Paihala, thence mauka to place at old road called Kuaiwahia: Thence mauka to grove of Puhala trees called Puanapouli: Thence to small hill called Kulanahae: Thence across Government road to hill called Puuainako: Thence to a small mound Wiliwilihalou: Thence to a grove of small ohia trees on the side of a pali at place called Kauluawaa: Thence to waterhole called Kauluawaa: Thence to grove of ohia trees Kuhewa: The place called Ohiakiihelele is on the land Honokaia a short distance from the boundary: From Kuhewa the boundary runs mauka to Kawelaloa: Thence to Kawahine: The boundary from the shore follows up the iwi aina: From Kawahine to to [sic] Inoino gulch, and mauka to a pali called Palinui: The brow of pali is boundary, level land is on Honokaia, and pali on Kawela: Thence along brow of pali and on to Pakeke: Thence to Pohokai: Thence up a ridge to Pohopuumaia, at this point cross the Inoino gulch: Thence to place called Puuloa at the old Kawela road: Thence follow up the old road to Nahaleopaa a puu pahoehoe in Inoino kahawai*:* the mauka corner of Kawela where it is cut off by Au 1st: The place where the boundary of Honokaia enters the woods is at the water hole Kaohiawaa mauka of the grove of ohia trees of the same name.
>
> From Nahaleopaa the boundary between Honokaia and Au 1st follows up the old road Honokaia one side of road and Au 1st on other, to place called Puuokane hekili (a small hill or mound): Thence along road to a hill Puupohaku: Thence to old mamake [sic] ground called Waiakekukai: Thence to Kalapahaaha: Thence to small hill Puulepo: Thence to Waiakahoi a Kahawai with a cave it where the bird catchers used to live: Thence Honokaia ends and Au is cut off by Kamoko: Thence boundary of Honokaia runs along Kamoko to old Mamake ground called Kumaweo: Thence to Mamake grounds called Nakikapio: Thence to a ridge called Makaleha: Thence makai to a hill Kalapaaki: Thence to Kalapa Hapu the mauka corner of land of Kapoaula The corner of Kamoku on boundary of Honokaia.
>
> I went with Wiltse when he surveyed the boundary between Honokaia and Kawela, marked trees and pointed out boundaries. Kaikauna went with us. I was born before the collecting of sandalwood by Boki. . . . (Boundary Commission Transcript April 18, 1873)

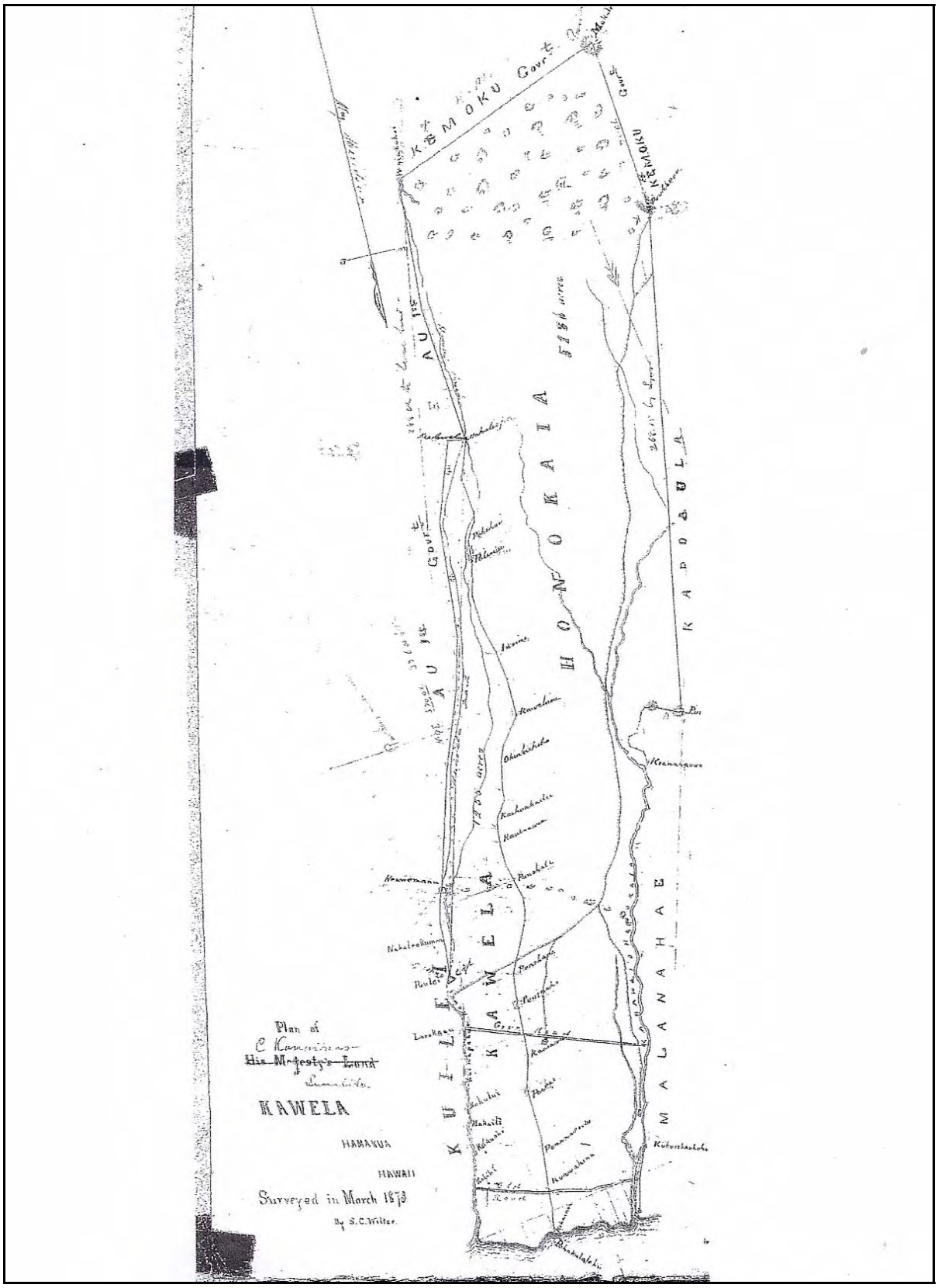


Figure 7. 1873 map of Kawela and Honokaia Ahupuaʻa prepared by S. C. Wiltse (in Fong et al. 2005).

The current project area follows the eastern boundary of Honokaia *mauka* from near the "grove of ohia trees Kuhewa" and "the place called Ohiakiihelele" past Kawelaloa and Kawahine to Inoino Gulch (see Figure 7). According to Makaenaena the boundary is marked from the shore to the *mauka* corner by an *iwi ʻāina* (stones or an earthen ridge; Lucas 1995). Kawelaloa is a small *puʻu* (hill) near the northern termination of the current project area (see Figure 1). Also mentioned in the boundary testimony are several waterholes, *puʻu*, an old road, a cave where bird catchers used to live, and three old "mamake" (*māmaki*) harvesting grounds. This map too, like the 1859 map, shows a trail running across Kawela Ahupuaʻa and then following the eastern boundary of Honokaia Ahupuaʻa, *mauka* of the current project area. On the 1873 map, however, the trail is labeled "Kawela Trail". According to Fong et al. (2005), on an 1853 map of Kapoaula Ahupuaʻa, Honokaia Trail (Alanui o Honokaia) is shown along the western boundary of the *ahupuaʻa* that it shares with Kapoaula.

By the mid to late 1800s the Hawaiian culture was well on its way towards Western assimilation as industry in Hawaiʻi went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar and cattle industries. Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. Sugarcane (*Saccharum officinarum*) was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy. 1972:185). 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. 1972:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903). The Chinese on Lānaʻi are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976).

Following the signing of a reciprocity treaty between the Kingdom of Hawaiʻi and the United States of America in 1876, sugar plantations developed rapidly throughout the islands (Fong et al. 2005). Between 1876 and 1888 twenty sugar plantations sprang up along the Hāmākua coast (Dorrance and Morgan 2000). In 1878 the first sugar mill was established in the Hāmākua District, and due to it's rich soil and plentiful water supply the district soon became the premiere location for growing sugar on the Island of Hawaiʻi (Hazlett et al. 2007). The seaward portions of Honokaia Ahupuaʻa (up to 1,400 feet elevation) were included in the lands of the Honokaʻa Sugar Company (1876-1979). The fields were originally unirrigated and for twenty-five years ratoon crops were grown in many areas because reaching the fields to replant was difficult. Eventually harvesting was accomplished using a combination of hand labor, flumes, and railroad (Dorrance and Morgan 2000).

In June 1906 the Hamakua Ditch Company began construction on an Upper Hāmākua Ditch. The ditch, which brought water from Kawainui Stream in the Kohala Mountains to the Honokaʻa Plantation and beyond, was completed in August of 1907 (Wilcox 1996). In 1909 the Hamakua Ditch Company became the Hawaiian Irrigation Company, and under that name work began on a second ditch, the Lower Hāmākua Ditch, which carried water from Waipiʻo Stream to the Honokaʻa Plantion and beyond. The Lower Hāmākua Ditch was completed in 1910 (Wilcox 1996).

An artical in the 1911 edition of Thrum's *Hawaiian Almanac and Annual* describes the Upper Hāmākua Ditch, which terminated in the vicinity of the current project area:

> . . . The upper ditch, some twenty-three miles in length, of a capacity of 30,000,000 gallons per day, was completed in 1907, in two parts, the first opening January 1, conveying water from the Kawainui stream, at an elevation of 4050 feet in the Kohala mountains, some fifteen miles through ditch tunnels to the Honokaa Plantation and the Pacific Sugar Mill, with terminal for the time at Purdy's gulch, benefiting homesteads en route with a needed supply. March 1 following the ditch was continued eight miles farther to the Paauhau Plantation for irrigating flume purposes. This lower point of delivery is at an elevation of 2300 feet. (Thrum 1911: 139)

The Upper Hāmākua Ditch, although initially a success, eventually failed. The ditch suffered from water loss in the porous soils and inconsistent output. It ran full in times of rain, but dry during times of drought when the irrigation water was most needed (Hazlett et al. 2007). By 1915 the ditch delivered only half of its original water volume, and by 1921 repairs and improvements had replaced most of the original ditch. Further extensive repairs were made to the ditch in 1925 and 1935. By 1948 the Hawaiian Irrigation company no longer cared to renew its water license, and control of the Upper Hāmākua Ditch reverted to the Territorial Government (Wilcox 1996).

By turn of the twentieth century the Honokaʻa Sugar Company had two parallel lines of railroad track that ran the width of its plantation; one at the level of the mill and one seaward of the mill. Cane harvested in the upper fields was flumed to the tracks, washed into railroad cars, and carried to the mill. The excess water was used to irrigate the lower fields (Dorrance and Morgan 2000). Until 1929 the raw sugar produced by the mill was loaded on to lighters at Honokaʻa Landing, taken to inter-island vessels off shore and brought to Honolulu for trans-shipment. After that date until World War II, the sugar was transported to Kukuihaele and loaded, using a cable and trolley system, onto large freighters waiting off shore for direct shipment to San Francisco. From 1946 on the sugar was transported to Hilo by truck for shipment (Dorrance and Morgan 2000). By 1979, several of the Hāmākua plantations had merged to form the Hamakua Sugar Company, a plantation that stretched along the Hāmākua coast for thirty-five miles and inland to a distance of four miles. The sugar company initially prospered, but eventually went bankrupt and closed its doors in 1993 (Hazlett et al. 2007).

The current project area was not part of any sugar plantation. Bergin (2004) indicates that a large portion of Honokaia Ahupuaʻa (3,000 acres), including the current study area, was a Parker Ranch pasture lease prior to 1906. In 1950 this pasture lease reverted back to the Hawaiian Homes Commission and the lands were divided into parcels for use by small ranchers (Bergin 2006). Today the Honokaia lands *mauka* of the Old Māmalahoa Highway have been subdivided into the Honokaia Pastoral lots, which are administered by the Department of Hawaiian Homelands (DHHL). The current project area continues to be leased for ranching purposes and used as pasture.

CURRENT PROJECT EXPECTATIONS

Based on 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, the archaeological expectations for the current study are limited. It is remotely possible that Precontact sites, including trails, temporary habitations, gardens, or resource procurement areas may have been present within the current project area. However, the extensive land use for cattle ranching throughout the late nineteenth and twentieth centuries has significantly altered the landscape. Ranching related features in the project area may include boundary markers, walls, roads, fences or enclosures. Remnants of the Upper Hāmākua Ditch, which once crossed the current project area and was maintained for irrigation purposes until 1948, could also be present.

ARCHAEOLOGICAL FIELDWORK

Matthew R. Clark, B.A., under the direction of Robert B. Rechtman, Ph. D., conducted a visual inspection of the entire access road corridor on October 9, 2009. The route of the corridor, which follows an existing fence line for its entire length, was clearly identifiable in the field. Vegetation within the survey corridor consisted primarily of low grasses, which allowed for excellent ground visibility. Also present during the inspection were Charles Morgan of Planning Solutions, Inc. and Finn McCall of DWS, who pointed out the specifics of the planned route, and Reginald David of Rana Biological Consulting, Inc., who conducted a biological survey at the same time as the archaeological survey. As a result of the pedestrian survey, no archaeological resources of any kind were observed on the surface of the project area, and the likelihood of encountering subsurface archaeological resources is extremely remote given the geology of the area and the history of ranching on the parcels. Also, with the exception of a few easily avoidable *ʻōhiʻa* trees, there were no resources (landforms, vegetation, etc.) of a traditional cultural nature observed within the project area.

The named places along the boundary between Honokaia and Kawela *ahupuaʻa* (see Figure 7) are located to the east of the proposed access road route. At three locations the boundary between these two *ahupuaʻa* is marked with, in addition to the fence line, concrete inscribed with the letter "+" (Figure 8). These markers may be more than fifty years old, but they are located outside of the current project area to the east of the proposed access road route. The fence lines in the vicinity of the project area (two that cross it, and one that parallels it to the east) may have originated during the Parker Ranch lease of the area, but they have been maintained or replaced over the years and appear modern. Only two short sections of fence will have to be removed to allow for the access road to pass through them. These sections will likely be replaced with gates. A tree line (primarily eucalyptus) that runs across the project area following Parcel 006 (see Figure 3), appears to mark the former alignment of the old Upper Hāmākua Ditch as indicated on TMK: 3-4-6-011 (see Figure 2). The tree line follows a steep, north-facing, soil slope where the ditch must have formerly run (Figure 9). However, no evidence of the ditch having existed at this location was observed within the current survey corridor during the pedestrian survey.

Figure 8. Concrete marker along the boundary between Honokaia and Kawela *ahupua'a*, overview to east.

Figure 9. Tree line that marks the former route of the Upper Hāmākua Ditch, view to south.

DISCUSSION OF CULTURAL PROPERTIES AND PRACTICES

As part of a prior study of the DHHL Honokaia Lands *mauka* of the current project area (Fong et al. 2005) an attempt was made to contact several individuals, organizations, and agencies by e-mail regarding traditional cultural properties in Honokaia. Only one organization, *Hui Mālama O Nā Kūpuna O Hawai'i Nei* headed by Mr. Halealoha Ayau, responded to the e-mail. Mr. Ayau indicated that the members of the organization primarily wanted to make sure that cultural monitors were present during excavations to assure that applicable burial treatment laws would be adhered to (see Fong et al. 2005:36). Fong et al. (2005) reviewed several areas of possible cultural concerns for properties that could by impacted by the proposed development of the DHHL lands including archaeological sites, burials, gathering rights, hunting rights, trails, and storied places, but no traditional cultural properties were identified within the area, so no impacts were expected.

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 several individuals were consulted.

Between November 23–25, 2009 phone interviews were conducted with five individuals from the Honokaia 'Ohana group. Those interviewed included Allison Mayeda, Allen H.N. Lindsey, Dolores Ramos, Angela Thomas, and Diana Terukina. These individuals were contacted for possible information regarding any significant past and/or present cultural practices or places within the current project area. Of those interviewed, both Allen Lindsey and Dolores Ramos recall the current project area as being pasture lands as long as they could remember.

On, November 30 2009, a phone interview was conducted with Yvonne L.K. Deluz and her husband Jacinth Deluz Jr. Jacinth grew up in Āhualoa during the 1950s and as long has he remembers the current project area has been ranch land. Another phone interview was conducted on November 30 2009, with Corky Bryant, who is the livestock manager for Parker Ranch. Mr. Byrant also recalls the current study parcel as being ranch land.

The other individuals interviewed had no information regarding significant cultural places or practices which may have occurred within the current project area.

CONCLUSION AND RECOMMENDATIONS

Given the negative findings of the current study, it is concluded that development of the proposed access road route will not significantly impact any known historic properties or any cultural resources and practices of a traditional and customary nature. It is therefore recommended that no further historic preservation work or mitigation is needed.

REFERENCES CITED

Armstrong, R. (editor)
1973 *Atlas of Hawaii*. Honolulu: University of Hawaii Press.

Barrère, D.
1983 Report 2: Notes on the Lands of Waimea and Kawaihae. IN Clark and Kirch (editors) Archaeological Investigation of the Mudlane-Waimea-Kawaihae Road Corridor, Island of Hawaii. Prepared for State of Hawaii, Department of Transportation, B.P. Bishop Museum 1983:25–38.

Bellwood, P.
1978 *The Polynesians, Prehistory of an Island People*. London: Thames and Hudson, Ltd.

Bergin, B.
2004 *Loyal to the Land: The Legendary Parker Ranch, 750-1950. Aloha ʻĀina Paka*. University of Hawaiʻi Press, Honolulu.

2006 *Loyal to the Land: The Legendary Parker Ranch, 1950-1970, Volume II. The Senior Stewards*. University of Hawaiʻi Press, Honolulu.

Cartwright, B.
1933 Some Aliis of the Migratory Period. *Bishop Museum Occasional Papers*, 10(7). Honolulu.

Chinen, J.
1958 *The Great Mahele: Hawaii's Land Division of 1848*. Honolulu: University of Hawaii Press.

1961 *Original Land Titles in Hawaii.* Honolulu: privately published.

Cleghorn, P.
1999 The Results of an Archaeological Inventory Survey at Inoino Bridge, Kawela, Hāmākua, Hawaiʻi. Prepared by Pacific Legacy, Honolulu.

Cordy, R.
1994 A Regional Synthesis of Hāmākua District, Island of Hawaiʻi. Historic Preservation Division, Department of Land and Natural Resources, State of Hawaiʻi.

2000 *Exalted Sits the Chief: The Ancient History of Hawaiʻi Island*. Mutual Publishing, Honolulu.

Dorrance, W., and F. Morgan
2000 *Sugar Islands: The 165-Year Story of Sugar in Hawaii*. Mutual Publishing, Honolulu, Hawaii.

Ellis, W.
2004 *Journal of William Ellis, A Narrative of an 1823 Tour Through Hawaiʻi.* Mutual Publishing.

Fong, J., Shideler, D., and Hammatt, H.
2005 Literature Review, Field Check and Cultural Impact Evaluation For Approximately 2,500-Acres of DHHL Lands at Honokaia Ahupuaʻa, Hāmākua District, Hawaii Island, TMK: 4-6-11: 3, 11, 12, and 13. Cultural Surveys Hawaiʻi Job Code: HONO 64. Prepared for Oceanit, Honolulu, HI.

Fornander, A.
1880 *An Account of the Polynesian Race*. Trubner: London.

1969 *An Account of the Polynesian Race: Its Origins and Migrations.* Tokyo: Charles E. Tuttle Co., Inc.

Handy, E., and E. Handy
1972 *Native Planters in Old Hawai‘i.* B.P. Bishop Museum Bulletin 233. Bishop Museum Press, Honolulu. (With M. Pukui).

Hazlett, A., Shideler, D., and Hammatt, H.
2007 Supplemental Archaeological Surveying, Recordation, Monitoring, Discovery, and Data Recovery Plan for the Hamakua Ditch System, Lālākea, Kukuihaele, Kanahonua, Waio‘eko‘e, Kea‘ā, Pu‘u‘ōpaha, Kalakala‘ula, Mo‘oiki 1, Hanapai, Niupuka, Kana, Pa‘akō, Puanui, Papalapuka, Waikōloa, Wai‘ale‘ale, Kapulena, Ka‘auhuhu, Ke‘ahakea, Hauko‘i, Mo‘oiki 2, Manae, Kapoa‘ula, Malanahae and Honokai‘a Ahupua‘a, Hāmākua District, Hawai‘i Island, Portions of TMK: [3] 4-06, 4-07, and 4-08. Cultural Surveys Hawai‘i Job Code: LALAKEA 1. Prepared for Belt Collins Hawaii, Ltd.

Hommon, R.
1986 Social Evolution in Ancient Hawai’i. IN Kirch, P.V. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.

Hono-ko-hau Study Advisory Commission
1974 The Spirit of Ka-Loko Hono-Ko-Hau. National Park Service, U.S. Department of the Interior.

Kamakau, S.
1964 Ka Po‘e Kahiko: The People of Old. B.P. *Bishop Museum Special Publication* 51. Bishop Museum Press.

1976 The Works of the People of Old: Na hana a ka Po‘e Kahiko. *B.P. Bishop Museum Special Publication 61*. Bishop Museum Press, Honolulu.

1991 *Tales and Traditions of the People of Old*. Honolulu: Bishop Museum Press.

1992 *Ruling Chiefs of Hawaii*. The Kamehameha Schools Press, Honolulu (revised edition).

Kent, N.
1983 *Hawaii: Islands Under Influence*. University of Hawai’i Press, Honolulu.

Kirch, P.
1984 *Evolution of the Polynesian Chiefdoms*. Cambridge University Press, New York.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* Honolulu: University of Hawaii Press.

1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).

Kuykendall, R.
1938 *The Hawaiian Kingdom 1778–1854. Foundation and Transformation*. Honolulu: University Press of Hawaii.

Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood*. Prentice-Hall, Inc., Englewood Cliffs.

Lucas, P. (editor)
1995 *A Dictionary of Hawaiian Legal Land-Terms*. Native Hawaiian Legal Corporation. University of Hawai‘i Committee for the Preservation and Study of Hawaiian Language, Art and Culture: Honolulu.

MacDonald, and Abbot
1970 *Volcanoes in the Sea: the Geology of Hawaii.* Honolulu: University of Hawaii Press.

Malo, D.
1903 Hawaiian Antiquties. *B.P. Bishop Museum Special Publication 2*. Bishop Museum Press, Honolulu.

McEldowney, H.
1983 A Description of Major Vegetation Patterns in the Waimea-Kawaihae Region During the Early Historic Period. Report 16, in Jeffrey T. Clark and Patrick V. Kirch (eds.), Archaeological Investigations of the Mudlane-Waimea-Kawaihae Road Corridor, Island of Hawai‘i, pp.407-445. Department Report 83-1. Dept. of Anthropology, Bernice P. Bishop Museum, Honolulu.

Menzies, A.
1920 *Hawaii Nei, 128 Years Ago.* Edited by William F. Wilson. Honolulu: The New Freedom Press.

Oliver, D.
1961 *The Pacific Islands*. University of Hawaii Press, Honolulu.

Pogue, J.
1978 Moolelo Hawaii. Hale Paipalapala Aupuni, Honolulu (Revised Edition).

Sinoto, Y., and M. Kelly
1970 Archaeological and Historical Survey of Pakini-Nui and Pakini-Iki Coastal Sites, Waiahukini, Kailikii, and Hawea, Ka‘u, Hawaii. *Departmental Report Series* 75-1. Department of Anthropology, B.P. Bishop Museum, Honolulu.

Thrum, T.
1911 Hamakua Ditch Opening. *Hawaiian Almanac and Annual for 1911*. Thos. G. Thrum, Honolulu.

Williams, J.
1919 A little Known Engineering Work in Hawaii. In Thrum’s *Hawaiian Almanac and Annual for 1919*. Thos. G. Thrum, Honolulu.

Wilcox, C.
1996 *Sugar Water: Hawaii’s Plantation Ditches*. University of Hawai‘i Press, Honolulu.

Wilkes, C.
1845 *Narrative of the United States Exploring Expedition During the Years 1838–1842, Under the Command of C. Wilkes, U.S.N.*, Volume 4. Philadelphia: Loa and Blanchard.