DRAFT ENVIRONMENTAL ASSESSMENT

KEOPU WELL, RESERVOIR, AND WATER TRANSMISSION LINES

Hienaloli 1-6, North Kona, Hawai'i

Hawaii Housing Finance &
Development Corporation

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September 2009

Prepared for:

Hawaii Housing Finance & Development Corporation
State of Hawai'i

Prepared by:

Belt Collins Hawaii Ltd.
Honolulu, Hawai'i

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ACRONYMS AND ABBREVIATIONS

BLNR	Board of Land and Natural Resources (State of Hawai'i)
BMP	Best Management Practices
CDUP	Conservation District Use Permit
CDP	Community Development Plan
CIA	Cultural Impact Assessment
CWRM	Commission on Water Resource Management (State of Hawai'i)
dBA	A-weighted decibels
DHHL	Department of Hawaiian Home Lands (State of Hawai'i)
DLNR	Department of Land and Natural Resources (State of Hawai'i)
DOH	Department of Health (State of Hawai'i)
DPW	Department of Public Works (County of Hawai'i)
DWRM	Division of Water Resource Management (State of Hawai'i)
DWS	Department of Water Supply (County of Hawai'i)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Emergency Medical Service
FEMA	Federal Emergency Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
gpm	gallons per minute
HAR	Hawai'i Administrative Rules
HELCO	Hawaii Electric Light Company
HHFDC	Hawaii Housing Finance and Development Corporation (State of Hawai'i)
HRS	Hawai'i Revised Statutes
IWS	individual wastewater system
Keahuolu Project	HHFDC's Planned Keahuolu Affordable Housing Development

Keopu Well	Keopu-HFDC Well No. 3957-05 or Keopu-HFDC Exploratory Well No. 1
MAV	moving average
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
msl	mean sea level
ND	not detected
NPDES	National Pollutant Discharge Elimination System
OEQC	Office of Environmental Quality Control
PHRI	Paul H. Rosendahl, Ph.D.
Planning Act	Hawai‘i State Planning Act
ppb	parts per billion
ppm	parts per million
SCADA	Supervisory control and Data Acquisition
SHPD	State Historic Preservation Division
SMA	Special Management Area
SO_2	sulfur dioxide
SY	sustainable yield
TCP	Traffic Control Plan
TMK	Tax Map Key
UIC	Underground Injection Control
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
vog	volcanic emissions
WUDP	Water Use and Development Plan (County of Hawai‘i)

1 SUMMARY

PROPOSING AGENCY:	Hawaii Housing Finance & Development Corporation (HHFDC)
APPROVING AGENCY:	HHFDC
GENERAL PROJECT DESCRIPTION:	The HHFDC is proposing to convert an existing exploratory well (Keopu-HFDC Well No. 3957-05) in Hienaloli 1-6 to a production well to serve as an additional source to the Hawaiʻi County Department of Water Supply's (DWS) system currently serving the North Kona District of the island of Hawaiʻi. When completed, the new production well and associated control building, reservoir (with capacity of up to 2.0 million gallons (MG)), and transmission lines will be turned over to the County DWS for full operation.
PROJECT LOCATION:	The well site is located along Mamalahoa Highway approximately 3.3 miles south of the Mamalahoa Highway-Palani Road Junction. The Tax Map Key (TMK) for the State-owned land is (3) 7-5-13: 22. The well's associated transmission lines will be located within Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street.
PRELIMINARY DETERMINATION:	Anticipated Finding of No Significant Impact (FONSI)
CONSULTED AGENCIES:	**State Agencies** Environmental Management Division, Department of Health (DOH) Division of Water Resource Management, Department of Land and Natural Resources (DLNR) Land Division, DLNR State Historic Preservation Division, DLNR **County Agencies** Planning Department Department of Public Works (DPW) Department of Environmental Management Department of Water Supply (DWS) Police Department

2 DESCRIPTION OF PROPOSED ACTION

2.1 Project Objective

The objective of the proposed action is to develop a supplemental source of potable water for the North Kona Water System to serve North Kona DWS customers including HHFDC's planned Keahuolu affordable housing development (referred to as "Keahuolu Project") (see Figure 1).

HHFDC seeks to convert the existing exploratory well, Keopu-HFDC Well No. 3957-05[1] (also known as Keopu-HFDC Exploratory Well No. 1), in the Hienaloli 1-6 land tract of North Kona, into a production well and construct an accompanying control building and reservoir with a capacity of up to 2.0 MG (see Figures 1 and 2). The existing well, hereafter referred to as Keopu Well, has been pump tested and its results have shown a sustainable yield of at least 2.0 million gallons per day (MGD).

HHFCD also proposes to install transmission lines to connect the Keopu Well with the North Kona Water System so DWS can distribute the water to area customers as well as the Keahuolu Project. The new water lines will be located within Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street (see Figures 1 and 3).

2.2 Background

2.2.1 Growth of Kealakehe and Keahuolu Areas in North Kona

The population in the North Kona District has more than doubled over the past 25 years, driven by resort development and a second-home residential market. In the center of the district is Kailua-Kona, a thriving urban center that has become a hub for government, commercial, industrial, and resort services and facilities for West Hawaiʻi. As of 2002, Kailua-Kona had 165 retail establishments with gross sales of $410 million, 24 percent of the island's total. The retail workforce alone in Kailua numbered 2,174.

Of the 10,000 people who work in Kailua-Kona, approximately 70 percent commute to the town center from other places on the island.[2] Hawaiʻi County recognizes this logistical pattern and has prepared plans calling for increased affordable housing in the Kailua-Kona area and help residents with commuting needs. HHFDC and the Hawaiʻi State Department of Hawaiian Home

[1] Well number designated by Commission on Water Resource Management, State of Hawaiʻi.

[2] This Census calculation is for the Kailua-Kona Census Designated Place. Residents of the subdivisions to the north of Kailua-Kona such as Kona Palisades would count as "commuters" to Kailua-Kona along with residents of more distant areas (US Census data calculated by DBEDT, available at http://www.hawaii.gov/dbedt/info/census/Folder.2005-10-13.2927/DaytimePop).

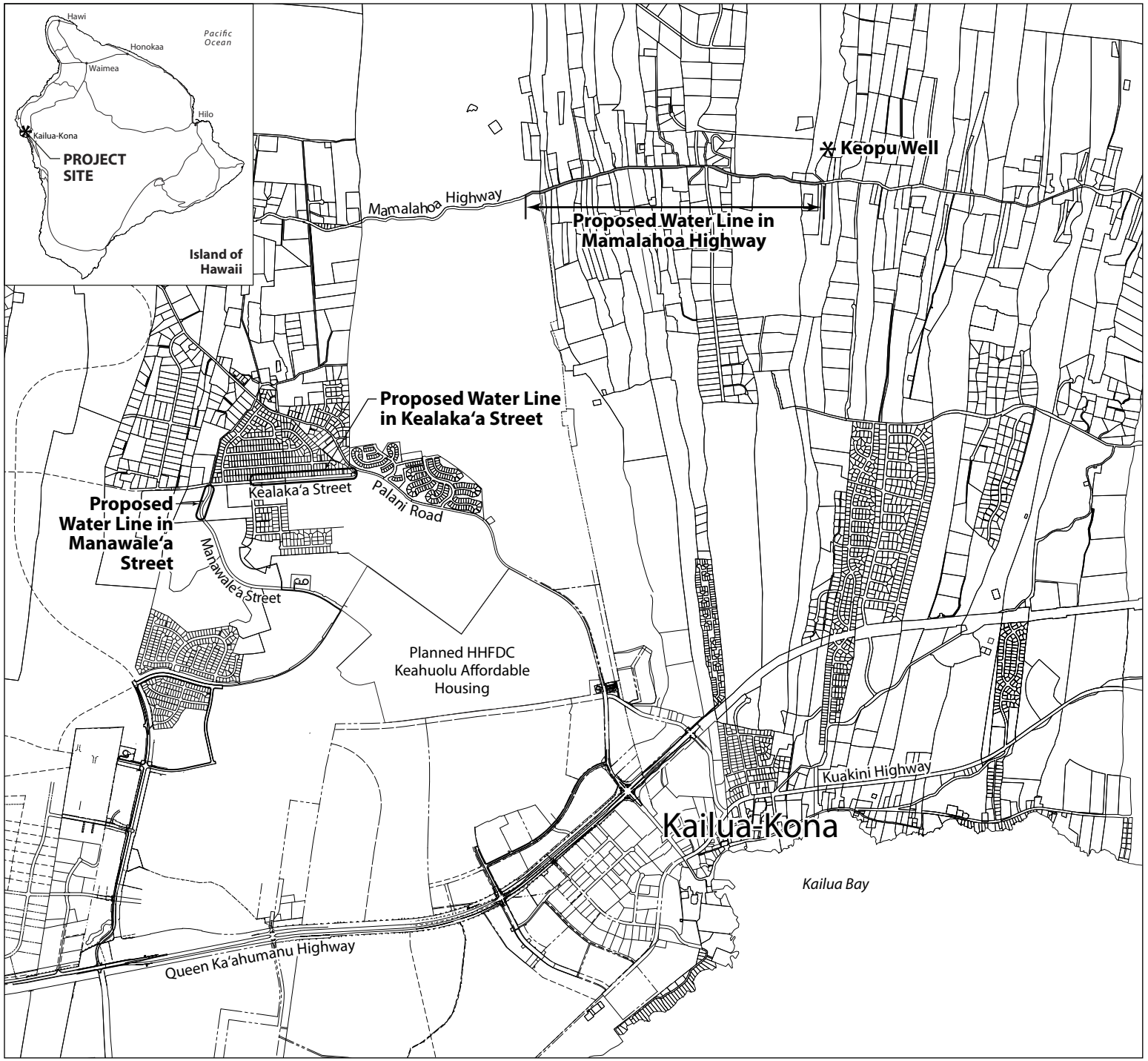

Figure 1
LOCATION MAP

NORTH

0 1500 3000
SCALE IN FEET

Keopu Well
North Kona, Hawaii

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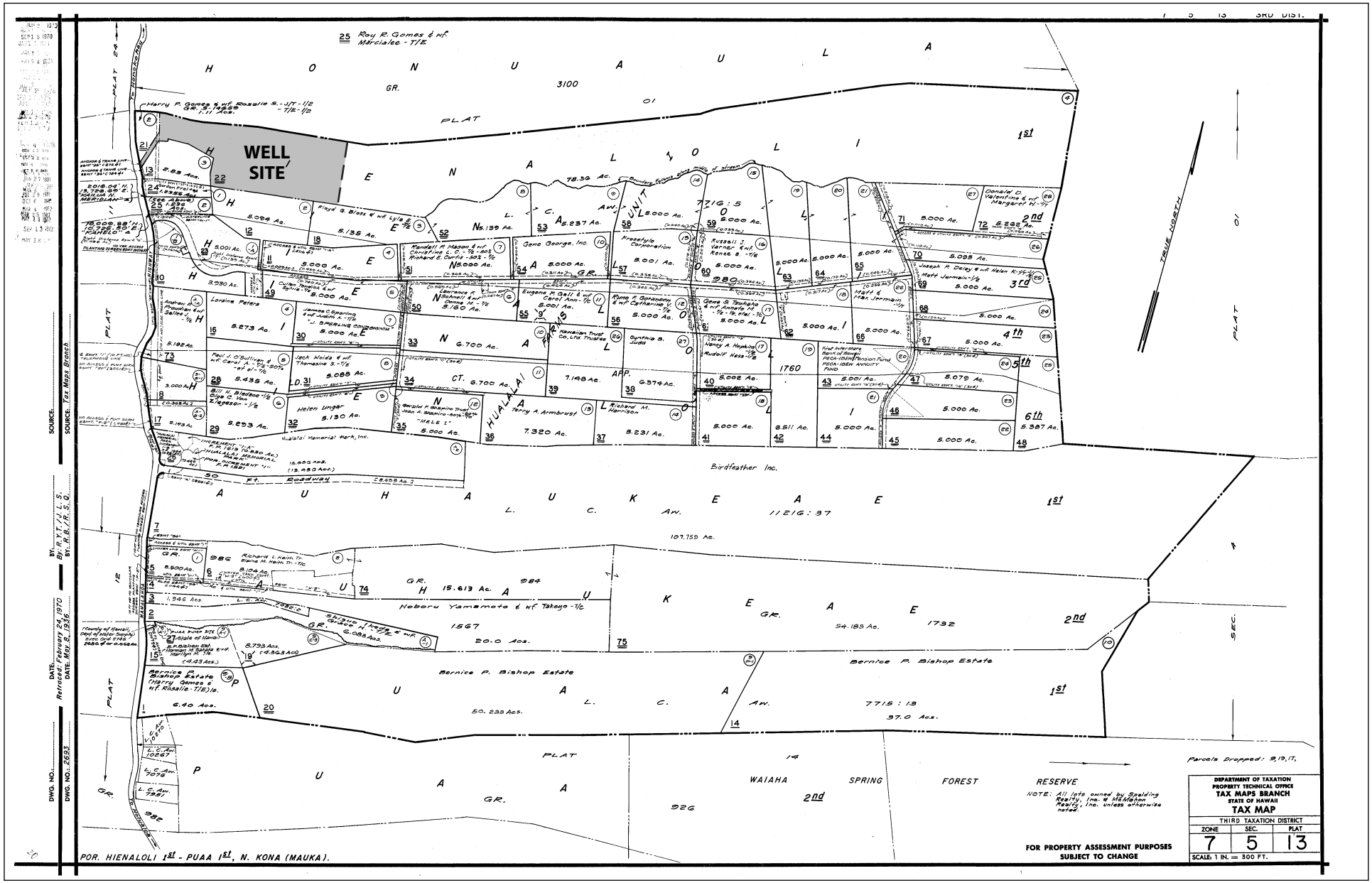

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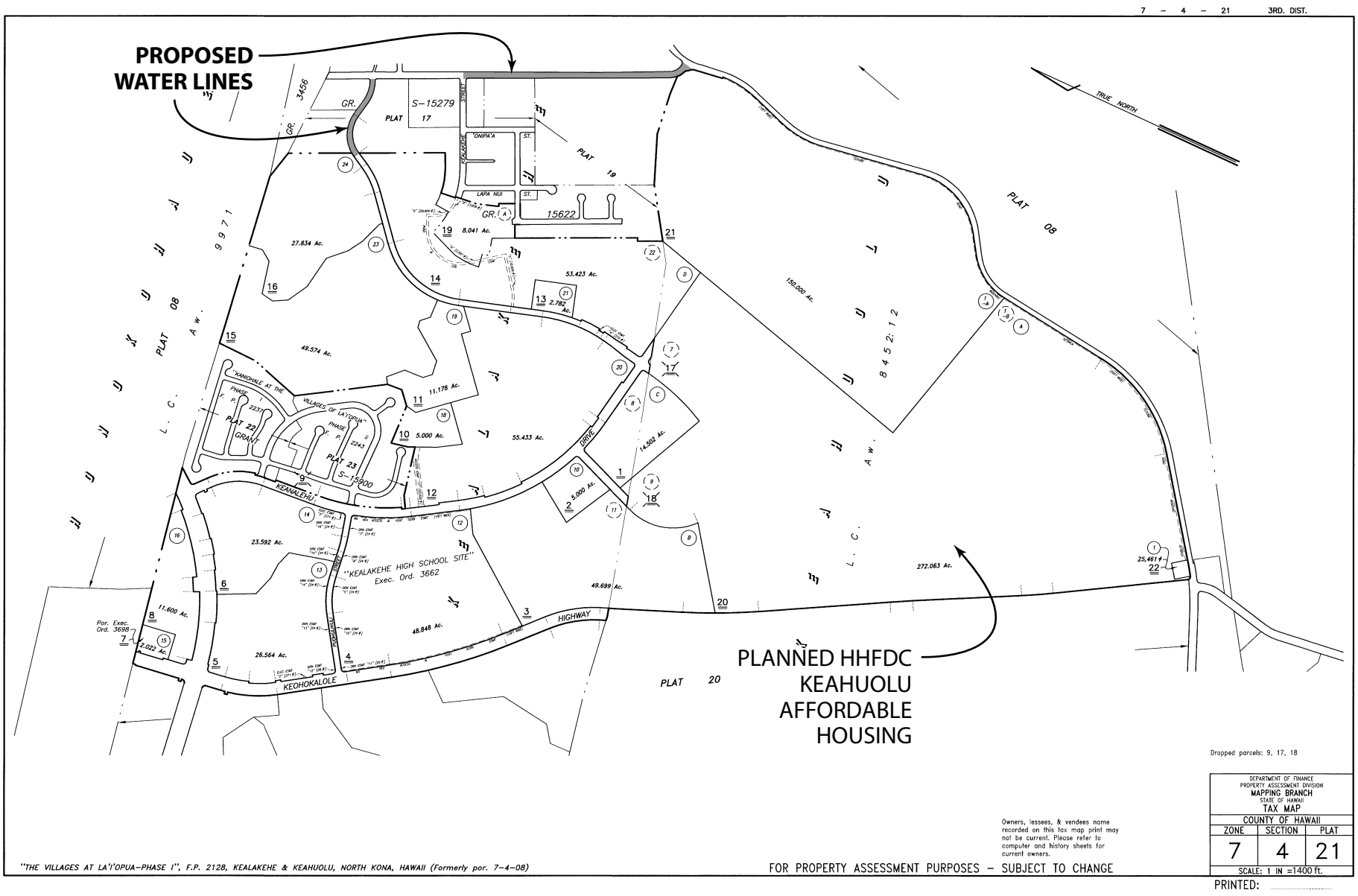
NORTH

0 250 500 1000

SCALE IN FEET

Figure 2
TAX MAP OF KEOPU WELL SITE
Keopu Well
North Kona, Hawaii



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NORTH

0 350 700 1400

SCALE IN FEET

Figure 3
TAX MAP OF WATER LINE SITE
Keopu Well
North Kona, Hawaii

Lands (DHHL) have developed or are planning to develop a number of affordable homes in the nearby Kealakehe and Keahuolu areas.

2.2.2 Discovery of High-Level Water in Uplands North Kona

In the early 1990s, fierce competition emerged in the region among landowners, developers, and other water purveyors because water availability became crucial to any type of development. The State Commission on Water Resource Management (CWRM) stepped in and found they needed to gather pertinent data on baseline water levels to mediate the problem and avoid major disputes.

A September 2003 *Study of the Ground-Water Conditions in North and South Kona and South Kohala Districts, Island of Hawaii, 1991-2002,* Glenn Bauer gathered 10 years of baseline water-level data.[3] Many of the wells were drilled by private landowners, public utilities, and State government, who invested large sums of money to drill the wells for the economic benefit of the island.

Groundwater in Hawai‘i County is the primary source of drinking water. It occurs in Kona as both basal groundwater and high-level groundwater. The basal lens in the region is relatively thin and inconsistent due to low rainfall and high permeability. Wells drawing from the basal groundwater are susceptible to salinity if drilled too deep or over-pumped.

Then in the 1990s, exploratory wells drilled above the 1,600-foot elevation encountered high-level groundwater 25- to 460-feet above sea level. The protection of this high-level groundwater is important since it has a significant potential for serving Kona.

2.2.3 Hawai‘i County Water Use and Development Plan

The Hawai‘i County Water Use and Development Plan (WUDP) serves as a continuing long-range guide for water resource development in the County. Its objective is “to set forth the allocation of water to land use through the development of policies and strategies which shall guide the County in its planning, management, and development of water resources to meet projected demands.”

In the current Hawai‘i County WUDP update,[4] a combination of water resource enhancement measures is recommended for each of the nine aquifer sectors on the island based upon an evaluation of its existing water resources, existing water uses, and future water needs.

According to the WUDP, the DWS has one water supply system in North Kona, which is the second largest system on the island. Most of the North Kona district population lies within the Hualalai Aquifer Sector. Water demands in this aquifer are the highest on the island due to the significant expansion associated with the increases in population and tourism over the past 20 years. The Hualalai Aquifer Sector is subdivided into a Kiholo Aquifer System and a Keauhou Aquifer System and their common boundary lies along Hualalai’s main northwest-southeast rift

[3] Information in this section from Glenn Bauer’s September 2003, *Study of the Ground-Water Conditions in North and South Kona and South Kohala Districts Island of Hawaii, 1991-2002*, prepared for DLNR CWRM.

[4] *Hawaii County Water Use and Development Plan Update*, Draft Report, December 2006.

zone. The average rainfall in the Keauhou Aquifer System, which contains the proposed production well, ranges from less than 20 inches along the region's northwest coast to about 125 inches in the Kahaluʻu Forest Reserve. This recharge of rainfall in the aquifer system results in a groundwater resource estimated by the CWRM to have a sustainable yield of 38 MGD. Existing water use of this aquifer system is estimated at 11.31 MGD, of which 9.44 MGD is purveyed by the DWS. Including agricultural use of the aquifer, the total usage would be 12.02 MGD.

Water resource planning in the WUDP considers both land use policy-based and population and growth rate-based water demand projections to plan for future water needs. For the Keauhou Aquifer System, land use policy-based water demand projections associated with full build-out development densities in the Hawaiʻi County General Plan Land Use Pattern Allocation Guide and the Hawaiʻi County Zoning Code both exceed the sustainable yield. Water demand based on the population and growth rate (through the horizon year 2025) is projected to remain below the sustainable yield.

Although population and growth rate-based projections indicate that water demand in the Keauhou Aquifer System will not approach the sustainable yield for some time, the WUDP advises that measures to control future water demands should be considered. Water conservation is the responsibility of the community, but must be facilitated by the potable water purveyors. The WUDP recommends that the DWS, being the largest provider of potable water in the Keauhou Aquifer System, develop water conservations programs aimed primarily at demand-side measures to reduce average consumption per user. Most importantly, the concept of using the highest quality water for the highest end use should be followed.

The WUDP proposes that efforts should be initiated to utilize reclaimed wastewater and brackish basal groundwater for non-potable uses, thereby reserving potable water for potable domestic use. Exploration of groundwater development and subsequent water transfers from the adjacent Kealakekua Aquifer System are possible backup resources should sources in the Keauhou Aquifer System become stressed.

2.2.4 Villages of Laʻiʻopua Water Master Plan

In August 2006, the *Villages of Laʻiʻopua Water Master Plan* was completed for the DHHL. The plan was substantially reviewed and its improvement concepts were generally approved by the DWS in October 2006. The plan identifies potential sources of water and required water distribution system improvements to serve DHHL's planned Villages of Laʻiʻopua located in Kealakehe and Keahuolu. The *Villages of Laʻiʻopua Water Master Plan* also includes service to a portion of HHFDC's Keahuolu Project, which (affected portion) was initially part of DHHL lands.

The water master plan recognizes four wells as potential sources for potable water: Kealakehe Well (State Well No. 4057-04), North Keopu Well (site only), North Keopu Well (State Well No. 3957-02), and Keopu Well (State Well No. 3957-05). The wells are all inactive (except North Keopu Well which is only a well site) and are located above Mamalahoa Highway in the high-level groundwater zone of the Keauhou Aquifer System. The wells are all owned by DWS, except the State-owned Keopu Well, which is the currently proposed production well for HHFDC.

2.2.5 HHFDC's Keahuolu Project

In 2007, HHFDC prepared a master plan for a residential community of up to 2,330 residential units, a commercial/retail district, a civic square, a school site, neighborhood parks, an archaeological preserve, and landscaped buffers and open space.

To supply water for the Keahuolu Project, HHFDC looked to the potential sources identified in the *Villages of Laʻiʻopua Water Master Plan*.

An Environmental Impact Statement (EIS) was prepared in late 2007 for the Keahuolu Project, and on October 8, 2008, a notice of the Final EIS was published in the Office of Environmental Quality Control's (OEQC) *The Environmental Notice*. Construction of the Keahuolu Project may begin as soon as 2011, after all land use approvals and construction permits are secured from the State and County agencies.

2.2.6 Identification of Keopu Well for the Keahuolu Project

As provided in the *Villages of Laʻiʻopua Water Master Plan,* the Keopu Well is identified as a potential source of potable water for the Laʻiʻopua lands of DHHL and HHFDC's Keahuolu Project. After conversion of the Keopu Well into a production well and construction of its associated control building and reservoir with a capacity of up to 2.0 MG, HHFDC plans to dedicate the facilities to the DWS. The DWS indicated that HHFDC would be able to use two-thirds of the yield and the remaining one-third would be made available to other DWS customers.

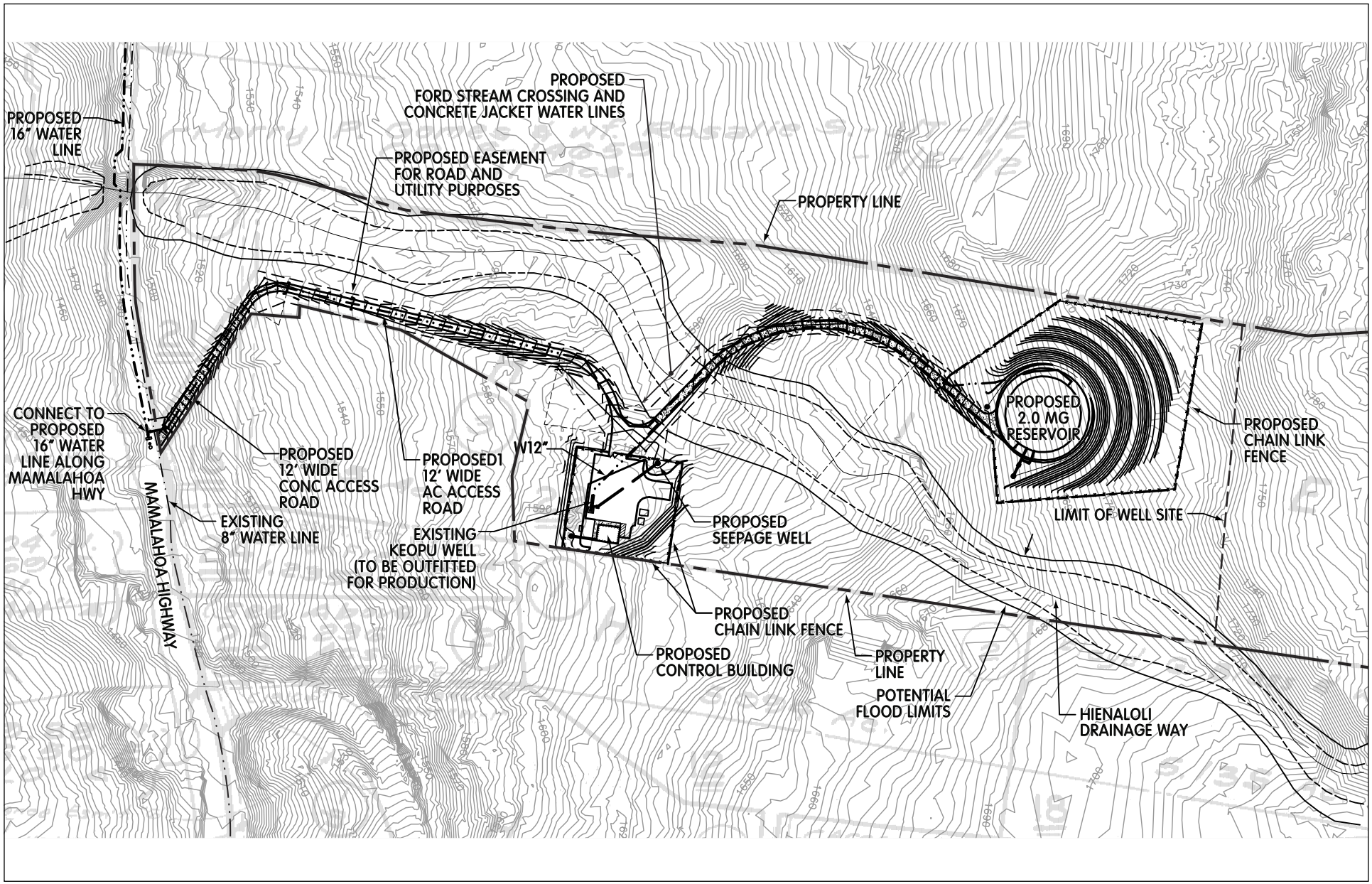
2.3 Proposed Action

2.3.1 Production Well

Keopu Well is located mauka of Mamalahoa Highway at the 1,601-foot elevation of the Hienaloli 1-6 land tract in North Kona. It has an existing depth of 1,799 feet (-198 feet, mean sea level (msl)) and a steel casing with a diameter of 18 inches to a depth of 1,641 feet. The pump used for initial pump tests has been removed, and the well is presently capped.

HHFDC is proposing to convert the existing exploratory well into a production well capable of producing up to 2.0 MGD (see Figures 4, 5, 6, and 7). Outfitting the well for production would require installation of a submersible or line shaft pump. A groundwater sensor will also be installed to monitor groundwater levels in the aquifer. Re-casing of the well will not be necessary as the present casing is adequate. The pump will be operated by electricity, and a control building will be constructed to provide control and monitoring of well operations. The control building will also include a chlorination unit and backup generator.

The well will also include a reservoir with a capacity of up to 2.0 MG to be located above the control building at the site's 1,672-foot elevation. The reservoir will be designed to DWS specifications and include an in-flow line from the well and an out-flow line to the proposed 16-inch diameter transmission line along Mamalahoa Highway. A chain link fence will be erected around the well and control building and the reservoir for security purposes.



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NORTH

0 100 200

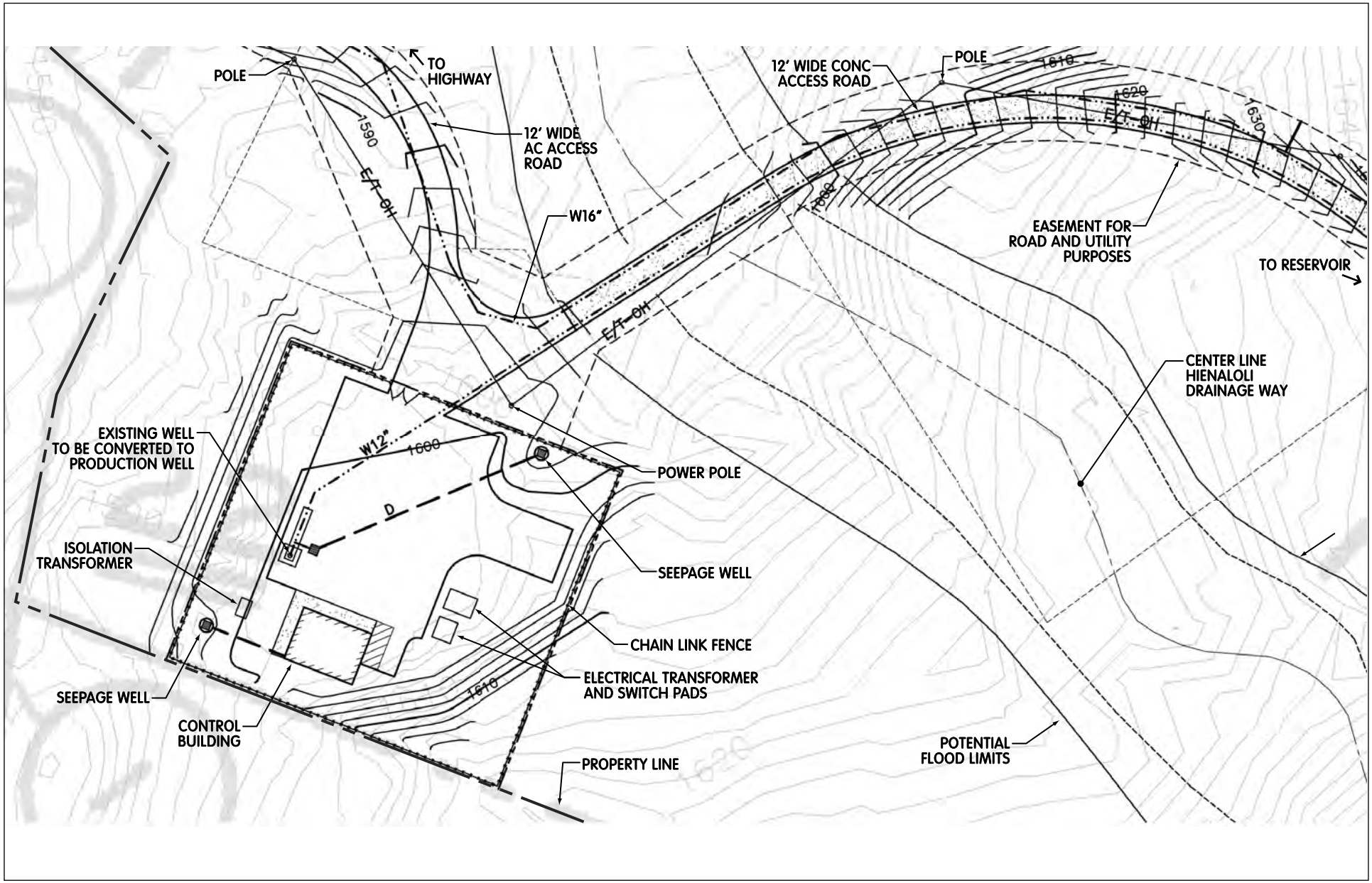
SCALE IN FEET

Figure 4

PROPOSED PRODUCTION WELL AND APPURTENANT FACILITIES

Keopu Well

North Kona, Hawaii



BELT COLLINS

NORTH

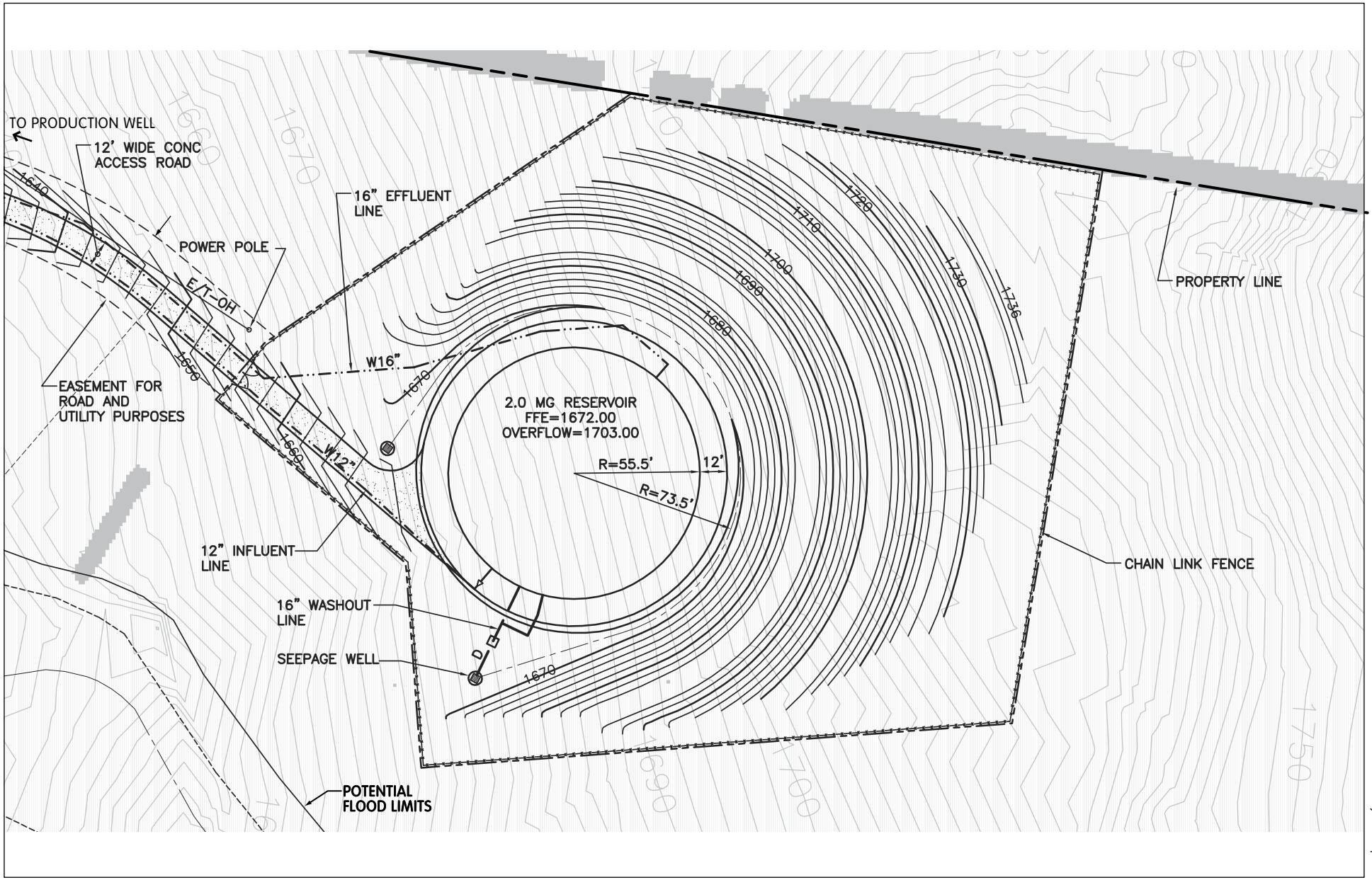
0 30 60

SCALE IN FEET

LEGEND

W	Water
E/T	Electrical/Telephone
OH	Overhead
D	Drain

Figure 5
PROPOSED KEOPU WELL AND CONTROL BUILDING
Keopu Well
North Kona, Hawaii



BELT COLLINS

NORTH

0 15 30 60

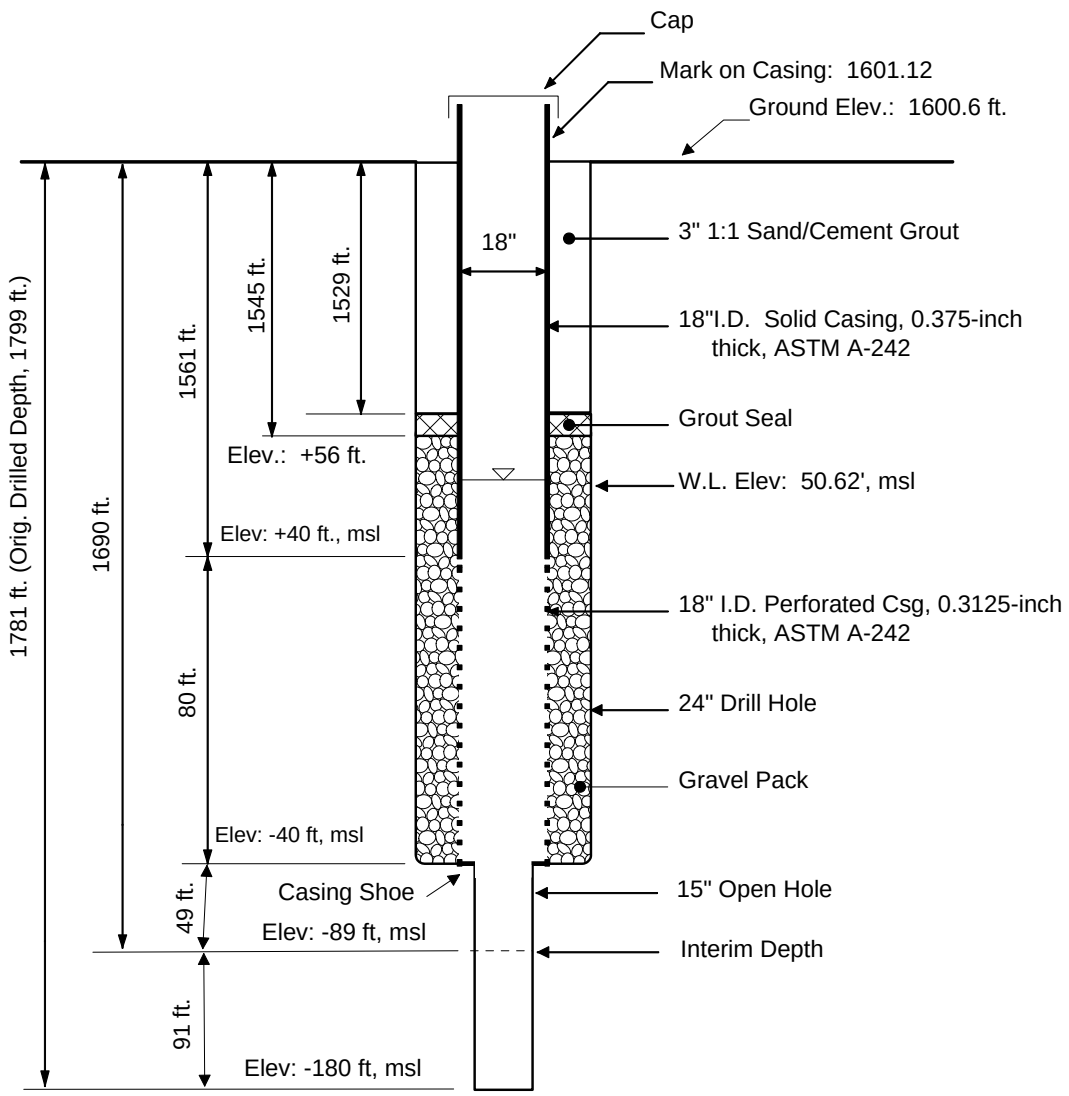
SCALE IN FEET

LEGEND

W	Water
E/T	Electrical/Telephone
OH	Overhead
R	Radius
D	Drain

Figure 6
PROPOSED 2.0 MG RESERVOIR
Keopu Well
North Kona, Hawaii

Figure 7
SECTION OF PROPOSED PRODUCTION WELL



Source: Water Resource Associates

Keopu Well
North Kona, Hawaii

An existing 900-foot long, dirt jeep road from Mamalahoa Highway to the well facility will be paved to provide improved access for facility monitoring and maintenance purposes. Another 640-foot long, paved driveway will be installed from the well facility to the reservoir. A section of the latter driveway will require crossing an existing natural drainage channel. A concrete ford stream crossing is proposed for that location. Power and telecommunication lines will be installed on utility poles following the new driveway from Mamalahoa Highway to the on-site well facilities.

2.3.2 Transmission Lines

Connecting the production well and reservoir to the County water system will require the construction of three water transmission lines. HHFDC is proposing to install a 16-inch diameter line along Mamalahoa Highway from the well site to an existing 16-inch County line in North Kona's Keahuolu land tract, a distance of approximately 7,000 feet (see Figures 1, 8, and 9). The new line will be located entirely within the existing County right-of-way.

Additionally, HHFDC will construct two new lines in the lower Keahuolu area where the planned Keahuolu Project is located (see Figures 1 and 10). Along Kealakaʻa Street, HHFDC will install an approximately 2,420 linear-foot, 12-inch diameter water line to accompany the road's existing 8-inch water line. Along Manawaleʻa Street, HHFDC will install an approximately 800 linear-foot, 12-inch diameter line to connect with existing DWS lines in that area. The new water lines will be constructed entirely within the County's rights-of-way and will supplement the network of interconnecting distribution lines in Kealakehe and Keahuolu.

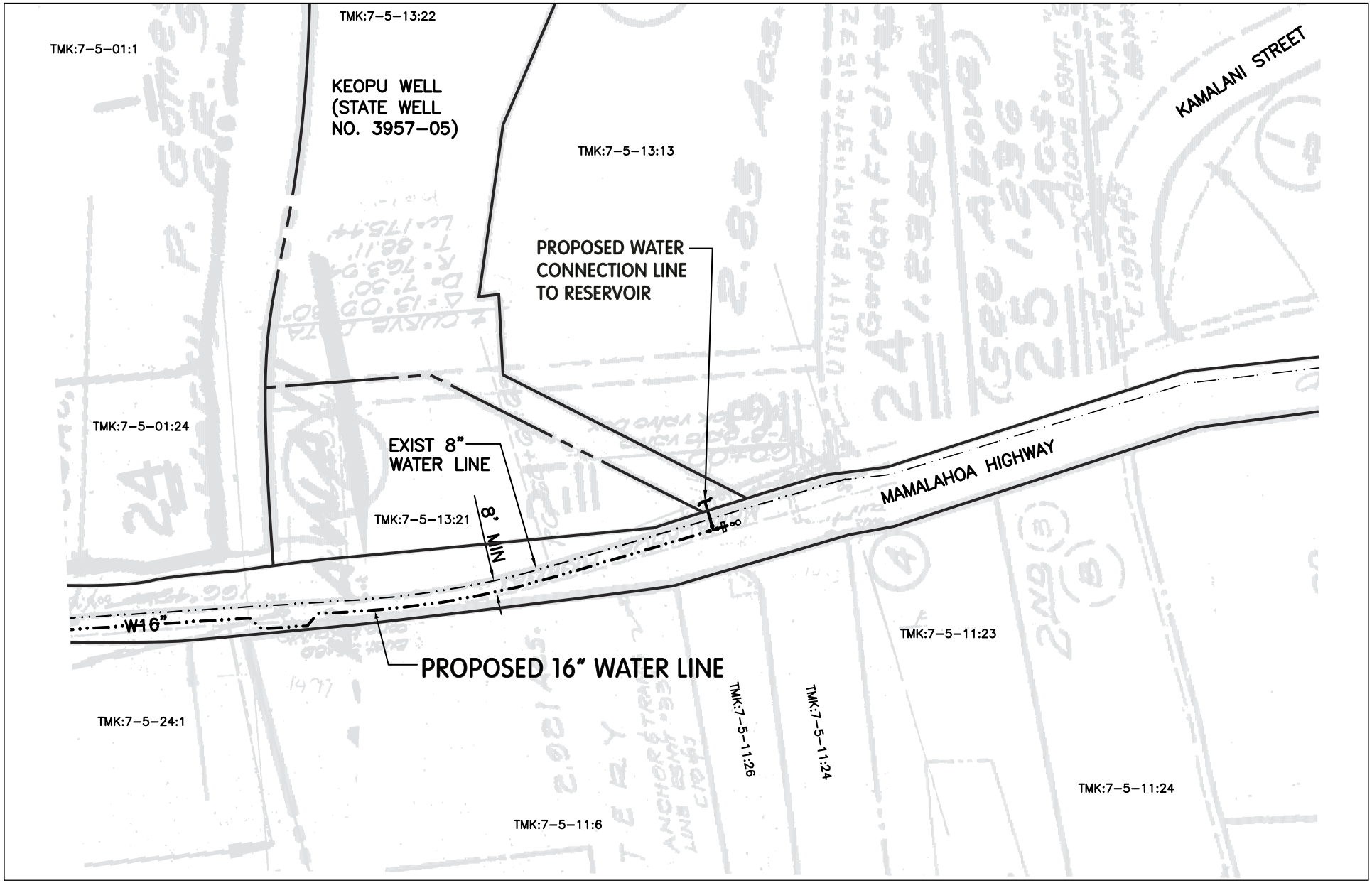
2.4 Estimated Cost

The order-of-magnitude cost for construction of the production well, control building, reservoir, and associated facilities in addition to the water lines along Mamalahoa Highway and Manawaleʻa Street is approximately $13.3 million.[5] The source of funding for the project is anticipated to be the State Legislature through the State's Capital Improvement Program, HHFDC's Dwelling Unit Revolving Fund, and/or private funds.

2.5 Construction Schedule

Construction of the well facilities is expected to begin in the first quarter of 2011 and be completed approximately 6 to 12 months thereafter. Installation of the water lines would occur simultaneously with the well construction.

[5] Belt Collins estimated the order-of-magnitude construction cost for the Keopu Well, control building, reservoir and ancillary equipment to be $9.7 million, and the construction of the proposed water lines in Mamalahoa Highway, Kealakaʻa Street and Manawaleʻa Street to be $3.6 million in 2009 dollars. These estimates include planning and design fees.



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NORTH

0 30 60 120

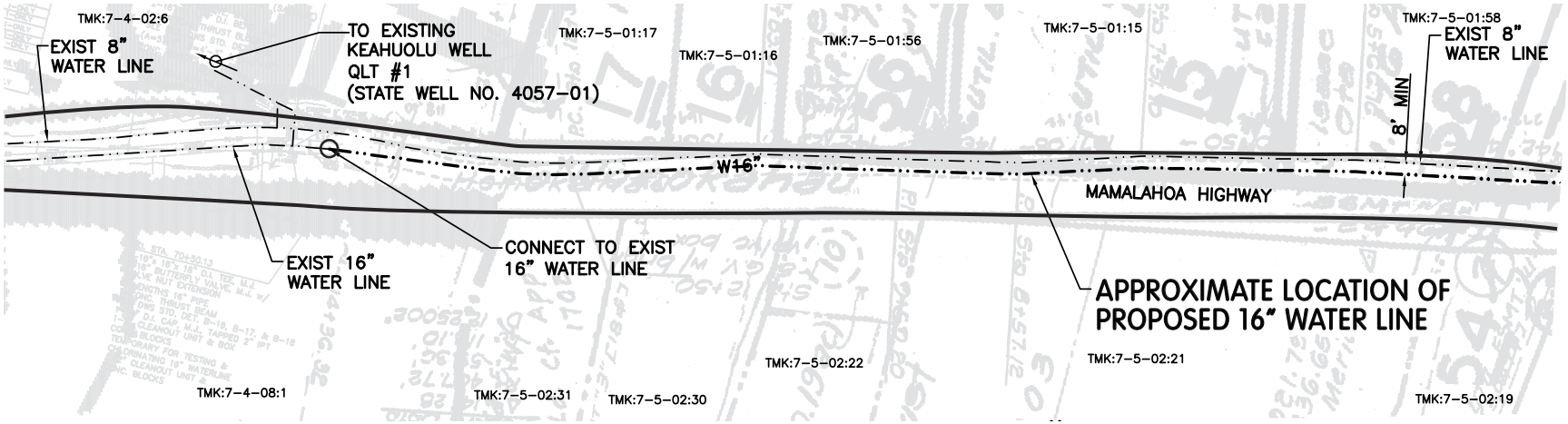
SCALE IN FEET

Figure 8

PROPOSED MAMALAHOA HIGHWAY 16" WATER LINE—SOUTH TERMINUS

Keopu Well

North Kona, Hawaii



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NORTH

0 75 150

SCALE IN FEET

Figure 9

PROPOSED MAMALAHOA HIGHWAY 16" WATER LINE—NORTH TERMINUS

Keopu Well

North Kona, Hawai

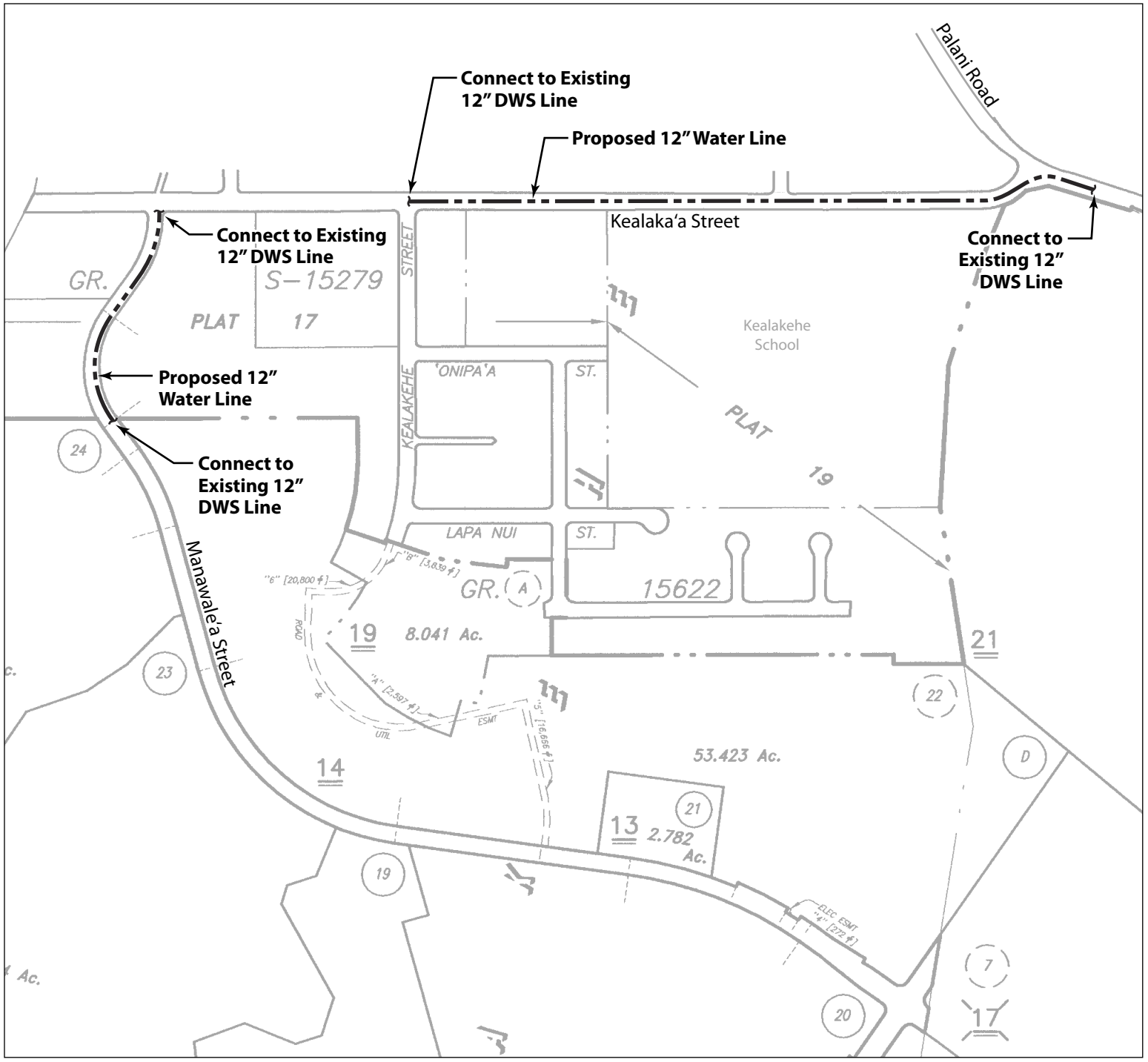

Figure 10
PROPOSED WATER LINES IN KEAHUOLU

NORTH 0 250 500 SCALE IN FEET

Keopu Well
North Kona, Hawaii

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3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Existing Land Use and Well

3.1.1 Land Use

The approximately 13.4-acre well site occupies the makai portion of the 78.4-acre vacant State parcel identified by TMK (1) 7-5-13: 22 (see Figures 1 and 11). The elongated rectangular parcel measures approximately 500 feet by 6,600 feet and extends east and upland from Mamalahoa Highway.

A dirt jeep road presently provides access from the highway into the property. The well is presently capped, and all equipment used to initially drill the facility has been removed.

The new production well, control building, reservoir, driveway, and appurtenant facilities, when completed, will occupy approximately 3.7 acres of the 13.4-acre well site. At DWS's option, a parcel may be subdivided out of the State property for the production well, pump, and control building, and a separate second parcel subdivided out for the reservoir. Access to these parcels from Mamalahoa Highway would be provided by an access easement. The parcels and easement could to be conveyed to the County when the well facilities are dedicated and turned over to the DWS.

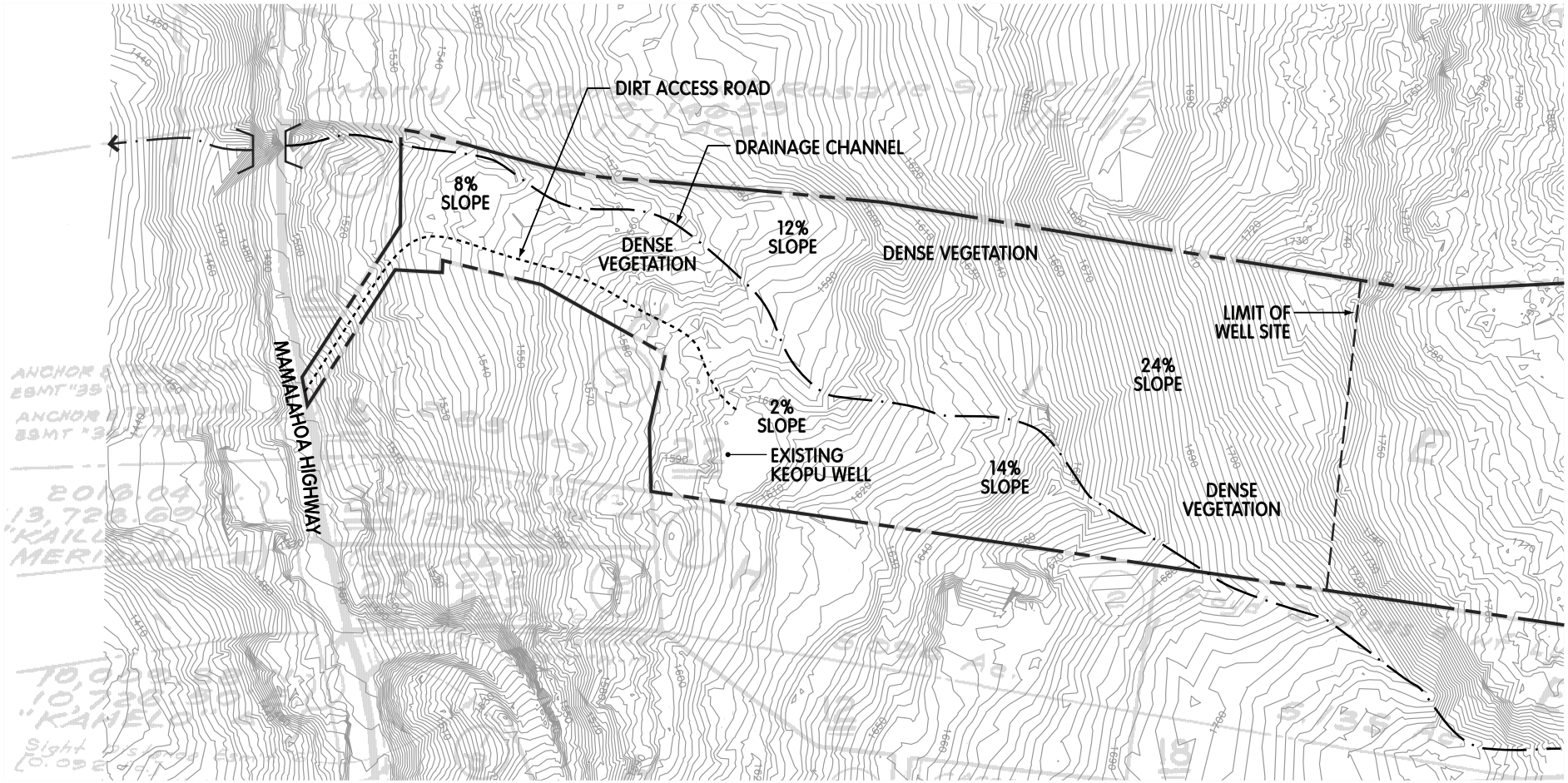
3.1.2 Existing Well

Drilled in 2002 by Waieli Drilling & Development Co., Keopu Well's purpose was to explore and determine if the high-level aquifer underlying the State property could provide a reliable source of municipal water. The well was completed in June 2003, to a total depth of 1,799 feet or -198 feet msl. It is presently outfitted with 18-inch diameter solid steel casing to a depth of 1,561 feet and perforated (louvered) steel casing to a depth of 1,641 feet (see Figure 7). Initially, the 158 feet of 15-inch diameter open hole was drilled below the casing for a total well depth of 1,799 feet, but subsequent fill-in has resulted in a present depth of 1,781 feet.

3.1.3 Pump Tests

Pump tests on the well were initially conducted in 2002 to determine general water quality and potential yield. During initial drilling, groundwater levels in the well ranged from 43.6-feet msl, to a high of 56.5-feet msl. The final measurement was 50.6-feet msl.

In an effort to improve well efficiency and yield, the well was deepened approximately 110 feet from 1,690 feet to 1,799 feet. At that time, the water level in the well rose 12.9 feet. This indicated an artesian condition that was later corroborated by visual evidence of up-hole flow in a video log. Contrary to general expectation, the well's performance decreased and the use of bentonite and cement to stabilize the drill hole from cave-ins appeared to have played a part in decreasing the well's efficiency. Results from standard step drawdown tests indicated that the



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NORTH

0 120 240

SCALE IN FEET

Figure 11
EXISTING SITE CONDITIONS
Keopu Well
North Kona, Hawaii

specific capacity of the well was reduced from 506 gallons per minute (gpm) per foot of drawdown (pumping at 1,518 gpm) to 137 gpm per foot of drawdown (pumping at 1,000 gpm).

Based on a follow-up 4-day constant-rate pump test conducted in August 2003, the Keopu Well proved capable of pumping at a sustainable rate of 2.34 MGD (1,648 gpm) with a stabilized drawdown of 9.4 feet, after 1,000 minutes of pumping. The recommended maximum capacity of a permanent pump for Keopu Well, however, is 2.0 MGD (1,400 gpm), or 85 percent of the test rate. The drawdown at the 2.0 MGD rate is estimated to be 8.3 feet.

The chloride content of the well was steady at a pristine value of 7 to 9 milligrams per liter (mg/L) throughout the four days of continuous pumping. These low readings are attributed to the nature of the high-level aquifer which is unaffected by salt-water intrusion.

3.2 Land Tenure

The well property identified as TMK (3) 7-5-13: 22 is owned by the State of Hawaiʻi. Although HHFDC is a State agency, it is still required to obtain authorization from the Board of Land and Natural Resources (BLNR) to enter the site and develop the well. Once conversion of the well is completed, HHFDC plans to turn over the facility to the DWS for ownership and operation. The transfer of ownership would first require the creation of the individual parcels for the well and reservoir facilities and easement for the access road.

The proposed transmission lines will be located within Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street. All three roadways are County rights-of-way, and installation of the waterlines will require approval from the County DPW. When completed, the new lines also will be turned over to the County for ownership and maintenance.

3.3 Geology/Physiography

3.3.1 Geology

The well site is located on the western slopes of Hualalai, a dormant volcano that rises to an elevation of 8,271-feet above sea level. The slopes of Hualalai consist of a veneer of geologically young (1,000 to 13,000 year old) lava flows of primarily alkali olivine basalts which cover an older theoliitic basaltic shield.[6] The alkalic veneer is largely undissected by erosion, although some local gullying has occurred on older flows. The oldest surface on Hualalai are found in the Kailua-Kona vicinity and also in the vicinity of Puʻu Waʻawaʻa, to the northeast. Hualalai's youngest rocks are the 1800-1801 lava flows which erupted north of the project site from the Northwest Rift Zone. The project site is located on lava flows older than 10,000 years, and the risk of lava flow inundation is considered to be low.

[6] Moore, et al, in USGS Professional Paper 1350, Vol. 1, Chapter 20.

3.3.2 Physiography

Elevations on the well site range from 1,490 feet at Mamalahoa Highway to approximately 1,750 feet immediately above the proposed reservoir. The upper property line of the State parcel extends to the 2,440-foot elevation.

The overall well and reservoir site is relatively steep with an average slope of 17 percent. The area immediately encompassing the production well, however, has been graded relatively level. The proposed driveway into the well site will be constructed of concrete and asphaltic concrete to accommodate for the steepness of the site.

A natural drainage channel diagonally crosses the lower section of the State parcel through the well site. The depth of the drainage channel varies from 2 to 4 feet and its width varies from 20 to 80 feet. The channel's alignment constrains the available area around the existing well for a reservoir. As a result, the proposed reservoir will be located above the well, across the drainage channel, at the 1,700-foot elevation of the property. The topography in the selected area is relatively steep and consequently will require major excavation to accommodate a level foundation for the storage facility.

Access from the proposed well to the reservoir will require crossing of the site's drainage channel. Current plans call for a concrete pavement ford crossing at grade which would be adequate for the intended purpose.

3.4 Hydrology and Water Resource

3.4.1 General Hydrology

Rainfall on Hualalai's western slopes above the approximately 2,000-foot elevation is the principal source of the region's groundwater resource. Rainfall occurs in a four- to five-mile-wide belt of 30 to 75 inches of annual rainfall. More than a third of this precipitation percolates deep enough into the ground to become groundwater in highly permeable, unweathered basaltic lava flows. There is virtually no surface runoff to the ocean and no perennial streams in North Kona.[7] A few small springs, such as Wai'aha Springs, may occur as groundwater seepage from shallow aquifers perched on soil and ash beds. Such springs, however, are minor and intermittent and suitable only for nominal needs. According to the CWRM, the estimated groundwater recharge of the Keauhou Aquifer System from rainfall is 87 MGD.

3.4.1.1 Basal Water

Prior to 1959, only basal groundwater was known to occur in North Kona. Existing drilled wells at that time indicated that the basal lens extended approximately 1.5 miles to 4.5 miles inland from the coast with a maximum head (water level elevation, msl) of almost 5 feet at Kahalu'u and Holualoa.

[7] Water Resource Associates, July 15, 2009.

The basal aquifer is recharged primarily by the seaward flow of high-level water across an undefined, impervious or low permeable geologic structure. Based on a water budget analysis by Water Resource Associates,[8] approximately 10 percent of the basal aquifer's total recharge originates from direct infiltration of overlying rainfall while the remainder originates from high-level groundwater flow across hydrogeologic, coastline-oriented discontinuities in the basal aquifer.

3.4.1.2 High-Level Water

Within the last 20 years, the occurrence of high-level groundwater in North Kona was discovered almost simultaneously in the southern and northern regions of North Kona. On August 1, 1990, Keauhou Well 2 (Well No. 3355-02), located 7-miles south of Kailua-Kona, encountered high-level groundwater at approximately 275-feet above sea level (later confirmed at 277 feet). Three weeks later on August 24th, DLNR's Kalaoa Well (Well No. 4358-01) encountered high-level groundwater at an elevation of 242-feet above sea level (later confirmed at 236 feet). These two exploratory wells were drilled at the then unprecedented elevations of 1,620 and 1,800 feet, respectively.

Less than a year later, in 1991, high-level groundwater was again discovered in the County's Honokohau Well (Well No. 4158-02), located 2½ miles north of Keopu Well. The well (elevation 1,675 feet) encountered groundwater at 109-feet above sea level. By 1993, high-level groundwater had been found in a total of 14 wells, confirming that high-level water bodies occur mauka of Mamalahoa Highway from Kalaoa to Ke'ei, a regional distance of 19 miles.

The nature of the confining geologic structure or formation is largely conjectural at this time. Based entirely upon water levels in the 14 wells, the hydrologic discontinuity between the high-level and basal-water aquifers roughly aligns with Mamalahoa Highway, and the high-level water appears to occur between 42-feet and 490-feet above sea level. These widely different water levels suggest some compartmentalization in the high-level aquifer, but no definitive well data is available to determine specifically whether this compartmentalization or confinement is directly related to volcanic dikes, unusual geologic formations, extensive ash deposits, or slump blocks and fault scarps associated with the North Kona Slump and Kealakekua Fault System.

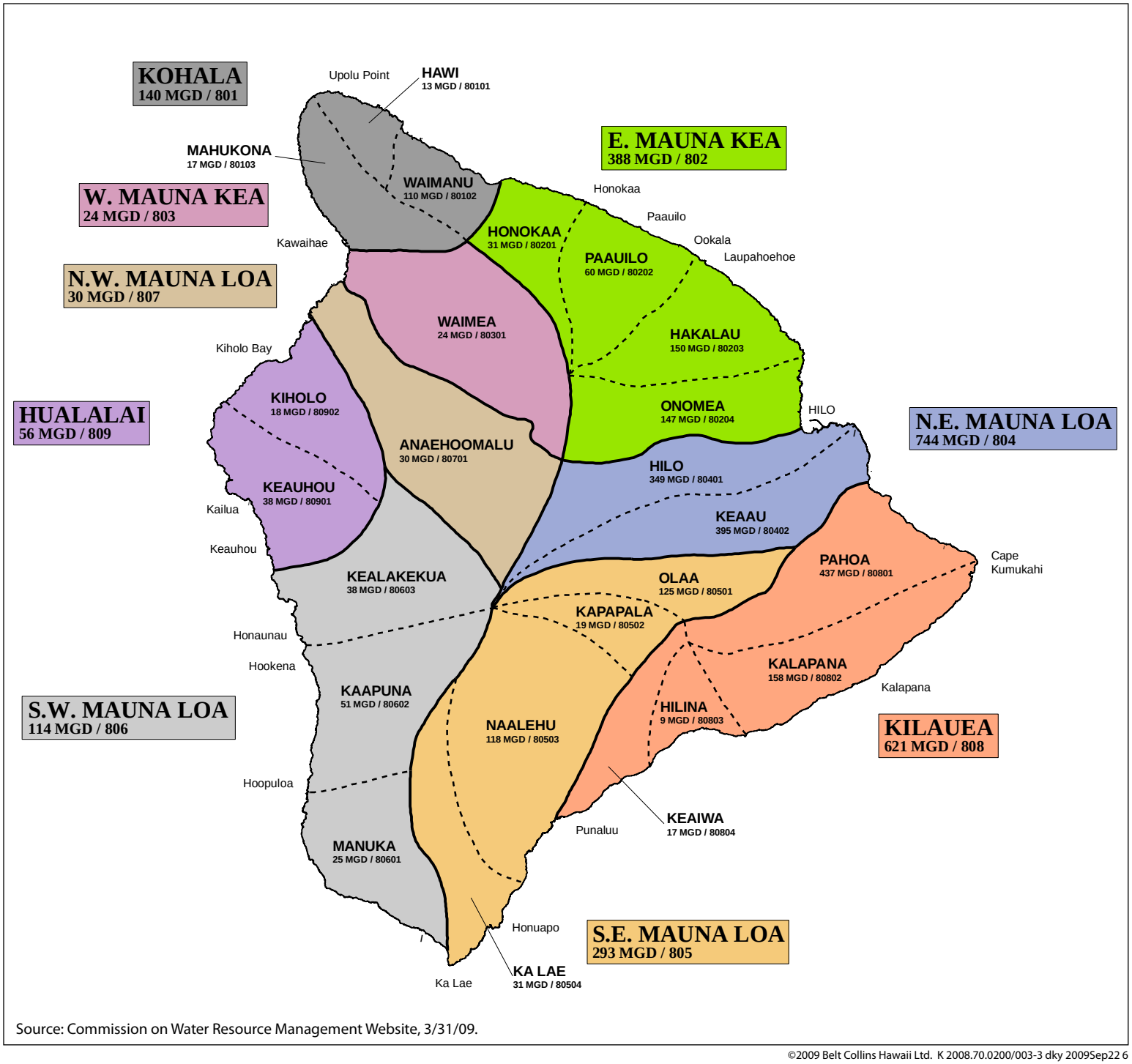
3.4.2 Keauhou Aquifer System

The Keauhou Aquifer System delineated by the CWRM in 1990, comprises the southern half of the Hualalai Hydrologic Sector which is defined by the exposed rocks of Hualalai Volcano (Figure 12).[9] The Keauhou Aquifer extends over the western and southwestern flank of Hualalai and the entire coastline from Mahai'ula to Keikiwaha Point. Having been designated prior to the

[8] Water Resource Associates, *Groundwater Resources and Supply, North Kona, Hawaii*, March 1995.

[9] A Hydrologic Sector reflects an area with broad hydrogeological (subsurface) similarities while maintaining traditional hydrographic (surface), topographic, and historical boundaries. An aquifer system is an area within a Hydrologic Sector that is more specifically defined by hydrogeologic continuity among aquifers in the system.

Figure 12
HYDROLOGIC UNITS



Source: Commission on Water Resource Management Website, 3/31/09.

Island of Hawaii
Total = 2,410 MGD

Hydrologic Units:
Sustainable Yield/Aquifer Code

NORTH

0 7.5 15
SCALE IN MILES

Keopu Well
North Kona, Hawaii

BELT COLLINS

discovery of high-level groundwater, the Keauhou Aquifer was described as a basal water system in the coastal area with the possibility of having high-level, dike-confined groundwater near the rift zones of Hualalai. The sustainable yield of the Keauhou Aquifer System is estimated by the CWRM to be 38 MGD, based on a recharge estimate of 87 MGD and an unconfined, thin basal water development scenario.

The general direction of groundwater flow in high-level aquifers is assumed to be directly seaward into the basal aquifer, except where influenced by hydrologically confining geologic structures. The direction of groundwater flow in the basal aquifers is generally unconfined and therefore presumed to be oriented more or less directly toward the coastline.

As noted previously, high-level water heads vary considerably and suggest some local, lateral (north-south) movement. The profile of this high-level water suggests that a regional hydrologic "sink" may occur in the Keopu Well area resulting in a concentration of groundwater flow to this general location.

The high-level groundwater of North Kona is of pristine quality, largely the result of the lack of saltwater intrusion and little to no urban development overlying the aquifer recharge area. The chloride content (a measure of freshness of Hawai'i's groundwater) in the high-level wells range between 5 and 10 mg/L, which is regarded as excellent quality.

3.4.3 Groundwater Resource for Keopu Well

Rainfall and fog drip are the principal sources of recharge to the high-level and basal water components of the Keauhou Aquifer System. The State CWRM estimates recharge to the Keauhou system to be 87 MGD, and assuming an entirely unconfined basal aquifer, the sustainable yield for the area would be 38 MGD.

Similar results for recharge were also estimated by Water Resource Associates,[10] after adjusting for small differences in area boundaries. In the consultant's 1995 water budget study, fog drip was included in the recharge calculation. The recharge was tabulated separately for the high-level aquifers above Mamalahoa Highway and for the coastal basal aquifers. Recharge from rainfall and fog drip overlying the high-level aquifers amounted to 79.4 MGD and recharge from rainfall overlying the basal aquifers amounted to 8.9 MGD, hence a system total of 88.3 MGD.

With the discovery of the high-level sources, management and development of the groundwater resource in the Keauhou Aquifer System can be optimized by focusing development of potable water sources in the high-level aquifers, rather than in the basal aquifers where salt water intrusion in wells may be problematic. The effective supply of high-level water will be greater than that of basal water, because the "allowable draft" (75 percent of recharge) of high-level aquifers is greater than the sustainable yield (44 percent of recharge) of basal aquifers.[11]

Since the Keauhou Aquifer System has not been designated for groundwater management by the CWRM, there are no regulatory constraints on the development of Keopu Well as a new potable water source.

[10] Water Resource Associates, *Groundwater Resources and Supply, North Kona, Hawaii*, March 1995.

[11] Based on CWRM's 1990 Water Resources Protection Plan.

As described in Section 3.1.3, Keopu Well was pump tested in 2003, and the results proved successful. Based on a 4-day constant-rate pumping, Keopu Well demonstrated that it is capable of pumping at a sustainable rate of 2.0 MGD. The drawdown at that rate is projected to be 8.3 feet. Based on a standard operating schedule of 16 hours per day, the average rate of withdrawal would be 1.33 MGD, or 3.5 percent of the aquifer's 38 MGD sustainable yield. This is not expected to have any major long-term adverse effect on the Keauhou Aquifer System.

3.4.4 Existing Water Systems and Usage

Table 1 below provides the current production of existing wells and shafts, potential production from those sources, sustainable yield (SY) of the two aquifers, and the percentage of the calculated potential productions to the SY. Current production is represented by the highest 12-month moving average (MAV) calculated from actual pumpage data reported to the CWRM for each aquifer system. Potential well production is based on installed pump capacities, and calculated for both 16 hours and 24 hours of operation a day.

Table 1: Well Production and Sustainable Yield in Hualalai Sector[12]

System Area	High 12-Month MAV (MGD)	Potential 16-Hr Productn (MGD)	Potential 24-Hr Productn (MGD)	Sustain-able Yield (MGD)	High 12-Month MAV / SY (%)	Potential 16-Hr Productn / SY (%)	Potential 24-Hr Productn / SY (%)
Hualalai							
Keauhou	11.49	16.58	24.87	38	30.24	43.63	65.45
Kiholo	4.06	16.21	24.31	18	22.56	90.06	135.06

Source: CWRM, Based on pumpage data from January 2003 to October 2005

MAV = moving average

SY = sustainable yield

As the table shows, the production of existing wells/shafts in the Keauhou Aquifer System operating on a standard 16-hour day would be 16.58 MGD or 43.63 percent of the aquifer's sustainable yield.

According to 2008/2009 CWRM records, the current water use of public and private wells in the Keauhou Aquifer System is 10.7 MGD (see Table 2). This usage was derived from 11 DWS wells and 9 private wells in the region.

[12] Based on pumpage data reported to CWRM from January 2003 through October 2005. Many wells do not report to CWRM or are not required to report.

Table 2: Reported Ground-Water Withdrawals in Hualalai Aquifer Sector

Aquifer	Sustainable Yield (MGD)	Total Existing Water Use 12-Month MAV July 2005 (MGD)	Existing DWS Water Use 12 MAV July 2005 (MGD)		Existing Private Water Use 12 MAV July 2005 (MGD)	
			Pumpage	No. of Wells	Pumpage	No. of Wells
Keauhou	38	10.723	9.965	11	0.758	9
Kiholo	18	3.703	0.000	0	3.703	19
Total	56	14.426	9.965	11	4.461	28

Source: State CWRM, July 2005

As noted in Table 3, the predominant user in the Keauhou Aquifer System is the DWS which comprises approximately 78.5 percent of the water usage. Agricultural use comprises 5.9 percent, wastewater re-use comprises 4.9 percent, and industrial use comprises 0.6 percent.

Table 3: Existing Water Uses in Keauhou Aquifer

CWRM Water User Category	Water Use (MGD)	Percent of Total w/o Ag	Percent of Total w/ Ag
Municipal			
DWS System	9.44	83.4	78.5
Private Public Water System	0.48	4.2	4.0
Agriculture	0.71	0.0	5.9
Domestic	0.35	3.1	3.0
Irrigation	0.38	3.4	3.2
Reclaimed Wastewater	0.59	5.2	4.9
Industrial	0.07	0.6	0.6
Military	0.00	0.0	0.0
Total w/o Agriculture	11.31	100.0	
Total w/ Agriculture	12.02		100.0

Source: *Hawai'i County Water Use and Development Plan Update, Draft Report,* 2006

Ag = agricultural

3.4.5 Future Demand and Source Development

The significant use of water by DWS is being generated by the continuing growth and development of new homes and businesses in the Kealakehe and Keahuolu areas. This development trend is recognized in the County General Plan and included in the long-range

development policies for Kailua-Kona. The boundaries of this urban center include the planned Keahuolu Project.

The growth in Kailua-Kona and the North Kona region is expected to increase the demand for water in the Keauhou Aquifer System by approximately 40 percent over the next 15 years.[13] By 2025, the demand for water in the region is expected to increase to 18.6 MGD (see Table 4).

Table 4: DWS Water Use Projections for Keauhou Aquifer System, 2005 to 2025

Sustainable Yield (MGD)	DWS Users	DWS Projected Water Use (MGD)				
		2005	2010	2015	2020	2025
38	With Ag	12.0	13.4	15.0	16.7	18.6
	Without Ag	11.3	12.6	14.1	15.7	17.5

Source: DWS, County of Hawaiʻi, 2006

Existing wells in the Keauhou system are capable of providing a total supply of 16.58 MGD, if operating on a 16-hour day (see Table 3). Current planned wells by public agencies, including DHHL and HHFDC, will provide additional supply to meet the projected demand.[14] DHHL's *Villages of Laʻiʻopua Water Master Plan* calls for the development of four high-level wells in the North Kona District. The development of these wells will occur as DHHL and HHFDC move forward with the development of their properties. One of the four wells is Keopu Well which is being proposed for production by HHFDC. It is expected to supply up to 2.0 MGD of water to the County's North Kona Water System.

The County's 20-Year Water Master Plan includes a prioritized capital improvement program that identifies new water facility improvements in the North Kona area as well as to other County systems on the island. Scheduled for the 2007 to 2011 period, a production well and reservoir are scheduled for installation at the Keopu-Puʻuhonua Well site. To date, that well and reservoir have been completed, but have not yet been placed in operation. For the long-term (2012 to 2026 period), a 2.0 MG reservoir replacement and standby well are planned at the Waiʻaha Well site.

A new well, identified as Palani Well No. 1, is being planned in the Honokohau 1-2 land track above the Mamalahoa Highway – Palani Road Junction. Lanihau Properties LLC announced that it would convert exploratory well (State Well No. 4158-03) into a production well with the construction of an accompanying 1.0 MG reservoir. When completed in 2010, the new facilities would be dedicated to the DWS for ownership and operation.

As development and expansion continue to occur in the North Kona area, public and private developers will participate and contribute to the development of additional sources in the Keauhou Aquifer. The Water Use and Development Plan Update (Draft Report) prepared by the DWS is serving as a guide for the long-range development of sources for the region.

[13] Based on a projected medium population growth by the County of Hawaiʻi of 19.2 percent from 2000 to 2010 and 24.2 percent growth from 2010 to 2020 (DWS, 2006).

[14] *Villages of Laʻiʻopua Water Master Plan*, prepared for DHHL, approved by Hawaiʻi County DWS, October 26, 2006.

3.4.6 Keopu Well Impact on Existing Area Wells and Groundwater Resource

Existing wells within the vicinity (3 miles to the north and 1-1/2 miles to the south) of Keopu Well, as identified by the Division of Water Resource Management (DWRM), are shown on Figure 13 and listed in Table 5. These wells include municipal, industrial, and irrigation wells. Some of the wells are in operation and others are inactive or abandoned.

Table 5: Existing Wells in the Project Vicinity – Physical Characteristics

Well No.	Well Name	Owner/User	Year Drilled	Ground Elev.	Depth (feet)	Static Head (in elev.)
3758-01*	Kailua-Kona	County DWS	1944	595	615	3.32
3857-04	Waiʻaha-DWS	County DWS	2000	1,544	1,752	59.56
3858-01*	Kalaoa Keopu Deep	State CWRM	2001	736	1,310	4.0
3859-01*	McCaskill	McCaskill J	1942	N.A.	N.A.	N.A.
3957-01**	Keopu-Puʻuhonua	County DWS	1993	1,675	1,706	47.0
3957-02*	Komo Monitor	County DWS	1991	1,601	1,623	N.A.
3957-04*	Douter Coffee #1	Douter Coffee Co.	2001	1,445	1,462	43.03
3957-05*	Keopu-HFDC (Keopu Well)	State DLNR	2003	1,601	1,799	49.6
4057-01	Keahuolu QLT 1	County DWS	1994	1,762	1,787	187.8
4059-01*	Palani	State DLNR	1958	800	853	1.6
4060-1	Honokohau Quarry	Honokohau Property	1995	121	137	2.0
4158-02	Honokohau	County DWS	1991	1,681	1,735	109.5
4158-03***	Palani Well No. 1	Lanihau Properties	2006	1,670		77.0

Source: DWRM, 2009

Note: * Indicates wells that are currently not in use, abandoned, or on standby.
** Indicates well is presently being converted to production well.
*** Indicates well is being proposed for conversion to a production well.

N.A. = not applicable

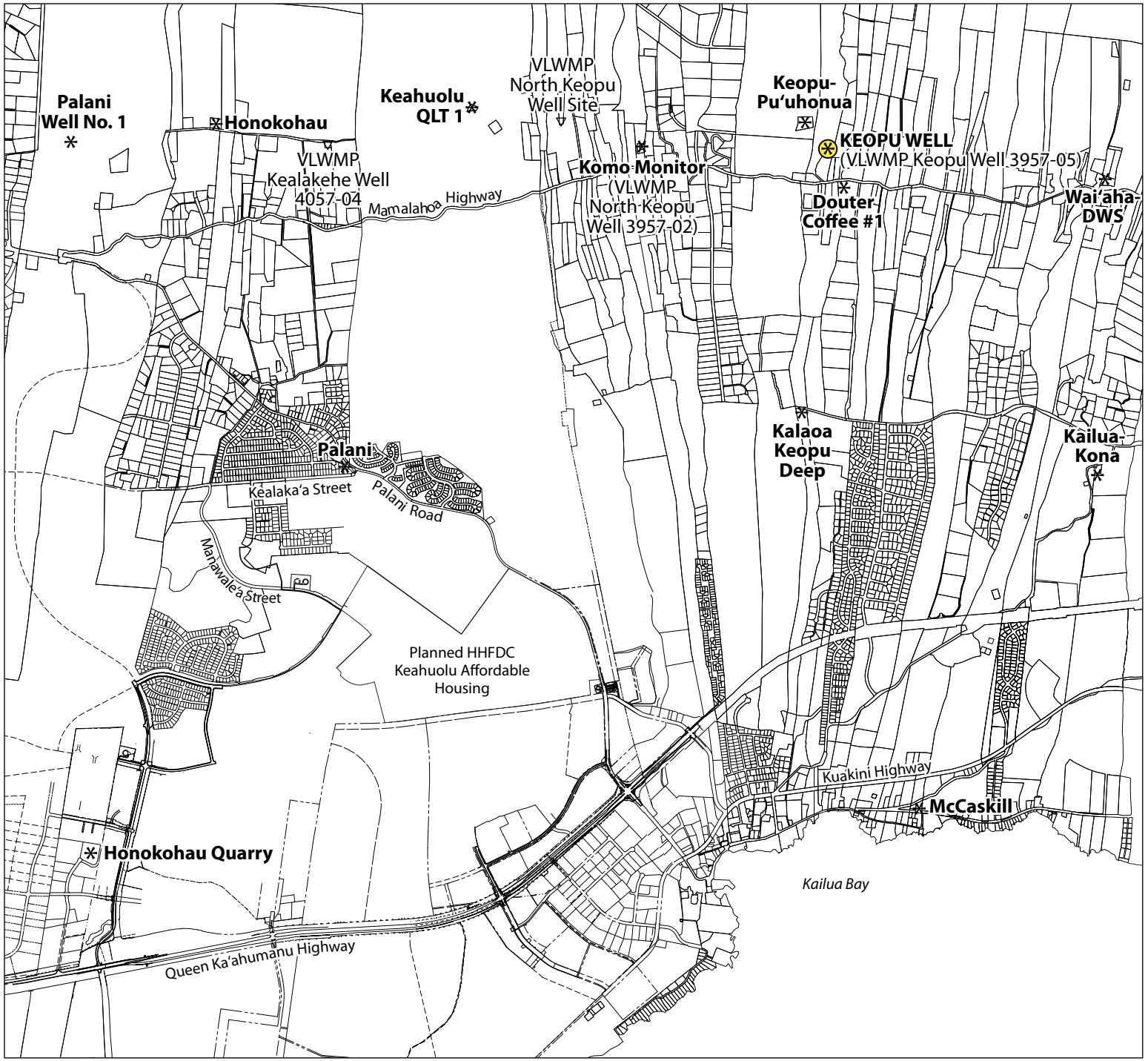


Figure 13
EXISTING WELLS

LEGEND

- ✳ Existing Wells
- ▽ Potential Wells
- VLWMP Villages of La'i'opua Water Master Plan

NORTH

0 1500 3000
SCALE IN FEET

Keopu Well
North Kona, Hawaii

BELT COLLINS

Table 6 identifies those wells that are currently in use. Three of the wells are operated by the DWS and are currently pumping approximately 3.0 MGD (12-month MAV). This total is substantially below their combined installed capacity of 5.5 MGD.

Table 6: Operational Characteristics of Existing Wells in Use

Well No.	Well Name	Specific Capacity (in gpm/ft)	Installed Capacity (in MGD)	Use	Water Usage (in MGD) (12-mo. MAV)
3857-04	Waiʻaha-DWS	192	2.016	Municipal	0.245
4057-01	Keahuolu QLT 1	387	1.440	Municipal	1.047
4060-1	Honokohau Quarry	175	0.036	Industrial	N.A.
4158-02	Honokohau	142	2.016	Municipal	1.663

Notes: "Specific capacity" is a measure of well yield per unit of drawdown and is expressed as gallons per minute per foot of drawdown. The "installed capacity" is another measure showing the quantity of water that a well's pump is capable of delivering in one day. "Water usage" is the current quantity of water that is being used by the well user.

Source for Water Usage: DWRM, June 2009

The conversion of Keopu Well to a production well would have no impact on the three DWS operating wells in the vicinity. These wells are no less than one mile away from Keopu Well. Other wells are located closer, but are currently inactive.

Pumping at the Keopu Well will result in a lowering of water levels in the project area. This effect is known as a "cone of depression" which establishes a "zone of influence" around the production well. Keopu Well was previously pump tested for four days at a constant rate of 1,458 gpm, or 2.35 MGD. The drawdown in the well was stable at 9.4 feet. The impact on the nearby Keopu-Puʻuhonua Well (3957-01) was a resulting drawdown of 0.6 feet. This County-owned well, first developed by Haseko Hawaii Inc., is situated approximately 800 feet to the northeast of the Keopu Well. It is being developed as a new high-level source for DWS' North Kona Water System. Although construction is completed, the well has not yet been placed into operation.

Another well located near the Keopu Well is the Komo Monitor Well (3957-02), initially drilled by the United States Geological Survey (USGS) but now owned by DWS. This inactive well is approximately 4,000 feet to the north and one of the identified potential sources in the *Villages of Laʻiʻopua Water Master Plan*.

Another well in the immediate area of Keopu Well is the Douter Coffee #1 well, which is approximately 650-feet west and downgradient of the Keopu Well. It is privately owned and used for landscape irrigation purposes. CWRM records currently show no reported use of this facility.

Also downslope of Keopu Well are Kalaoa Keopu Deep Well and McCaskill Well. According to CWRM records, these wells are also inactive.

Mitigation measures would not be needed relative to the inactive wells around Keopu Well. Pump tests show that the Keopu-Puʻuhonua Well will experience only 0.6 feet of drawdown during pumping at the Keopu Well. Similarly, the Douter Well, located downslope of Keopu

Well, is expected to be affected by a drawdown of 0.6 feet or less. The planned use of Keopu Well, with an anticipated production rate of 2.0 MGD, is expected to have little or no adverse impact on active or inactive wells located within the project vicinity.

In the context that the Keopu Well is one of a number of existing and planned wells in the Keauhou Aquifer System, the cumulative impact of these sources could have a major long-term impact on the North Kona's groundwater resource. Attaining a full understanding on the dynamics and condition of the Keauhou Aquifer is ongoing. HHFDC is participating with two groundwater working groups including the National Park Service group and the County of Hawai'i DWS group. It is believed that the working groups are meeting to study, analyze and address the long-term cumulative impacts of increased groundwater development in the high-level aquifer, and the potential impacts of existing and planned developments on the area's water resources.

Meanwhile, efforts are being made to closely monitor the groundwater levels in the Keauhou Aquifer. Keopu Well will include a sensor to monitor groundwater levels in the area. Water conservation practices will be promoted to aid in the reduction of excessive water consumption. The developer of the Keahuolu Project will include in its development water conservation practices, such as installing low-flow toilets and low-flow showerheads, landscaping with drought-tolerant native plants, and providing new residents with information on the importance of water conservation.

3.4.7 Potential Contamination

Since the recharge areas of Keauhou Aquifer System are on the slopes of Hualalai, land uses and development have been limited predominantly to shrub and forest lands. Land uses immediately surrounding Keopu Well consist predominantly of a scattering of rural residential homes, vacant lands, and minor agricultural endeavors. None of these land uses are considered generators of major potential contaminants. No large-scale agricultural operations (which use pesticides and herbicides extensively) occur particularly upslope of the property, and no County landfills are located within the project vicinity; the nearest such operation is in South Kohala more than 20 miles away.

Commercial and industrial facilities engaged in petroleum product use are located in the urban center of Kailua-Kona. An isolated fueling station associated with a country general store is located more than two-thirds of a mile north and downslope of the well site.

Wastewater disposal in the region is primarily accommodated by individual wastewater systems (IWS) comprised predominantly of cesspools. The County does not have a wastewater collection system in the uplands of North Kona or along Mamalahoa Highway. Strict government regulations currently prohibit the installation of cesspools on the island, and as a result, homeowners are opting for septic tanks as an alternative. These IWSs collect and hold effluent, allowing the unit to separate and biodegrade the fluid before allowing it to cant by overflow to a drain field for disposal. The stricter wastewater disposal regulation is designed to protect the watersheds as valuable recharge areas.

The project area is located above the Underground Injection Control (UIC) line established by the State DOH (see Figure 14). This line marks the area of the island which strictly limits the type of injection wells that can be installed by an UIC Permit. Injection wells are typically used by individual wastewater treatment facilities to dispose their treated wastewater effluent in ground pits.

The water quality tests on Keopu Well for chloride content revealed levels of between 5 mg/L and 10 mg/L, which are regarded as excellent quality. Other wells in the region have tested chloride content levels of 4 to 8 mg/L (see Table 7), which are well within potable standards.

Table 7: Existing Operational Wells in the Project Vicinity – Water Quality Characteristics – Spot Sampling During January to May 2008

Well No.	Well Name	Chloride Content (Parts per Million)
3857-04	Wai'aha-DWS	4.0 to 5.0
4057-01	Keahuolu QLT 1	5.0 to 6.0
4158-02	Honokohau	7.0 to 8.0

Source: DWS, County of Hawai'i

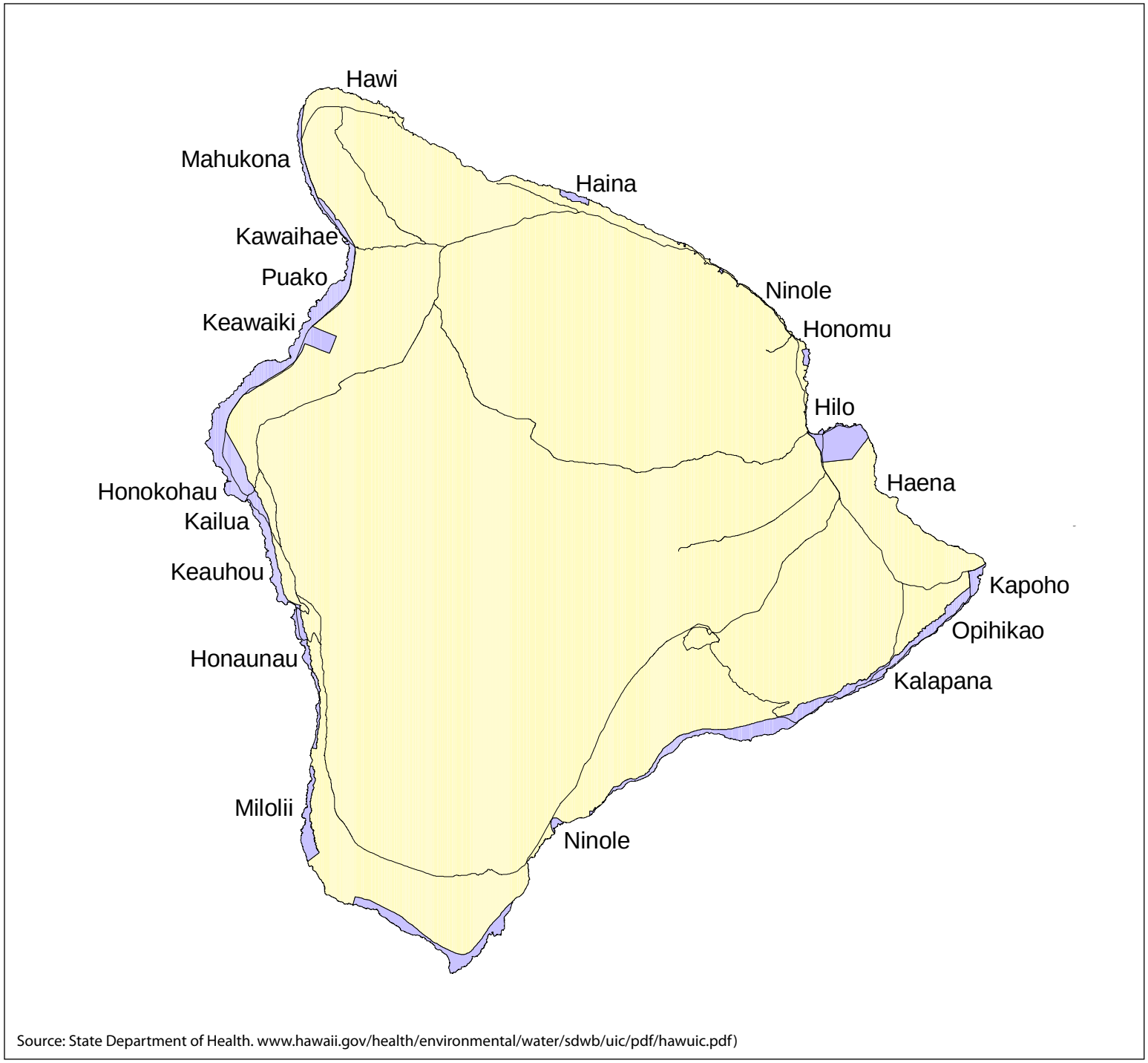
The County also performs other water quality tests on their wells (see Table 8). Inorganic contaminants, disinfection by-products, and sodium all show safe levels for DWS wells currently operating in the Keopu Well area.

Table 8: Existing Operational Wells in Project Vicinity – Water Quality Contaminants, 2008

Regulated Contaminants	Wai'aha Well/Honokohau Well/Keahuolu Well (QLT)/Hualalai Well		Honokohau Well/ Hualalai Well		Violation
	Level Found	Range of Detections	Level Found	Range of Detections	Yes/No
Inorganic Contaminants					
Chromium (ppb)	2.0	ND-2.0	2.0	2.0-2.0	No
Fluoride (ppm)	0.53	0.23-0.53	0.53	0.41-0.53	No
Nitrate (ppm)	1.10	0.92-1.10	1.10	0.92-1.10	No
Disinfection By-Products					
Haloacetic acids (ppb)	1.81	ND-2.0	1.81	ND-2.0	No
Total Trihalomethanes (ppb)	6.93	3.6-11.5	6.93	3.6-11.5	No
Sodium (ppm)	30.0	14.0-30.0	30.0	27.0-30.0	No

Source: DWS, County of Hawai'i

Keys: ND = Not detected,
ppm = parts per million,
ppb = parts per billion.



Source: State Department of Health. www.hawaii.gov/health/environmental/water/sdwb/uic/pdf/hawuic.pdf)

Figure 14
ISLAND OF HAWAII
UNDERGROUND
INJECTION CONTROL
AREAS

LEGEND

BELOW (makai) UIC LINE
- Underlying aquifer not considered drinking water source
- Wider variety of wells allowed
- Injection wells need UIC Permit or Permit Exemption
- Permit limitations are imposed

ABOVE (mauka) UIC LINE
- Underlying aquifer considered a drinking water source
- Limited types of injection wells allowed
- Injection wells need UIC Permit or Permit Exemption
- Permit limitations are imposed and requirements are more stringent

Major Roads

NORTH

0 7.5 15
SCALE IN MILES

Keopu Well
North Kona, Hawaii

BELT COLLINS

The State DOH has strict requirements for new sources of drinking water that are intended to serve a public water system. In conformance with those requirements, HHFDC will submit an engineering report to the DOH for approval prior to placement of Keopu Well on line with the DWS system. The report will identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate potential contamination, including treatment of the water source. A water quality analysis is also required for all regulated contaminants and the results will be submitted as part of the engineering report to demonstrate compliance with current drinking water standards.

3.5 Flora

3.5.1 Background

Isle Botanica conducted a botanical survey of the well site in 2008. The overall objectives of the survey were to provide a general description of the vegetation types occurring on the site (particularly any sensitive types of vegetation that may harbor rare plant species), make a checklist of all native and naturalized vascular plants found, and search for threatened and endangered species.

Although most of the project area is highly disturbed, and native vegetation no longer occurs on the property, a botanical survey was necessary, especially since there are known federally-listed threatened and endangered plant species in the general area.

3.5.2 Methodology

Prior to conducting fieldwork, a review of literature was undertaken, and the United States Fish and Wildlife Service (USFWS) official database was consulted for a complete listing of all significant threatened and endangered species in the area. After the literature review was performed, the botanical field survey was conducted. All plants encountered were recorded, along with the indication of their frequency. A comprehensive listing of the recorded vegetation is provided in Appendix B.

The vegetation on the well site can be categorized into three groups: (1) Managed Land Vegetation; (2) *Schinus*/*Psidium* Forest; and (3) Bamboo Forest.

The Managed Land Vegetation comprises the dirt access road, extending into the western part of the property, and appears to be in an area of former pastureland. Additionally, most of the northeast quarter of the property appears to have been formerly used as a cattle pasture. Practically no native species are found in these areas of highly disturbed vegetation.

The *Schinus*/*Psidium* Forest is a relatively low-stature forest that covers most of the well site, especially in areas that have not been cleared. The ground cover is dominated by only a few species that are able to survive in the relatively dense shade.

The mono-dominant groves of bamboo cover the northwest part of the well site. The bamboo grows so close, that it forms a dense, impermeable canopy that few other species can survive.

3.5.3 Existing Conditions

Eighty-three plant species were recorded at the well site (see Appendix B). The majority of the recorded species are classified as "alien" plants, which have been accidentally or intentionally introduced to Hawai'i. Nine of the recorded species are native. The botanical survey opined that this is an unusually low number of native species, which is possibly the result of extensive disturbance in the area. No species which are federally listed as threatened or endangered or classified as sensitive were found.

3.5.4 Impacts and Mitigation Measures

Since there is a noticeable absence of native vegetation and no presence of threatened or endangered species in the project area, mitigation measures would not be necessary. It is noted that existing vegetation on the property is common and widespread in the region.

3.6 Fauna

3.6.1 Existing Conditions

In January 2009, Phillip L. Bruner, Environmental Consultant, conducted a fauna survey of the well site with the goals of documenting bird and mammal species observed on or near the property and, in particular, recording the presence of any native and migratory species listed as threatened or endangered (see Appendix C).

During the survey, 11 alien species were recorded including Java sparrow, Japanese white-eye, cardinals, doves, finches, and common myna. No native land or sea birds were observed. Although the Hawaiian Short-Eared Owl or Pueo (*Asio flammeus sandwichensis*) and endangered Hawaiian Hawk or 'Io (*Buteo solitarius*) have been sighted, none have been observed in the project area during the survey. The Pueo is not listed as endangered or threaten on the island of Hawai'i, but is listed as endangered on the island of O'ahu.

Seabirds or migratory birds were not observed during the survey. It is also possible that limited numbers of the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened Newell's Shearwater (*Puffinus auricularis newelli*) might on rare occasion over-fly the project site between the months of May and November.

The only feral mammals observed were two pigs (*Sus scrofa*). Cats (*Felis catus*), rats (*Rattus rattus* spp.), mice (*Mus Musculus*), and small Indian mongoose (*Herpestes Javanicus*), although not observed, are likely to occur on the site. The endangered Hawaiian Hoary Bat was not recorded, but the native species is also known to occur in the region. It generally roosts solitarily in trees and forages for flying insects in a wide variety of habitats including forests, agricultural lands, urban areas, as well as over bays and ponds.

3.6.2 Impacts and Mitigation Measures

The proposed project is not anticipated to have any significant adverse impact on fauna resources. Although the endangered Hawaiian Hoary Bat and endangered Hawaiian Hawk could potentially forage on the well site, construction and operation of the proposed project would not result in significant impact to native species or their habitats. The proposed well facilities will occur in a small selected area of the State parcel.

In the unlikely event that a Hawaiian Hawk nest is found during construction, work in the immediate vicinity of the nest would be halted and the USFWS would be contacted and consulted prior to any re-commencement of work.

To reduce any potential for interaction of nocturnally-flying seabirds (i.e., endangered Hawaiian Petrels and threatened Newell's Shearwater) with external lights and man-made structures, exterior lighting associated with the control building and storage tank will be shielded.

3.7 Air Quality

3.7.1 Existing Conditions

Recent activity at the Kilauea Volcano has resulted in temporary increased levels (spikes) of sulfur dioxide (SO_2) and particulates occurring in communities closest to the vent areas in the Ka'u and Puna Districts.[15] North Kona can experience periodic impacts from volcanic emissions (vog) depending on wind conditions across the island, however, the air quality in North Kona is relatively good and concentrations appear well within state and national air quality standards. The State DOH Clean Air Branch monitors air quality conditions for the State and has six monitoring stations for certain pollutants on the island of Hawai'i. Recent readings for the Kona area appear negligible.

3.7.2 Impacts and Mitigation Measures

The proposed project is not expected to generate significant impact on air quality considering the type of operational facilities that will occur. Construction activities, however, may result in short-term air quality impacts, including the generation of dust from soil excavation and emissions from construction vehicles and equipment. To mitigate these impacts, the contractor will be required to comply with the DOH Hawai'i Administrative Rules (HAR), Title 11, Chapter 60.1, "Air Pollution Control." Compliance with State regulations will require adequate measures to control fugitive dust by such methods as:

- Planning different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes, and locating potentially dusty equipment to areas of the least impact;
- Frequent watering of exposed dirt areas;

[15] State DOH, Clean Air Branch website at http://hawaii.gov/health/environmental/air/cab/ index.html.

- Landscaping and rapid covering of bare areas, including slopes;
- Controlling of dust from unpaved access roads;
- Controlling dust from debris being hauled away from the project site; and
- Constructing a dust barrier/fence.

Exhaust emissions from construction vehicles are anticipated to have negligible impacts on air quality, as emissions would be relatively minor and readily dissipated.

3.8 Acoustical Environment

3.8.1 Existing Conditions

The predominant noise sources in the vicinity of the well site are traffic from Mamalahoa Highway and surrounding neighbors engaged in agricultural activities. The majority of the land uses above Mamalahoa Highway in the uplands of North Kona are undeveloped or in open space.

3.8.2 Impacts and Mitigation Measures

No significant adverse impacts are anticipated during the long-term operations of the production well. There will be daily monitoring inspections and periodic maintenance work; otherwise, the proposed project will operate as an unmanned utility facility. Noise from the well pump is expected to be insignificant.

To mitigate short-term construction-related noise impacts, compliance with the provisions of HAR 11-46, "Community Noise Control," will be exercised. A noise permit will be required if the noise levels from construction activity are expected to exceed specified standards. It will be the contractor's responsibility to minimize noise by properly maintaining mufflers and other noise-attenuating equipment. If construction work is required during evenings, night, and weekend hours, a variance will be sought from the DOH.

3.9 Natural Hazards

3.9.1 Flood

A natural drainage channel crosses the lower portion of the State parcel and through the existing well site to and beyond the Mamalahoa Highway. Through the well site, the channel width varies from 20 feet to 80 feet. The Federal Emergency Management Agency (FEMA) designates this drainageway in Flood Zone AE on its Flood Insurance Rate Maps (FIRM).[16] Flood Zones AE are areas that are subject to inundation by potential 100-year floods (see Figure 15). Along the outer edges of the Flood Zone AE, FEMA delineates Flood Zone X. These areas are subject to

[16] FIRM Community – Panel Number 155166 0714 C, Revised September 16, 1988.

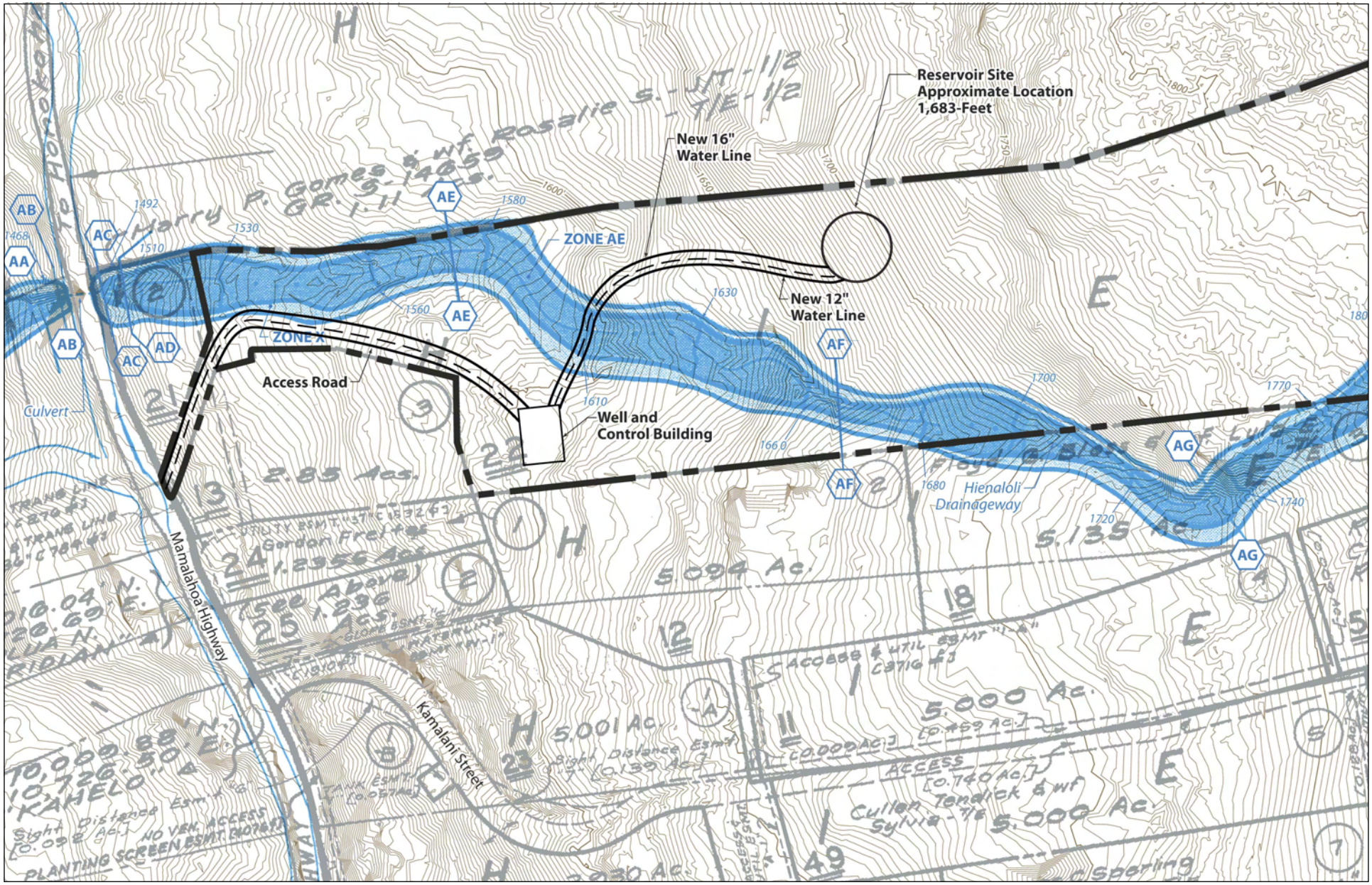


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Figure 15
FLOOD INSURANCE RATE MAP
Keopu Well
North Kona, Hawaii

flooding from a potential 500-year flood or from a 100-year flood with flood levels less than one foot.

Site planning for the well facilities has taken into account the location and extent of the identified FEMA flood zones. The only portion of the proposed facilities that might be affected is the access road from the well and control building to the proposed reservoir. Design of the drainage channel crossing will include a paved at-grade driveway that would minimize disruption to any flow in the channel and in turn, not be adversely impacted by potential flood waters in the same drainageway.

3.9.2 Earthquakes

The island of Hawai'i experiences thousands of earthquakes every year although only a few are strong enough to be felt or cause any damage. Most of the earthquakes are directly related to volcanic activity caused by magma moving below the earth's surface; particularly beneath the island's two most active volcanoes, Mauna Loa and Kilauea. A few of the earthquakes are less directly related to volcanic activity and may occur in zones of structural weakness at the base of the volcanoes or deep within the earth under the island.[17]

Strong earthquakes, while infrequent, may endanger people and property by shaking structures, and causing ground cracks, ground settling, and landslides. Such earthquakes can destroy buildings, water tanks, and bridges as well as damage roadways, water lines, sewer lines, and other utilities. The Kona area is subject to earthquakes with intensities up to VIII on the Modified Mercalli Scale.[18] The most recent damaging earthquake to the Big Island occurred on October 15, 2006, with a measured magnitude of 6.7 on the Modified Mercalli Scale.[19]

The proposed well and water line installation are expected to take into account the possible effects of earthquake. Well constructions with outfitted casings have withstood earthquake events fairly well. Current water line installations have incorporated flexible joints and pliable material in the pipeline trenches to accommodate potential ground tremors, and improvements are continuing to be made in reservoir construction technology to address vibrations from potential quakes.

3.9.3 Hurricane

Since 1950, when adequate records began, 8 hurricanes affected the Hawaiian Islands and 12 others posed as threats by their passage. Hurricane Iniki was the most recent, and most powerful hurricane to strike Hawai'i in recorded history.

[17] Civil Defense Agency, 2005.

[18] According to the FEMA, during an earthquake with an intensity of VIII on the Modified Mercalli Scale, drivers have trouble steering. Houses that are not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Tree branches break. Hillsides might crack if the ground is wet. Water levels in wells might change.

[19] See USGS website at http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/ustwbh.php.

Hurricanes can be damaging to trees, vegetation, crops, overhead transmission lines, and lightly built dwellings and structures. However, well facilities and underground water lines are less susceptible to damage from those forceful winds.

3.9.4 Volcanic

The well site is located on the western flank of Hualalai, one of five prominent volcanoes on the island of Hawaiʻi. The estimated lava production rate for Hualalai over the past 3,000 years is about 2 percent of the current rate for Kilauea Volcano. The last volcanic eruption of Hualalai in the general project area occurred in 1800 to 1801. Lavas emerged from the northwest volcanic rift zone at about the 1,600-foot elevation (in the vicinity of the Puhi-a-Pele Cinder Cone, just makai of Mamalahoa Highway), creating a flow that entered the ocean north of Keahole Point.

The Lava Flow Hazard Map prepared by the Hawaiian Volcano Observatory of the USGS shows the island of Hawaiʻi in nine Lava Flow Hazard Zones (Zone 1 being the most hazardous and Zone 9 being the least), based on geologic criteria, including frequency of past lava flows and coverage, distance from eruptive vents, and topography that currently protects certain areas from lava inundation. The summit of Mauna Loa and its rift zones as well as Kilauea Crater and its rift zones are located in Zone 1. The project site and the town of Kailua-Kona are located in Zone 4, a moderately rated hazardous zone.

3.9.5 Tsunami

Although tsunami inundation can be devastating to coastal properties, the proposed project will not be impacted. The well facilities and transmission lines will be located far above any potentially hazardous areas. The lowest portion of the proposed facilities (water line in Manawaleʻa Street) will be at elevation 720-feet msl, more than 2-1/2 miles from the shoreline.

3.9.6 Wildfires

Wildfires are becoming known as “wildland” fires, defined as any non-structural fire in an uncultivated or undeveloped area. On Hawaiʻi island, wildfires range from moderate size grass fires on ranch lands to major scrub ʻohiʻa fires in large national parks. Approximately 1.6 million acres of the island’s 2.6 million acres of land are listed as forested, while a large amount but unstated acreage is in pasture and brush. Areas on the mountains above the tree line are bare.

DLNR has reported that 70 to 80 wildfires occurred on the island of Hawaiʻi annually. Any adverse impact from wildfires on the proposed production well, control building, and reservoir would be minor with the fire protection assistance of the Hawaiʻi County’s Fire Department.

3.10 Scenic Resources

The existing visual character of the well site can be described as undeveloped sloping land overgrown with dense vegetation. Views of the project site from Mamalahoa Highway are

obstructed by the relief topography of intervening properties. The Pacific Ocean and Kona coastline form the backdrop of views toward the makai lands from the site's upper elevations.

Although the well facilities will result in visual alterations to the land itself, significant adverse impacts to surrounding scenic resources are not expected. The proposed control build will be modest in size and unobtrusive. The 2.0 MG reservoir will be tucked into the slope of the site and visually shielded by abutting topography and high vegetation. View planes from properties in the vicinity to the sea and mountains will be retained.

3.11 Archaeological Resources

3.11.1 Background

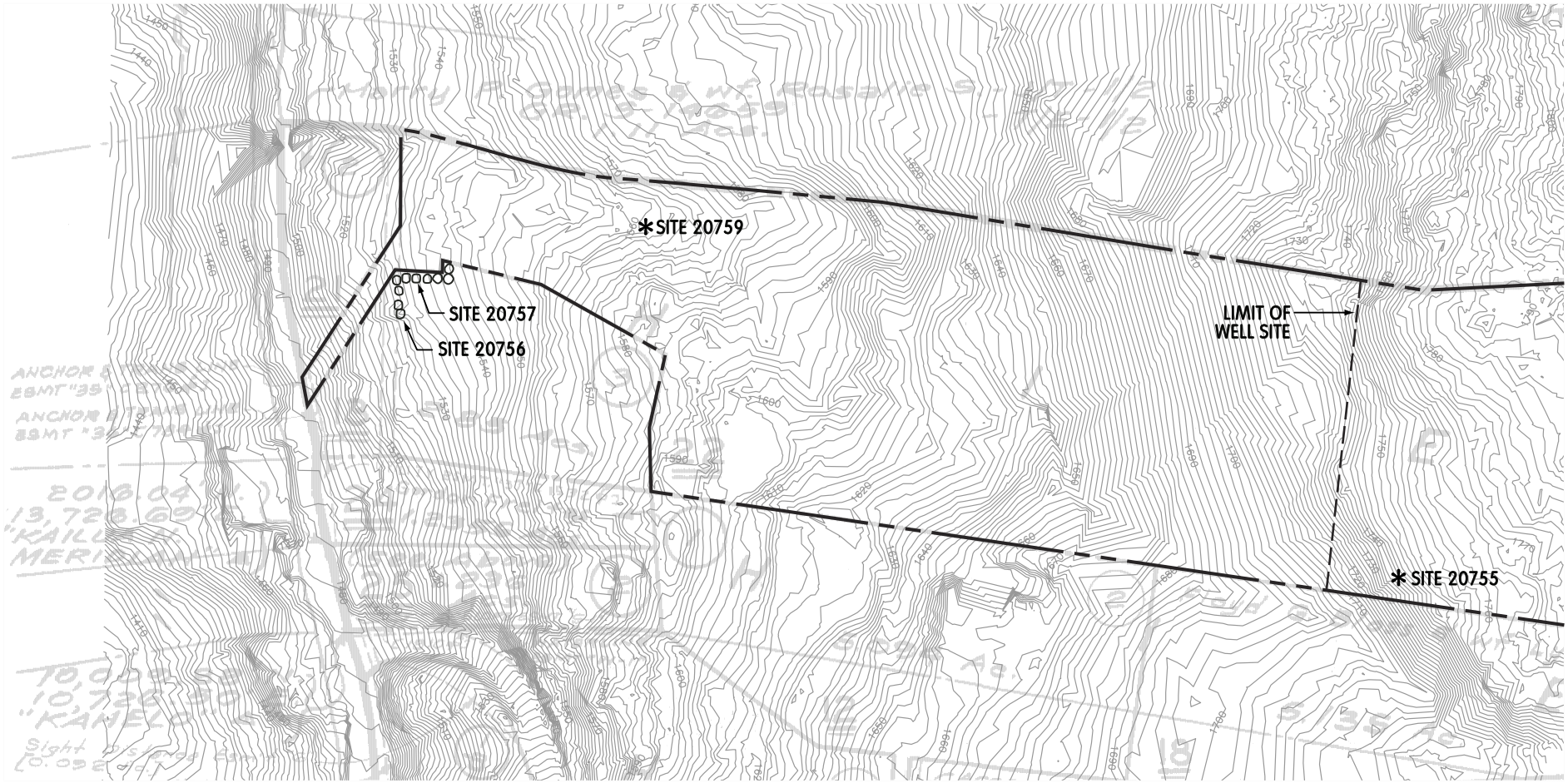
Rechtman Consulting, LLC, conducted an archaeological inventory survey of the well site in 2008 (see Appendix D). The survey encompassed a 17-acre portion of the State parcel lying between the 980-foot and 2,460-foot elevations. The purpose of the survey was to summarize the background information concerning the project area's physical setting, cultural context, previous archaeological work, and current survey expectations based on previous work.

Four previous archaeological studies were conducted in the current project area (Halpern and Rosendahl 1996; Kawachi 1994; and Yent 1991, 1999). Due to the current inventory of previously recorded sites, all five features were reconfirmed within the project area (see Figure 16). The sites included four core-filled ranching/boundary walls (Sites 20754, 20755, 20757, and 20758) and a terrace and wall located along the edge of the natural drainage which were likely used for agricultural activities (Site 20759).

3.11.2 Impacts and Mitigation Measures

All of the reconfirmed sites are considered significant based on the criteria established and promoted by the DLNR-State Historic Preservation Division (SHPD). For sites to be significant, they must possess the integrity of location, design, settings, materials, workmanship, feeling, and association and meet one or more of the following criteria provided by SHPD:

- Be associated with events that have made an important contribution to the broad patterns of our history;
- Be associated with the lives of persons important in our past;
- Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- Have yielded, or is likely to yield, information important for research on prehistory or history;
- Have an important traditional cultural value to the Native Hawaiian people or to another ethnic group of the state due to associations with traditional and customary practices.



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* Archaeological Site

Historic Wall

Figure 16
ARCHAEOLOGICAL SITES
Keopu Well
North Kona, Hawaii

The information collected during the previous studies, along with the current Rechtman inventory survey, is sufficient to document these sites and mitigate any potential negative impacts that might result from the construction of Keopu Well facilities. Rechtman Consulting concludes that no further work is necessary on the five recorded sites.

3.12 Cultural Impact Assessment

3.12.1 Background

In 2008, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted a cultural impact assessment (CIA) of the well site to evaluate the potential impacts of the proposed project on the cultural resources of Native Hawaiians (see Appendix E). The overall objective was to determine whether traditional and customary practices were being conducted within, or adjacent to, the project area and could possibly be constrained, constricted, prohibited, or eliminated if the proposed project were to be implemented.

In its research, the CIA documented the scarcity of information on the history of Hienaloli. The usual references used to determine place names were silent regarding the translation and meaning of Hienaloli. Over thirty informants were contacted to relate any experience or knowledge they might have of the project area. The noticeable dearth of information indicated that pre-contact cultural activities within Hienaloli were limited to agricultural and residential practices. There was little, to no information regarding current day practices specific to the study area.

3.12.2 Impacts and Mitigation Measures

The information presented in the CIA, historical documentation, archaeological surveys and research, and oral reminiscences, all indicate that the development of the well facilities will have little effect on Native Hawaiian traditional or customary rights and practices. Thus, no mitigation measures would be necessary. PHRI, however, emphasized that remnants of Native Hawaiian practices may reveal themselves during site construction. If that were to occur, work in the immediate area would be halted and DLNR-SHPD would be contacted, pursuant to the HAR 13§13-280.

4 SOCIOECONOMIC SETTING

4.1 Socioeconomic Background

For most of the 20th century, North Kona thrived historically as an agricultural region. With its scenic coastal resources, the area has experienced tremendous change and growth since statehood, driven by resort development and a second-home residential market. North Kona's ideal climate has attracted an influx of new residents and visitors, doubling the population over

the past 25 years and increasing the number of visitor units to 4,081 hotel rooms. This total comprises over 45 percent of the island's room inventory.

In addition to the gradual in-filling of residential homes between Kailua-Kona and Keauhou, urban development has been moving north toward the Kona International Airport in Keahole. HHFDC's Keahuolu Project is located in this northern growth pattern, and substantial amounts of public money are being invested in infrastructure to support this growth.

Kailua-Kona is considered the center for government, banking, and retail activities in West Hawai'i.[20] The old Kailua industrial area and new industrial subdivisions in Kaloko provide the largest concentration of such activities in the region, accommodating a wide range of manufacturing, service, and wholesale operations.

Despite the expansion of urban activities in North Kona, agricultural enterprises continue to prosper particularly in the uplands and southern sections of the district. Kona coffee has reached sales valued at $16.2 million.[21] Other agricultural operations have flourished including cattle ranching and the harvesting of fruits, macadamia nuts, flowers, and vegetables.

4.2 Economic Considerations

The estimated cost of $13.3 million[22] to construct the proposed well facilities will generate substantial beneficial effects in the local economy. During the design and construction stage of the project, work would be created in planning, engineering, landscape architecture, construction trades, material and supply vendors, and related fields. Secondary and induced effects will occur as monies from these industries are spent and re-spent generating a greater impact in the economy.

In the long-term, the new source of water for North Kona would accommodate continued urban development. It would support the development of new homes and businesses, prompt additional mobilization in the construction industry, stir another round of income and spending, and continue to generate state income tax and sales tax revenues.

4.3 Social Considerations

All state, county, regional, and community plans discussed in subsequent sections recognize the social and moral obligations for government and community leaders to plan for and provide the necessary infrastructure that support residential growth in the County. The County of Hawai'i General Plan states:

> *In the social and human realm, adequate housing is one of the primary factors that provide a person a sense of satisfaction and well being. For most families, it is a major expenditure of the household income and represents, in varying degrees, long term commitments to a place and/or community. In turn, these commitments contribute to a community's sense of well being and stability . . . .*

[20] County of Hawai'i, 2005. *General Plan*.

[21] 1997 estimate.

[22] Order of magnitude cost estimate based on today's (2009) prices.

> *From governments' perspective, adequate housing for residents is part of the considerations of public health, welfare and safety. Housing and residential use of land is a generator of government revenue through local real property taxes. The revenues are balanced by significant expenditures of public funds for roads, schools, protective services and other capital improvement projects that service residential areas. Thus, the provision of housing requires the coordination of planning and implementation on all levels of government.*

The proposed well will supply water and provide a vital service to the residents of North Kona, including the Keahuolu Project. As a utility, it will be an essential component for growth supported by State and County planning and land use policies. Notably, these policies include objectives to improve the infrastructure to support new development. Keopu Well is a component that is intended to support the planned development and growth in Keahuolu.

5 PUBLIC FACILITIES AND SERVICES

5.1 Circulation and Traffic

Mamalahoa Highway, a County right-of-way, is a two-lane highway that serves as the primary access through the uplands of North Kona and the Keopu Well site in Hienaloli 1-6. Traffic volume on this meandering rural road can be categorized as low.

Long-term operations of the production well will not generate any notable traffic. Typically, a monitoring crew of one technician would make daily trips to the site, while a maintenance crew would make periodic trips. Overall, however, there would be no multiple trips to the well facility on a per day basis.

In the short-term, construction activities at the well site will generate traffic associated with construction workers commuting to and from the property, delivery of construction material and equipment, and removal of construction wastes and debris. Traffic delays are expected to be intermittent and brief at isolated locations along the project's primary route: Mamalahoa Highway and Palani Road.

In addition to Mamalahoa Highway, Kealakaʻa Street and Manawaleʻa Street will also be affected by the proposed project. These two local streets serve as major accesses in the Kealakehe community. Kealakehe Street extends from Palani Road to the Kealakehe Homesteads boundary. It serves such facilities as Kealakehe Elementary School, Kealakehe Intermediate School, public housing projects, and area residential homes. Peak traffic occurs during the morning and afternoon commuter hours and end-of-school sessions.

Manawaleʻa Street is located at the end of Kealakaʻa Street near the Kealakehe Homesteads boundary. It connects Kealakaʻa Street with the newly completed Keanalehu Drive extension. Construction of the Keanalehu Drive extension coincided with the completion of Manawaleʻa Street's southern and final section.

Installation of a transmission line in Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street will require trenching, placement of the pipeline, and backfilling. These activities will

require temporary closure of a traffic lane and rerouting of passing vehicles to the opposite lane. Such a procedure could generate temporary, short-term traffic delays. As provided in Section 8.1 of this document, mitigation measures will be employed to minimize project impact on traffic.

5.2 Sewer, Electricity, and Telecommunications

5.2.1 Water

An 8-inch DWS water line currently runs along Mamalahoa Highway at the well site. This line is part of the North Kona Water System that consists of high-level, mid-level, and shaft wells; storage tanks; and an interconnecting distribution system serving DWS customers from Keahole to Keauhou.

The water from Keopu Well will connect to this system in the Keahuolu land tract where an existing 16-inch DWS line occurs. The connection is situated in Mamalahoa Highway approximately 7,000 feet to the north of HHFDC's well site. The new line will be 16 inches in diameter and aligned parallel with the existing 8-inch line. The new line will be entirely within the highway's existing right-of-way.

In conveying the Keopu Well water to the Keahuolu area, upgrades are required in the DWS distribution system. A new 12-inch diameter line will be needed in Kealakaʻa Street from Palani Road to Manawaleʻa Street and in a portion of Manawaleʻa Street from Kealakaʻa Street to the extension of Manawaleʻa Street. The latter street was recently constructed and includes a connecting DWS line. The two new lines will increase the capacity of the distribution system in Kealakehe to serve the Keahuolu Project.

5.2.2 Sewer

The County's sewer collection system currently services the town of Kailua-Kona, the coastal properties along Alii Drive, several inland subdivisions between Kailua-Kona and Keauhou, and new development above Queen Kaʻahumanu Highway, mauka of the County's Kealakehe Wastewater Reclamation Facility. The County system does not service, however, the upland homes and agricultural properties along Mamalahoa Highway.

Historically, the unserviced properties have used IWSs consisting primarily of cesspools to accommodate their wastewater disposal needs. However, recent government regulations now require an environmentally safer method of disposal to protect the area's watershed. Homeowners are opting, as an alternative, septic tanks which collect and hold its effluent, allowing the IWS to separate and biodegrade the outflow, before the liquid component is canted by overflow into typically a drain field for disposal.

The planned unmanned facilities at Keopu Well will not require an IWS. Hence, no impact from wastewater disposal is expected to occur on groundwater.

5.2.3 Electricity

Electricity is provided by Hawaii Electric Light Company (HELCO) via existing overhead lines along Mamalahoa Highway. The production well and support facilities will require electrical power for its operations, but the power demand is expected to be nominal and have no adverse impact on HELCO's capacity to serve other customers.

5.2.4 Telecommunications

Telecommunications service is available from Hawaiian Telcom. Telemetering equipment or a Supervisory Control and Data Acquisition (SCADA) system would be installed at the control building to monitor the well's operations. An overhead line along the well site's driveway will be installed to connect the SCADA with existing Hawaiian Telcom lines along Mamalahoa Highway. The proposed well facility will not require telephone land line services.

5.3 Solid Waste

The County of Hawaiʻi does provide solid waste collection service. Property owners or occupants hire private companies to haul their waste or self-haul their waste to the County's Puʻuanahulu Landfill in North Kona or to the County's transfer stations in Kailua, Keauhou, Keʻei, Wailea, and Miloliʻi. Most self-hauled wastes are taken to the transfer stations which are provided for use primarily from single-family residences. Other solid wastes, such as agricultural wastes, do not enter the county waste stream and are usually recycled at the source.[23]

Solid waste that would be generated at the well site, including construction and maintenance debris, is expected to be minimal and have no noticeable effect on County solid waste disposal facilities. Construction contractors, notably, often re-use construction material for subsequent projects. This economic use of supplies helps minimize solid waste disposal at the public land fills.

5.4 Public Facilities and Services

Police. The project site is located within the Hawaiʻi County Police Department's Kona District which is headquartered in Kealakehe. Substations are located in Captain Cook, Kailua-Kona, and Keauhou.

Fire and Emergency. A 24-hour fire station with fire, emergency medical service (EMS), and rescue capabilities is located in Kailua-Kona. In addition, fire stations with regular full-time fire and EMS services are located in Keauhou and Captain Cook. On-call volunteer services operate out of Kalaoa Mauka, Miloliʻi Village, and Kona Paradise Subdivision.

Medical. Kona Community Hospital, which serves West Hawaiʻi, is a full-service hospital located in Kealakekua. Hospital services include acute inpatient medical/surgical, obstetrics, skilled nursing, intensive care, and outpatient surgery. Outpatient and ancillary services include a

[23] Wilson Okamoto Corporation, May 2008. *Mapping the Future - Kona Community Development Plan.*

24-hour emergency room, laboratory, radiology, pharmacy, occupational, physical, respiratory and speech therapy, and dietary services.

Public Education. The Kona public school system is comprised of the Konawaena and Kealakehe complexes. The Konawaena complex includes Konawaena High School, Konawaena Middle School, Konawaena Elementary School, Hookena Elementary School, and Honaunau Elementary School. The Kealakehe complex includes Kealakehe High School, Kealakehe Intermediate School, Kealakehe Elementary School, Holualoa Elementary School, and Kahakai Elementary School.

Due to the purpose and function of the proposed project, adverse impacts to public facilities and services are not anticipated. Short-term impacts generated by project construction are addressed in Section 7.1 of this document.

6 RELATIONSHIP TO PUBLIC AND LAND USE POLICIES

6.1 Hawai'i State Plan

The Hawai'i State Planning Act (Planning Act) has served as a guide for the long-range development of the state since its adoption into law in 1978 as Hawai'i Revised Statutes (HRS) Chapter 226. The Planning Act identifies goals, objectives, and policies for the state to: (1) provide a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources; (2) improve coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities; and (3) establish a system for plan formulation and program coordination to provide for an integration of all major state and county activities.

Of the 107 sections that comprise HRS Chapter 226, three are directly applicable to the proposed project: (1) HRS §226-13 - Objectives and Policies for the Physical Environment – Land, Air, and Water Quality; (2) HRS §226-14 - Objective and Policies for Facility Systems – In General; and (3) HRS §226-16 - Objectives and Policies for Facility Systems – Water. The following table presents the applicable sections, measures conformance with the plan's goals and objectives, and summarizes the project's benefits and probable impacts.

SECTION	CHAPTER 226 - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	CONFORMS		NOT APPLICABLE
		YES	NO	
226-13	OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT – LAND, AIR, AND WATER QUALITY.			
(a)	Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:			
(1)	Maintenance and pursuit of improved quality in Hawai'i's land, air, and water resources.	√		
(2)	Greater public awareness and appreciation of Hawai'i's environmental resources.	√		
(b)	To achieve the land, air, and water quality objectives, it shall be the policy of this State to:			
(1)	Foster educational activities that promote a better understanding of Hawai'i's limited environmental resources.			√
(2)	Promote the proper management of Hawai'i's land and water resources.	√		
(3)	Promote effective measures to achieve desired quality in Hawai'i's surface, ground, and coastal waters.	√		
(4)	Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawai'i's people.			√
(5)	Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.			√
(6)	Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.	√		
(7)	Encourage urban developments in close proximity to existing services and facilities.	√		
(8)	Foster recognition of the importance and value of the land, air, and water resources to Hawai'i's people, their cultures and visitors.	√		
DISCUSSION: Conversion of Keopu Well to a production well will add a new source to the DWS water system. The long-term impact of the project will improve the County's capacity to serve customers in the North Kona region. The proposed project will also include a storage reservoir and transmission lines to enhance the County's overall delivery system. No long-term detrimental impacts on the County's existing water supply system are anticipated.				
226-14	OBJECTIVE AND POLICIES FOR FACILITY SYSTEMS – IN GENERAL.			
(a)	Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.	√		
(b)	To achieve the general facility systems objective, it shall be the policy of this State to:			
(1)	Accommodate the needs of Hawai'i's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.	√		

(2)	Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.	√		
(3)	Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.	√		
(4)	Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.	√		

DISCUSSION:

The proposed project fully supports the objectives and policies for "facility systems" as set forth in HRS §226-14. It is also consistent with the County General Plan, Kona Community Development Plan, and Hawai'i County Water Use and Development Plan. The new production well will supply water to HHFDC's Keahuolu Project, which will offer a range of affordable and market-priced housing units. The well will be located in the high-level zone of the Keauhou Aquifer at about the 1,600-foot elevation where previous exploratory wells have encountered favorable groundwater levels at 25- to 460-feet above sea level.[24]

226-16	OBJECTIVE AND POLICIES FOR FACILITY SYSTEMS – WATER.			
(a)	Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.	√		
(b)	To achieve the facility systems water objective, it shall be the policy of this State to:			
(1)	Coordinate development of land use activities with existing and potential water supply.	√		
(2)	Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.	√		
(3)	Reclaim and encourage the productive use of runoff water and wastewater discharges.		√	
(4)	Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.	√		
(5)	Support water supply services to areas experiencing critical water problems.	√		
(6)	Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.		√	

DISCUSSION:

The County recognizes Keopu Well as a potential source for serving new development in the Keahuolu area. HHFDC will construct Keopu Well, including its reservoir and transmission lines, and dedicate the improvements to the DWS.

[24] Wilson Okamoto Corporation, May 2008. *Mapping the Future - Kona Community Development Plan.*

6.2 State Land Use Law

The State Land Use District Maps, administered by the State Land Use Commission, designates the project site in the Conservation District. The Conservation District includes primarily lands in existing forest and water reserves, and areas necessary for protecting watersheds and water sources. It also includes lands for preserving scenic/historic areas, park areas, wilderness, and beach reserves, as well as for conserving indigenous or endemic plants, forestry, and fish.

The State BLNR oversees the Conservation District, which includes five subzones: *protective*, *limited*, *resource*, *general*, and *special*. HHFDC's well site is located in the Conservation District, but in an unspecified subzone. As a water system that will serve a public purpose, the proposed well and appurtenants are permitted uses in the Conservation District. A Conservation District Use Permit (CDUP), however, will be required for its construction. The existing exploratory well received a CDUP from the BLNR in 1999.

6.3 State Environmental Policy

The State Environmental Policy under HRS Chapter 344, established a policy that (1) encourages productive and enjoyable harmony between people and their environment; (2) promotes efforts that will prevent or eliminate damage to the environment and biosphere; (3) stimulates the health and welfare of humanity; and (4) enriches the understanding of the ecological systems and natural resources important to the people of Hawai'i.

HRS 344-3(1) states that it shall be the policy of the State, through its programs, authorities, and resources to:

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

The proposed well has the capacity of producing a sustainable yield up to 2.0 MGD to supply a large portion of water needs for the future Keahuolu residents, without a detrimental effect on the water resource of the district. The use of the island's water resource to fulfill the County's social, economic, and other requirements would be highly beneficial to the people of Hawai'i.

6.4 County of Hawai'i General Plan

The County initially adopted its first comprehensive General Plan for the island of Hawai'i in 1971. In 2005, the County made its most recent update of the long-range planning document, under Ordinance 05-69. The updated Plan sets forth policies of comprehensive development for the entire island based upon long-term goals, visions, values, and priorities important to the people of the island.

The General Plan cites in Section 11.2.4.7.2(a) specific courses of action for the North Kona region: *Continue to pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and an efficient and economic system operation.*

6.5 Keahole to Kailua Development Plan

In 1990, the County adopted the Keahole to Kailua Development Plan to serve as a guide for future land use development and infrastructure in the region. The 20-year plan includes residential, resort, commercial, industrial, recreational, and public facility uses.

At its conception, the plan recognized that the development of potable water resources would be crucial for the continued development of the Keahole to Kailua area and that the availability of potable water may become a limiting factor. In plan's program policies, a series of wells above the 1,500- to 1,800-foot elevation was proposed for development.

6.6 Kona Community Development Plan

The Kona Community Development Plan (CDP), adopted by the County in September 2008, translates the broad statements of the General Plan to specific actions as they apply to geographical areas of the region. Its vision for the future is:

> *A more sustainable Kona characterized by a deep respect for the culture and the environment and residents that responsively and responsibly accommodate change through an active and collaborative community.*

The CDP's goal for public facilities, infrastructure, and services is a community where the public infrastructure and facilities are sustainably built and maintained with innovation and pride, promote a sense of community, and support a quality of life where visitors and residents feel safe, healthy, and inspired.

As a utility and a component of required infrastructure, the proposed well and reservoir will support the planned growth of Kona as provided in the County's General Plan Land Use Pattern Allocation Guide and Kona CDP's Official Kona Land Use Map. The proposed project recognizes the identification of the Kona Mauka Watershed Management Program and will comply with the workings of that program.

6.7 County Zoning

The proposed well site is zoned A-5a Agricultural by the County of Hawai'i. It is also designated in the Conservation District by the State Land Use Commission. Lands that are located in the State Conservation District are regulated by the State DLNR and administered by the Office of Conservation and Coastal Lands. Since the well site is located in the State Conservation District, land use approval is obtained through a Conservation District Use Permit from the State BLNR. County zoning requirements are not applicable.

6.8 Special Management Area

Under HRS Chapter 205A (Coastal Zone Management), the County is authorized to regulate land uses within the Special Management Area (SMA) of the island of Hawai'i. The SMA encompasses a defined area along the coast of the Big Island.

The proposed production well, reservoir, and water lines are located outside of the SMA, and therefore, not subject to the SMA Rules and Regulations of the County of Hawai'i.

6.9 Other Permits and Approvals

Construction permits will be required for the outfitting of the production well and construction of its appurtenant facilities. These would include a water use permit, issued by the CWRM, and well construction and pump installation permit, approved by the State DOH. A National Pollutant Discharge Elimination System (NPDES) general permit coverage authorizing discharge of stormwater associated with construction activities will be required from the State DOH.

If a dry well is constructed at the well site, an UIC Permit will also be required for the project.

At the County level, a grading permit and building permit must be obtained from the County DPW and Planning Department, respectively. Plans of the water pipeline installation are reviewed and approved by the DWS.

6.10 Summary of Required Permits and Approvals

The following is a summary of the required permits and approvals for the construction of the proposed well, well appurtenants, reservoir, and water lines.

Table 9: Summary of Required Permits and Approvals for the Well Project

Permits/Approvals	Approving Agency
State of Hawai'i	
Conservation District Use Permit	Board of Land and Natural Resources
Water Use Permit	Commission on Water Resource Management
Well Construction* & Pump Installation Permits	Commission on Water Resource Management
NPDES Permit	Department of Health
Underground Injection Control Permit	Department of Health
County of Hawai'i	
Subdivision	Planning Department
Building Permit	Planning Department
Grading Permit	Department of Public Works
Water Pipeline Installation	Department of Water Supply

* May not be required if no further drilling and casing are required.

7 SUMMARY OF MAJOR IMPACTS

7.1 Short-Term Probable Impacts

Conversion of the exploratory well to a production well will involve construction activities that generate short-term, temporary impacts. At the well site, construction activities will include site preparation work, well pump installation, control building and reservoir construction, utility line placement, new driveway pavement, landscaping, and construction area cleanup. The probable impacts associated with these activities include construction noise, fugitive dust, stormwater run-off, and sedimentation. On the roadways, there would be construction vehicles delivering equipment and supplies to the construction site and construction employees commuting to and from the work area. The volume of construction-related trips would be small and occur at various times in the day, but not necessarily during the morning and afternoon peak-hour traffic.

Construction of the new water lines along Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street would involve the conventional trenching methodology. Installation of the utility would occur in phases over an approximately 6- to 12-month time period and involve short-term, temporary impacts from site preparation, trenching, pipeline placement, backfilling, and clean up operations. Heavy equipment including jack hammers, backhoes, dump trucks, pick-up trucks, boom-mounted flatbed trucks, asphaltic concrete hauling trucks, pavers, and rollers would be employed, and diesel-powered generators may be used if on-site temporary electric power is required.

During the pipeline installation, when construction work calls for excavation or trenching, noise and fugitive dust would be generated. Adjacent residential properties would be affected, but mitigation measures (discussed in Section 8.1) will be employed to minimize potential impacts. Also, after heavy rainfall, runoff and possible sedimentation may occur in adjacent private properties and County stormwater drainage systems.

Although existing and as-built utility plans have been reviewed, unexpected or altered utility line alignments may be encountered during trenching for the new water lines. Additionally, despite no evidence of surface archaeological features within the road rights-of-way, underground archaeological deposits may be encountered. Mitigation measures as described in the next section will be employed.

The installation of water lines within the road rights-of-way will also disrupt vehicular travel as traffic will be diverted to adjacent lane or to another area of the right-of-way while the pipeline work is being performed. No encroachment on adjacent private properties is anticipated; however vehicle access to some properties may be temporarily obstructed when construction occurs directly in front of them.

The economic impact of the proposed action would be positive and include the mobilization of construction personnel and equipment in the construction industry and the purchases of construction material and supplies in the local market generating a multiplier effect as monies are spent and re-spent on other purchases in the economy.

7.2 Long-Term Probable Impacts

Once the proposed facility is constructed and the utility is in full operation, the long-term impacts would be positive to area residents. The availability of additional water to the community would be a major public benefit.

The conversion of Keopu Well to a production well would have minimal or minor impact on other wells in the vicinity. Pumpage at Keopu Well will result in a lowering of water levels in the project area, a condition known as "cone of depression." Pump tests at the Keopu Well have shown that the nearby Keopu-Puʻuhonua Well will experience a drawdown of only 0.6 feet. Similarly, the nearby Douter Well located downslope of Keopu Well is expected to be affected by a drawdown of 0.6 feet or less. These drawdowns are considered insignificant and limited to the immediate vicinity of Keopu Well.

The proposed production well is an unmanned operation that would be monitored by telemetry and associated telecommunications equipment. There will also be regular daily monitoring and periodic maintenance of facilities by DWS personnel, but these activities would not result in major long-term impacts on traffic, fugitive dust, fauna, flora, archaeological sites, and cultural resources. The staff required for monitoring the well operations would comprise of one technician, while the maintenance crew would comprise of no more than a handful of repairmen and groundskeepers. Including Keopu Well in DWS's North Kona Water System is not expected to generate the hiring of additional DWS staff. However, if such a need is required, the number of new personnel would be minimal resulting in no substantial increase in resident population and resultant increase in housing, public facilities, and public services demand.

Noise from the well pump will be insignificant and require no special buffering.

Electrical energy will be required to operate the project's well pump, but not in significant quantities to exhaust the current supply of power to the area.

7.3 Cumulative Impacts

There are several wells that are currently being planned or have been recently completed in the Keauhou Aquifer System. As described in Section 3.4.5, these wells include Wells 1, 2, 3, and 4 (Keopu Well) of DHHL's *Villages of Laʻiʻopua Water Master Plan*, Keopu-Puʻuhonua Well (under construction), Palani Well No. 1, and Waiʻaha-DWS Well (completed in 2007). The wells are all planned to connect with DWS's North Kona Water System to service customers from Keahole to Keauhou. Each of these wells is being sought as needed sources to supplement and improve the capacity of the County's water system. All are intended to provide beneficial effects as a basic service for an expanding community in North Kona.

As each well development must demonstrate that it would not draw more than the sustainable yield of the groundwater at its site, the cumulative effect from the development of all the sources could have a major long-term impact on the region's groundwater supply or quality. As described in Section 3.4.1.2, the nature of the geologic formation and movement of groundwater in the Keauhou Aquifer System is very complex. Attaining a full understanding on the dynamics and condition of the aquifer is still ongoing. HHFDC is currently participating with two groundwater working groups (National Park Service and Hawaiʻi County DWS) to study,

analyze and address the long-term cumulative impacts of increased groundwater development in the high-level aquifer.

Meanwhile, efforts to monitor the groundwater resource and minimize secondary impacts generated by land development in the region will be undertaken. HHFDC is proposing to include a sensor in the Keopu Well's shaft to monitor groundwater level in the aquifer. Water conservation practices will be promoted to aid in the reduction of excessive water consumption, and the developer of the Keahuolu Project will include water conservation practices in the development of its housing project (see Section 3.4.6 of this document).

Existing groundwater protection procedures such as Best Management Practices (BMPs), Stormwater Pollution Prevention Plan approval, Chapter 401 Water Quality Certification, and NPDES permits are in place to regulate and control discharges to our state's groundwater resources. The Hawai'i State Water Code requires the CWRM to develop minimum standards to prevent polluting, contaminating, and wasting groundwater, and to minimize saltwater intrusion into wells and groundwater. Since well construction and pump installation permits require adherence to the Hawai'i Well Construction and Pump Installation Standards, the CWRM is ensuring adequate protection, testing, and optimization of aquifers with respect to the development of new ground water sources.

8 PROPOSED MITIGATION MEASURES

8.1 Mitigation Measures for Short-Term Impacts

The noise generated from construction activities will be short-term and localized to the immediate vicinity of the construction work in progress. A community noise permit will be sought from the DOH prior to the commencement of any construction activity. Night-time construction is not anticipated, but should such activity occur, a public informational meeting would be held for the affected residents and property owners. DOH's maximum permissible noise level for construction equipment during night hours in residential areas is 45 dBA. If the generated noise is expected to exceed the State's maximum permissible level, a noise variance will be sought from the DOH.

Construction equipment and on-site vehicles that emit gas or other emissions during operations (excluding pneumatic hand tools weighing less than 15 pounds) must be equipped with mufflers.

Dust control measures would include the use of dust screens, if necessary, frequent water sprinkling of exposed dirt areas, and temporary ceasing of operations during high wind conditions.

Although there are a few surface archaeological features on the well property, project engineers have designed the placement of the well facilities to avoid impacting any of the identified features. Additionally, if any buried cultural deposits are found during construction, work will cease in the immediate area of the find and the SHPD will be notified and consulted regarding proper treatment before any construction work is allowed to resume.

Erosion and sedimentation control measures and BMPs, such as berms, silt screens, snake bags, and sedimentation basins, will be employed, if necessary, to ensure that no runoff from the construction site flows onto adjacent properties and County stormwater drainage systems.

No dewatering will be required for the project. Groundwater is located far beneath the surface of the site and will not be encountered during excavation or trenching operations.

All solid waste and debris generated during construction will be collected and hauled away to a public landfill by the construction contractor.

A traffic control plan (TCP) for the water line construction along Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street will be prepared and submitted to the County for review and approval. The TCP will include traffic controls and management provisions designed to maintain safe vehicular passage through or around the project construction area.

Traffic cones and posted signs will be placed far in advance of the construction site to provide adequate warnings to motorists. Lane closures may be required during trenching and pipeline placement resulting in the use of the remaining lane for local traffic to past through. Traffic monitors or flaggers will be employed to control and direct vehicular movement through the construction area. Work on the water line will be conducted in phases so affected areas would occur in short sections at a time.

To further minimize traffic impact, work will be conducted during off-peak hours to avoid the day's heaviest traffic periods. In the event that the pipeline construction blocks a resident's direct access to his or her home, the construction contractor will immediately cease work in the area, place a metal plate over the pipeline trench, and allow the property owner to traverse the obstructed area. This procedure would also apply to the County Fire Department where access to its fire hydrants may be hindered during construction.

The project engineers (or consultants) and construction contractor are expected to coordinate construction of the water line with all potentially affected utility companies. This coordination would begin early in the planning and design process, with the construction contractor continuing the effort into the construction stage. The cost of any concessions or required alterations to the affected utilities may be borne by the project owner, contractor or design engineer, or a combination of these three.

8.2 Mitigation Measures for Long-Term Impacts

As a means to protect the watershed area around Keopu Well, the DOH notes that a source water assessment should be conducted.[25] This process is preliminary to the creation of a source water protection plan for the source.

Keopu Well was initially installed to protect the high-level aquifer from potential surface contamination by including cement-grouting in the annular space around the well's steel casing from the ground surface to a depth of 1,529 feet (72-feet above the static water level). Further, when Keopu Well is converted to a production well, standard engineering practice would be employed to direct surface drainage away from the well bore.

[25] DOH letter, dated July 9, 2009, to Belt Collins Hawaii.

The visual impact of the well and reservoir on motorists traveling on Mamalahoa Highway will be mitigated by existing vegetation on the property. The colors of the new facility will be in natural hues that harmonize with the surrounding setting.

Long-term use of electrical energy to power the well pump and control building will be minor in scale and not require special conservation practices.

Since adverse impacts to the social and economic environment of the community are expected to be negligible, no mitigative measures would be necessary.

9 ALTERNATIVES CONSIDERED

9.1 No Action Alternative

At the well site, the no action alternative would result in the retention of the existing exploratory well even if it had been pump tested and proven to be capable of serving as a production well. The well site would remain undeveloped in a natural state heavily covered with vegetation typical of the area. No alteration of the land will occur and no construction impacts will result. The well site would remain unproductive and idle, HHFDC would not have a readily available source of water for its Keahuolu Project, and DWS would not have a supplemental source for its North Kona Water System.

9.2 Alternative Location

9.2.1 Alternative Well Site

An alternative location for the production well would require an existing exploratory well that has been tested and proven successful. The exploratory well would need to be located in an appropriate location and elevation to fit into the DWS distribution network of the North Kona Water System. The *Villages of La'i'opua Water Master Plan* identifies four potential sources of water to serve projects in the Kealakehe and Keahuolu area. These sources, Kealakehe Well (State Well No. 4057-04), North Keopu Well (site only), North Keopu Well (State Well No. 3957-02), and Keopu Well (State Well No. 3957-05), are all located mauka of the Mamalahoa Highway in the high-level zone of the Keauhou Aquifer System. One of the sources is designated for DWS use; the other is on private land and will require acquisition. The two remaining sources are Keopu Well and North Keopu Well (No. 3957-02).

The North Keopu Well is presently a monitoring well with a small bore on a limited-size site. There is no space on the property for a full-size reservoir. Although it is closer to Keahuolu, the well would require significant work (more than the Keopu Well) to bring it on line as a production well. For the present, the Keopu Well is the more feasible well for initial development.

9.2.2 Alternative Water Transmission Line Alignment

The new transmission lines will be located within Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street. The new line from Keopu Well to the existing 16-inch County line in upper Keahuolu has only one possible route which is along the Mamalahoa Highway right-of-way. No alternative alignment is feasible.

An alternative alignment for the water line in Kealakaʻa Street and Manawaleʻa Street was considered but determined to be undesirable. Installation of the alternative water line along the highly-travelled Palani Road from Kealakaʻa Street to the Keahuolu Project would result in a major construction impact on traffic and a high construction cost involving use of lands beyond the County right-of-way. Other alternative alignments would require traversing State lands and private properties, which entail high land acquisition costs. Selection of the present proposed alignment would result in a far less impact on traffic and at a more reasonable cost.

9.3 Alternative Use

9.3.1 Well Site

The well site is located in the State-designated Conservation District. Permitted uses include activities and land uses that protect or conserve the natural resources of the land. Utilities are permitted as essential facilities and services for the permitted uses.

An alternative use for the well site is agricultural activities that are consistent with existing agricultural operations in the area. Coffee bean and macadamia nut are predominant crops in Kona; so are cattle and forestry. Although these crops do well in the region, they do not dictate the necessity to engage in such crops. HHFDC is not in the agricultural business and would not consider anything but uses that would support its objective to provide affordable housing in the community. A production well at the Keopu Well site will fulfill the need of an essential utility to serve North Kona and the Keahuolu Project.

9.3.2 Roadway Site

Use of Mamalahoa Highway, Kealakaʻa Street, and Manawaleʻa Street for vehicle and pedestrian access as well as for public utilities is appropriate and for the intended purpose. Any other use would interfere or be detrimental to that purpose. The proposed water lines will be compatible and consistent with the intended function of the three County rights-of-way.

9.4 Alternative Design

9.4.1 Facility Size

Alternative sizes for the proposed facility are generally dictated by the potential yield that the well can draw from the site, and standard practices would indicate that the facility be designed to accommodate the potential maximum sustainable production. Pump test results show that Keopu

Well is capable of pumping at a sustainable rate of 2.34 MGD. The recommended maximum capacity of a permanent pump for the well, however, would be 2.0 MGD. To provide storage for that water, a reservoir will be installed with the well.

9.4.2 Construction Material

Since the well, control building, reservoir, and appurtenants will be turned over to the County once construction is completed, they would be required to meet DWS design specifications. The proposed material of concrete for the reservoir is a DWS requirement. Design of the proposed pump, control building, and transmission lines will be reviewed and approved by the DWS before construction proceeds on those facilities.

10 PRELIMINARY DETERMINATION

This environmental assessment (EA) demonstrates that the proposed action will have no significant adverse impacts on the environment and that an EIS would not be warranted. A FONSI is, therefore, anticipated for this project.

11 FINDINGS AND REASONS SUPPORTING PRELIMINARY DETERMINATION

The following findings and reasons demonstrate that the proposed action will have no significant adverse impact on the environment based on the 13 significance criteria provided in HAR 11-200-12.

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

Alternative plans were considered in determining the best concept for the proposed well and appurtenants in order to avoid or minimize environmental impacts. The proposed project would not result in significant loss or destruction of the area's natural and cultural resources.

2) Curtails the range of beneficial uses of the environment.

The proposed well is identified in the *Villages of La'i'opua Water Master Plan* as a source for the water system to serve the Keahuolu area. No other uses are planned for the well site. The proposed facility would not curtail future beneficial uses of the land.

The proposed water transmission lines will be installed in existing County rights-of-way, which are intended to accommodate public roads and utilities.

3) Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions

thereof and amendments thereto, court decisions, or executive orders.

As demonstrated in Chapter 6.3 of this document, the proposed action is consistent with the state's long-term environmental policies and guidelines as expressed in HRS, Chapter 344.

4) Substantially affects the economic or social welfare of the community or state.

The proposed project is expected to provide an essential utility that would stimulate and sustain growth in the community as well as create economic benefits in the Kona region. The construction activity associated with the proposed project will mobilize existing labor forces and generate an infusion of business and personal income into the local economy. No negative effects on the social welfare of the Kona community are anticipated.

5) Substantially affects public health.

The proposed project would not result in the uncontrolled and unsupervised use of hazardous material or construction methodology that would detrimentally affect the area's public health and safety. Existing State DOH regulations are established to protect air and water quality. Construction noise will be minimized through compliance with HAR Chapter 11-46, Community Noise Control.

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

The proposed project will provide a basic service for the planned Keahuolu Project and other DWS customers in North Kona. To that effect, the proposed project is not intended to have substantial secondary impacts such as population changes or effects on public facilities.

7) Involves a substantial degradation of environmental quality.

The proposed well and appurtenants will occupy only a portion of the State property leaving a substantial area unaltered. The new production facility will be unmanned so no constant human activity will take place at the site; only regular monitoring and periodic maintenance will occur. The proposed facilities will be designed to harmonize with the land, and the area's dense vegetation will continue to provide visual screens for the surrounding properties.

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

The current design of the proposed well and appurtenants represents the complete facility. No expansion plans or additions are being contemplated.

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

Field surveys of the area's existing natural resources indicate that no federal- or state-listed rare, threatened, or endangered wildlife or flora species will be negatively affected by the proposed project.

10) Detrimentally affects air or water quality or ambient noise levels.

The anticipated impacts associated with the project's construction, such as fugitive dust, noise, and erosion and sedimentation, are short-term and temporary. These impacts would be minimized by the implementation of BMPs and mitigation measures in accordance with applicable laws, statutes, ordinances, as well as rules and regulations of the federal, state, and county governments.

Long-term operations of the production well are expected to generate minor or no impacts on air quality, water quality or ambient noise levels. The unmanned facility will have minimal human operations and heavy machinery on the property.

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.

Keopu Well is located more than 2.5 miles from the shoreline. It will not affect or be affected by high surf and tsunami inundation. Groundwater is typically connected to the coastal and shoreline resources including estuaries, natural ponds, and coastal waters. Studies, groundwater working groups, and groundwater monitoring are ongoing to attain a fuller understanding of the dynamics and condition of the groundwater resource in the Keauhou Aquifer System. HHFDC is participating in these government and community efforts to minimize groundwater impacts.

A large drainage channel traverses the property, but will not significantly affect well operations. The proposed well and reservoir will be constructed on high ground, and the service driveway connecting the two facilities on either side of the channel will be designed to accommodate heavy runoff through the site. Planned re-landscaping will mitigate any erosion-prone areas around the new facilities.

12) Substantially affects scenic vistas and view planes identified in county or state plans or studies.

The proposed well and appurtenants will be located more than 280-feet above Mamalahoa Highway and out of view from traveling motorists on the County right-of-way. No scenic vistas or view planes, identified by public plans, will be adversely impacted.

13) Requires substantial energy consumption.

The proposed well and appurtenants will require little electrical energy to operate. Use of the public utility would not result in a significant drain on the power supply for the County.

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APPENDICES

APPENDIX A

Preconsultation Letters

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/SDWB

July 9, 2009

Mr. Glen Koyama
Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819-4554

Dear Mr. Koyama:

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR PROPOSED WELL AND OFF-SITE WATERLINE IMPROVEMENTS FOR KEAHUOLU AFFORDABLE HOUSING PROJECT, KAILUA-KONA, HAWAII,
TMK: (3) 7-5-13:22 & VARIOUS COUNTY ROADS
REFERENCE NO. 09-105

The Safe Drinking Water Branch has reviewed the subject document and offers the following comments:

1. In the Draft Environmental Assessment, please confirm that all water infrastructure will be dedicated to the Department of Water Supply, County of Hawaii and become incorporated into the North Kona (Public Water System No. 131) water system.

2. Projects that propose development of new sources of drinking water serving or proposed to serve a public water system must comply with Hawaii Administrative Rules, Title 11, Chapter 20, Section 29, entitled "Use of new sources of raw water for public water systems." This section requires that all new public water system sources be approved by the Director of Health prior to its use. Such approval is based primarily upon the submission of a satisfactory engineering report, which addresses the requirements set forth in Section 11-20-29.

   The engineering report must identify all potential sources of contamination and evaluate alternative control measures, which could be implemented to reduce or eliminate the potential for contamination, including treatment of the

water source. In addition, water quality analyses for all regulated contaminants, performed by a laboratory certified by the State Laboratories Division of the state of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional parameters may be required by the Director for this submittal or additional tests required upon his or her review of the information submitted.

3. All public water system sources must undergo a source water assessment, which will delineate a source water protection area. This process is preliminary to the creation of a source water protection plan for that source and activities, which will take place to protect the drinking water source.

4. For further information concerning the application of new source approval and source water assessment or other regulated public water system programs, please contact the Safe Drinking Water Branch, Engineering Section at 586-4258.

If there are any questions, please call Jennifer Nikaido at 586-4258.

Sincerely,

STUART YAMADA, P.E., CHIEF
Safe Drinking Water Branch
Environmental Management Division

JN:cb

c: Jiacai Liu, EPO

William P. Kenoi
Mayor

BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

County of Hawai'i

PLANNING DEPARTMENT
Aupuni Center • 101 Pauahi Street, Suite 3 • Hilo, Hawai'i 96720
Phone (808) 961-8288 • Fax (808) 961-8742

July 15, 2009

Mr. Glen T. Koyama
Belt Collins Hawai'i Ltd.
2153 North King Street, Suite 200
Honolulu HI 96819-4554

Dear Mr. Koyama:

Subject: Pre-Consultation on Environmental Assessment
Applicant: Hawai'i Housing Finance and Development Corporation (HHFDC)
Project: Well and Off-Site Water Line Improvements for Keahuolu Affordable Housing Project
TMK: 7-5-13:22 and Various County Roads, North Kona, Hawai'i

This is in response to your letter dated June 29, 2009.

HHFDC proposed to convert the existing exploratory Well No. 4 into a production well to serve as a source of water for their planned Keahuolu affordable housing project. The new well will be furnished with ancillary equipment and facilities including a permanent pump, control building with chlorination system, backup generator, and 2.0-million-gallon storage reservoir.

Delivery of water from Well 4 to the housing project requires improvements to the existing County water distribution system. Additional water lines will be installed within the County roads' right-of-way.

Parcel 22 consists of 78.36 acres. It is zoned Agricultural (A-1a and A-5a) by the County and designated Conservation by the State Land Use Commission. Within the State Land Use Conservation district, there is no County zoning per se. The Department of Land and Natural Resources has jurisdiction over the Conservation area.

The subject parcel appears to be designated Conservation by the General Plan's Land Use Pattern Allocation Guide (LUPAG) Map. It is not located within the County's Special Management Area.

The Kona Community Development Plan was adopted by the County of Hawaii as Ordinance No. 08-131, effective September 25, 2008. A discussion of the proposed improvement as it relates to this plan should be included in the Environmental Assessment.

Should you have questions, please feel free to contact Esther Imamura of our Department at 961-8139.

Sincerely,

BJ LEITHEAD TODD
Planning Director

ETI:cs
P:\Public\Wpwin60\ETI\Eadraftpre-Consul\Koyama Well Water Line Keahuolu AHP.Rtf

xc: Planning Department, Kona

William P. Kenoi
Mayor

William T. Takaba
Managing Director

Warren H. W. Lee
Director

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

July 14, 2009

Mr. Glen T. Koyama
Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, HI 96819-4554

Subject: Environmental Assessment
Proposed Well and Offsite Water Line Improvements for
Keahuolu Affordable Housing Project
Kailua-Kona, Hawaii, TMK 7-5-13: 22 and Various County Roads

We reviewed the pre-draft announcement dated June 29, 2009.
The project cost estimate should allow for cold-planing and resurfacing of the entire lane of any existing County road where longitudinal trenching is proposed.

The proposed water line and reservoir service road and waterline cross Hienaloli Drainageway. All work within the flood zone and drainageway shall comply with Chapter 27 of Hawaii County Code and be constructed to minimize flood damage.

If you have any questions, please contact Kiran Emler of our Kona office at 327-3530.

Galen M. Kuba, Division Chief
Engineering Division

cc: ENG-HILO

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

February 23, 2009

Mr. Glenn T. Koyama
Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, HI 96819-4554

REQUEST FOR ENVIRONMENTAL ASSESSMENT CONSIDERATION
PROPOSED KEAHUOLŪ WELL NO. 4 AND RELATED IMPROVEMENTS
KEAHUOLŪ AFFORDABLE HOUSING PROJECT
TAX MAP KEY 7-5-013:022 AND VARIOUS COUNTY ROADS

This is in response to your letter, dated January 14, 2009.

We have reviewed your letter and attached information regarding the need for an Environmental Assessment (EA) for the proposed Keahuolū Well No. 4 and related improvements. We agree that an EA for the proposed production well and supporting facilities will be needed However, the EA should also cover the proposed transmission waterlines within Māmalahoa Highway (16-inch), Kealakaa Street (12-inch), and Manawale'a Street (12-inch).

In addition to the well/reservoir site improvements and transmission waterlines within the existing County right-of-ways, the EA should also cover the transmission waterline from the well site to Māmalahoa Highway (16-inch).

Should there be any questions, please contact Mr. Finn McCall of our Water Resources and Planning Branch at 961-8070, extension 255.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

FM:dfg

copy - Mr. Alan Kato, Belt Collins Hawaii

... Water brings progress...

William P. Kenoi
Mayor

Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawaii

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

January 27, 2009

Mr. Glen T. Koyama
Belt Collins Hawaii Ltd.
2153 North King Street, Suite 200
Honolulu, Hawaii 96819-4554

Dear Mr. Koyama:

SUBJECT: Environmental Assessment Consideration Regarding Proposed Well and Off-Site Water Line Improvements for Keahuolu Affordable Housing Project, Kailua-Kona, Hawaii
TMK: (3) 7-5-13: 22 and Various County Roads

This responds to your January 14, 2009 letter requesting comments on any special environmental conditions or impacts related to the project.

Staff recommends that the Environmental Assessment address the following during the construction stage:

- Traffic safety and flow.
- Emergency response.
- Strategies to address pedestrian safety.

Should you have any questions, please contact Captain Chad Basque, Commander of Kona Patrol, at 326-4646 extension 249.

Mahalo,

HARRY S. KUBOJIRI
POLICE CHIEF

HENRY J. TAVARES JR.
ASSISTANT CHIEF
AREA II OPERATIONS

APPENDIX B

Botanical Survey

Botanical Survey
of the
Keahuolu Affordable Housing Project
Proposed Well Site,
North Kona,
Island of Hawai'i

by

Art Whistler, Ph.D.
Isle Botanica
Honolulu, Hawai'i

Report prepared for

Belt Collins Hawai'i Ltd.
Honolulu, Hawai'i

January 2008

INTRODUCTION

The study site comprises a parcel of land where the construction of a well for the Keahuolu Affordable Housing Project is proposed (Fig. 1). It is located several miles east-southeast of the housing area along Mamalahoa Highway nearly due east of Kailua-Kona. The rectangular property comprises 13.8 acres, starting from the highway at about 1600 ft elevation and extending upslope to about 1750 ft, and is located on TMK (3) 7-5-13: 022. The surface of the site comprises soil rather than exposed rock, and is covered with secondary forest and grassland.

The construction of the well requires an up-to-date botanical survey, especially since there are federally listed, threatened and endangered plant species occurring in the general vicinity. Most of the area is highly disturbed, since the native vegetation has long since been removed. An Environmental Assessment of the site (Fukunaga and Associates 1994) was prepared for the Hawai'i Finance and Development Corporation (HFDC), but it contained no relevant botanical information other than a single paragraph describing the general vegetation in the area.

The objectives of the current field study were to provide a general description of the vegetation types present at the project site (particularly any sensitive types of vegetation that may harbor rare plant species), to make a checklist of all native and naturalized vascular plants found, and to search for threatened and endangered species.

METHODOLOGY

Before the fieldwork was carried out, a review of the literature was undertaken by the Principal Investigator (PI). The current status of any endangered species previously reported from the general area was checked using the official database of threatened and endangered species (USFWS 2005). This list is identical to the State of Hawai'i list of threatened and endangered plant species. In addition, information about these categories of plant species found in the area was extracted from the Hawai'i Natural Heritage Program database (Anon. 2005) of federally listed plant species, and is presented here in the form of a map of these collections and sightings (Fig. 2). Topographic maps and aerial photos were studied to find the best access points and to determine if any native forest was present at the site.

After the literature review, a botanical field survey was conducted at the site by a two-person botanical team consisting of the PI (Art Whistler) and a Field Assistant (Beate Neher) on 5 and 15 December 2007. The site was accessed from a narrow dirt road leading off of Mamalahoa Highway. A walk-through survey was employed to study the vegetation and flora. This involved doing transects off of dirt roads, tracks, and streambeds. All plant species encountered during the survey were recorded, along with an indication of their frequency. New lists were made for each vegetation type and/or day, and these were combined into a comprehensive checklist of all plants found at the site (see Table 2 in the Appendix). Notes were also taken on vegetation types present, indicating the dominance and frequency of the plant species found there. These were later analyzed and written up to form the vegetation section below. Nearly all of the species encountered during the fieldwork were familiar to the botanical team and were identified in the field. The few that were not immediately recognized were collected and taken back to the lab for further study involving the use of the flora of Hawai'i (Wagner et al. 1999).

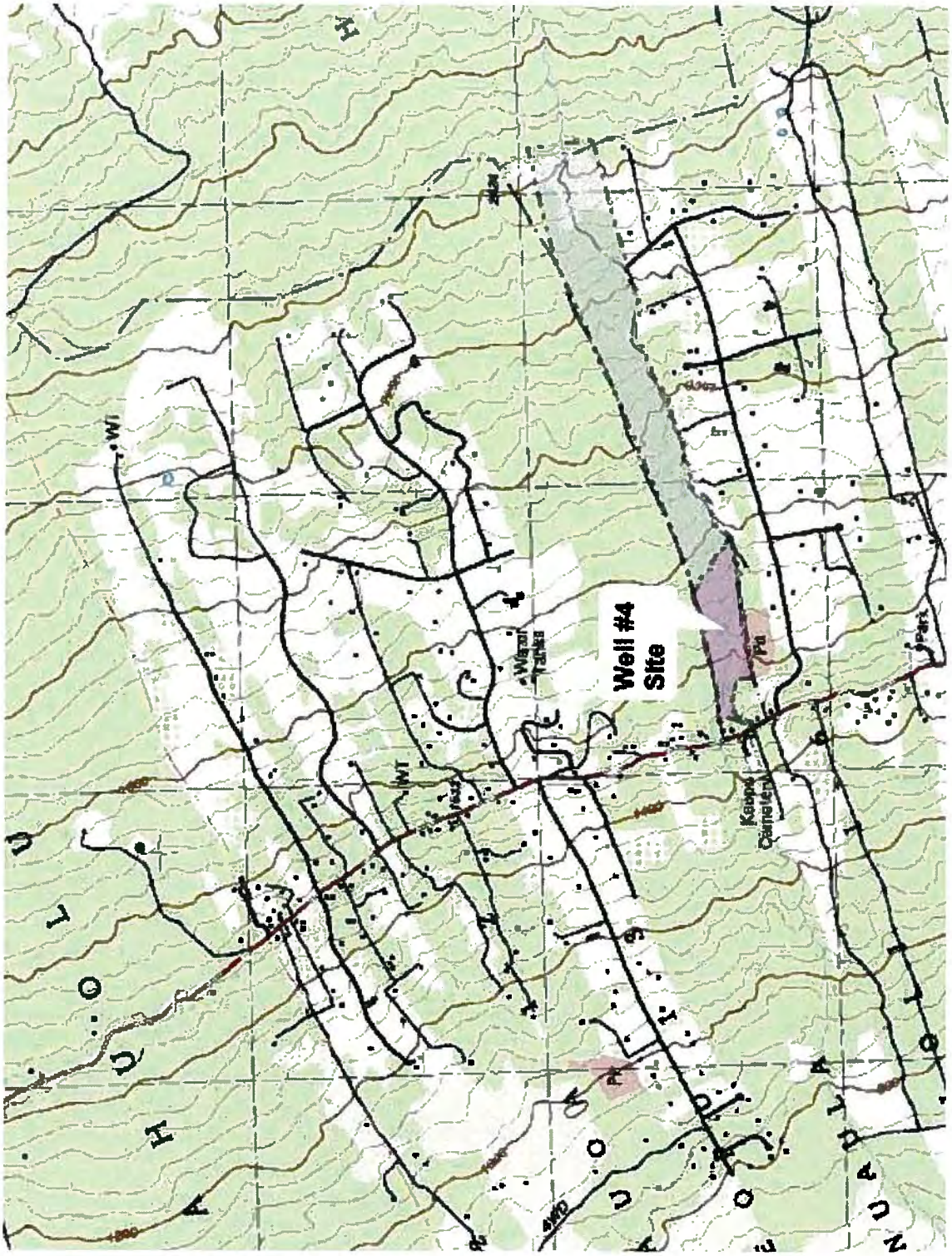

Fig. 1. The Keahuolu Affordable Housing Project Proposed Well study site.

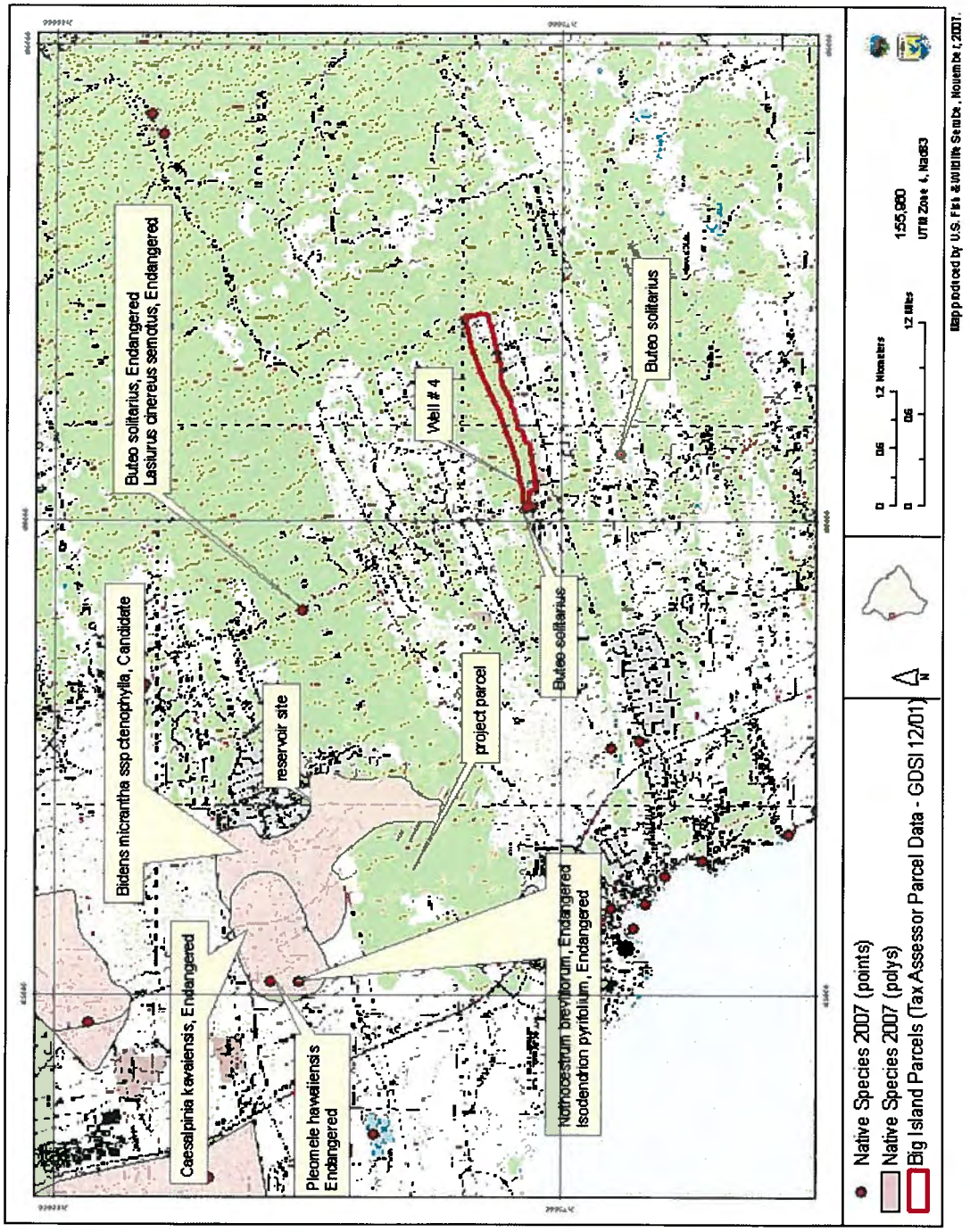

Fig. 2. Hawai'i Natural Heritage Program map of federally listed plant species in the area, with the study site indicated in red.

Three types of vegetation can be recognized at the study site: (1) Managed Land Vegetation; (2) *Schinus/Psidium* Forest; and bamboo forest. These are described below.

(1) Managed Land Vegetation

The Managed Land Vegetation comprises a dirt access road extending into the western portion of the property, grassy areas either cut regularly (forming a lawn along the south-central portion of the property) or irregularly (an herbaceous area around the existing well site), and what appear to be areas of former pastureland. The access road is dominated by low-growing herbaceous species such as *Desmodium intortum*, *Heterocentron subtriplinervium*, pluchea (*Pluchea carolinensis*), and comb hyptis (*Hyptis pectinata*). The herbaceous vegetation around the actual well site is dominated by alien species such *Desmodium intortum*, Canada fleabane (*Conyza canadensis*), pluchea, and partridge pea (*Chamaecrista nictitans*). The mowed lawn is dominated mostly by alien species, such as carpet grass (*Axonopus fissifolius*), Glenwood grass (*Sacciolepis indica*), and broom grass (*Andropogon virginicus*); the sedge *Pycreus polystachyos*; and the dicot herb sensitive plant (*Mimosa pudica*). In areas along the roadside that probably have not been disturbed for several years, thickets of pluchea up to 2 m in height dominate, often overgrown with *Desmodium intortum* and *Heterocentron subtriplinervium*. Much of the northeast quarter of the property appears to have been formerly used as a cattle pasture. These areas are dominated by grasses, such as *Digitaria procumbens* (pangola grass), which are mainly used in cattle pastures. Virtually no native species are found in these areas of highly disturbed vegetation.

(2) *Schinus/Psidium* Forest

The 1994 Environmental Assessment of the area recognized three types of vegetation; (1) a strawberry guava community, which included significant amounts of Christmas berry; (2) an unnamed community dominated by guava and Christmas berry; and (3) another unnamed one that "includes" koa (*Acacia koa*) and ohi'a lehua (*Metrosideros polymorpha*). Based on the present fieldwork, a division into these three vegetation types could not be distinguished, and no koa and only a few scattered individuals of ohi'a lehua were encountered. The description of "a ground cover of young guava..., ferns and various grasses" does not fit the current situation either, as the few guava trees seen were in open areas rather than under the forest cover of strawberry guava. These 1994 divisions may have been general types of vegetation found in the area, but not specifically on the site, but little information was given on how the study was conducted.

The *Schinus/Psidium* Forest recognized here is the relatively low-stature forest that covers most of the well site, at least in areas that have not recently been cleared. It is dominated by two species, Christmas berry (*Schinus terebinthifolius*) and strawberry guava (*Psidium cattleanum*). The forest could just as easily be classified as two separate forests, since in many places only one of the two tree species dominate, but a division into two types is unsatisfactory since the two species are often found commingled and sharing dominance. When strawberry guava dominates, it could be called a *Psidium cattleianum* forest (Fig. 3); when Christmas berry dominates, it could be called a *Schinus* Forest (Fig. 4); and when the two share dominance, it could be called a

Schinus/Psidium Forest, the term used here for all these variations. The factors that determine whether one species, the other, or both dominate at any one place are unclear. Few other trees are found in this forest, except for the previously mentioned ohi'a lehua, tall but scattered individuals of silk oak (*Grevillea robusta*), and much lesser amounts of guava (*Psidium guajava*).

The ground cover is dominated by only a few species that are able to survive in the relatively dense shade (Figs. 5 and 6). The most common of these are the native fern blechnum (*Blechnum occidentale*), the Polynesian-introduced herb shampoo ginger (*Zingiber zerumbet*), and the alien basket grass (*Oplismenus hirtellus*). These often form mono-dominant patches, just as the canopy trees do. In areas with more sunlight, the alien herb buttonweed (*Spermacoce assurgens*) can dominate, and *Desmodium intortum* is also sometimes common here. Yellow ginger (*Hedychium flavescens*) is also common in some places.

Several stream courses run across the property (Fig. 7). These are usually shaded by a canopy formed by the trees along the banks, particularly strawberry guava. The rocks of the streambed are covered with mosses, with only a few flowering plants being able to colonize the shaded rocks that are occasionally awash in floodwaters after heavy rains.

(3) Bamboo Forest

This comprises extensive monodominant groves of bamboo (*Bambusa vulgaris*) that cover the northwest part of the study site. The bamboo grows so close and thick, and forms such a dense canopy, that few other species, even ground cover species, can survive (Fig. 8).

THE FLORA

Eight-three plant species (see Table 2 in the Appendix) were recorded at the study site. The majority of these are naturalized "alien" plants that were accidentally or intentionally introduced to Hawai'i, but which have now become established in the islands and can spread on their own. The remaining plants, which are termed native species, comprise indigenous and endemic species. Indigenous plants are species that are native to a region or place, but are also found elsewhere. Endemic plants are species restricted to a single region or area, i.e., in the case of Hawai'i, they are found only in Hawai'i. In biodiversity terms, the endemic status is the more important of the two categories, since if a species belonging to it is endangered or threatened in Hawai'i, it would likewise be classified globally. Indigenous species, however, can be rare in Hawai'i, but may be common elsewhere in the Pacific. Over 90% of the native plants in Hawai'i are endemic, one of the highest rates in the world.

The study site included, among its 83 recorded species, nine native plant species—two endemic and seven indigenous species (Table 1). This is an unusually low number of native species, which can be accounted for by the extensive disturbance at the site. A checklist of all species found at the site is shown in Table 2 in the Appendix.

DISCUSSION

Eighty-three plant species were recorded at the study site, with 9 of them being native—two endemic and seven indigenous. The low number of native species is to be expected, since the site is so disturbed. No species federally listed as threatened or endangered were found, and this in agreement with previous studies in Hawai'i as shown on the Hawai'i Natural Heritage Program database map (Fig. 2). None of the native species are even particularly uncommon in Hawai'i.

No sensitive types of vegetation were found at either study site. Such types of vegetation include wetlands and dryland forest. The surface at the well site is too porous to have wetlands, and the streambeds have water only after heavy rains. Dryland forest with sensitive plant species is found at Kaloko to the north of the present study site (Whistler 2006), but none was encountered at the study site itself because the higher rainfall there creates much wetter forests.

Table 1. Native species recorded at the study site.

Species	Common Name
Endemic Species	
Cibotium chamissoi	haupu'u 'i'i
Metrosideros polymorpha	'ohi'a lehua
Indigenous Species	
Pteridium aquilinum	bracken fern, kilau
Blechnum occidentale	blechnum
Paspalum scrobiculatum	rice grass
Pleopeltis thunbergiana	pakahakaha
Psilotum nudum	moa
Solanum americanum	black nightshade, popolo
Sphenomeris chinensis	pala'a

CONCLUSIONS AND RECOMMENDATIONS

Based upon the survey, three main types of vegetation are present at the study site: (1) Managed Land Vegetation; (2) *Schinus/Psidium* Forest; and (3) Bamboo Forest. No areas of wetlands or undisturbed native vegetation are encountered. Eighty-three plant species were recorded from the site. Because of the highly disturbed nature of the vegetation, only nine native species were recorded—seven indigenous species and two endemic species. None of these are federally listed as "threatened" or "endangered."

Because of the absence of native vegetation, there are no vegetation issues. Because of the relative absence of native species and the complete absence of threatened or endangered plant species, there are no botanical impediments to carrying out the proposed construction.

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APPENDIX

Table 2. Checklist of plant species at the study site.

The following is a checklist of the vascular plants inventoried during the field studies on the Keahuolu Affordable Housing project proposed well site. The plants are divided into three groups, Ferns (including fern allies), Monocots, and Dicots. Within these groups, the species are presented taxonomically by family, with each family and each species in the family in alphabetical order. The taxonomy and nomenclature of the ferns follow Palmer 2003 and the flowering plants (Monocots and Dicots) follow Wagner *et al.* (1990). In most cases, common English and/or Hawaiian names listed here have been taken from St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used.
   - E = endemic (found only in Hawai'i).
   - I = indigenous (native to Hawai'i as well as other geographic areas).
   - P = Polynesian introduction (introduced to Hawai'i by Polynesians before the advent of the Europeans).
   - X = Introduced or alien (not native, introduced to Hawai'i, either accidentally or intentionally, after the advent of the Europeans).

Species	Common Names	Status[1]
FERNS AND FERN ALLIES		
ADIANTACEAE (Maiden's-hair Family)		
Adiantum hispidulum Sw.	rough maidenhair fern	X
BLECHNACEAE (Blechnum Family)		
Blechnum occidentale L	blechnum	I
DENNSTAEDTIACEAE		
Pteridium aquilinum (L.) Kuhn	bracken fern, kilau	I
DICKSONIACEAE (Tree Fern Family)		
Cibotium chamissoi Kaulf.	haupu'u 'i'i	E
LINDSAEACEAE (Lace Fern Family)		
Sphenomeris chinensis (L.) Maxon	pala'a	I
NEPHROLEPIDACEAE (Sword Fern Family)		
Nephrolepis multiflora (Roxb.)	hairy swordfern	X
POLYPODIACEAE (Common Fern Family)		
Phlebodium aureum (L.) J. Sm.	laua'e-haole	X
Pleopeltis thunbergiana Kaulf.	pakahakaha	I
PSILOTACEAE (Psilotum Family)		
Psilotum nudum L.	moa	I

Species	Common Names	Status[1]
THELYPTERIDACEAE (Downy Woodfern Family)		
Christella dentata (Forssk.) Brownsey & Jermy	downy woodfern	X
Christella parasitica (L.) Leville	oak fern	X
	MONOCOTS	
AGAVACEAE (Agave Family)		
Dracaena fragrans (L.) Ker-Gawler	fragrant dracaena	X
Dracaena cf. *deremensis* Engler	----------	X
COMMELINACEAE (Spiderwort Family)		
Commelina diffusa N. L. Burm.	honohono	X
CYPERACEAE (Sedge Family)		
Kyllinga brevifolia Rottb.	kyllinga	X
Pycreus polystachyos (Rottb.) P. Beauv.	----------	X
POACEAE (Grass Family)		
Andropogon virginicus L.	broomsedge	X
Axonopus fissifolius (Raddi) Kuhlm.	carpet grass	X
Bambusa vulgaris Schrader ex Wendl.	bamboo	X
Digitaria procumbens Stent	pangola grass	X
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	love grass	X
Melinus minutiflora P. Beauv.	molasses grass	X
Oplismenus hirtellus (L.) P. Beauv.	basket grass	X
Panicum maximum Jacq.	Guinea grass	X
Paspalum conjugatum Bergius	t-grass	X
Paspalum scrobiculatum L.	rice grass	I?
Pennisetum purpureum Schumach.	elephant grass	X
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X
Sacciolepis indica (L.) Chase	Glenwood grass	X
Setaria gracilis Kunth	perennial foxtail	X
Sporobolus cf. *africanus* (Poir.) Robyns & Tournay	African dropseed	X
ZINGIBERACEAE (Ginger Family)		
Hedychium flavescens N. Carey ex Roscoe	yellow ginger	X
Zingiber zerumbet (L.) Sm.	shampoo ginger, ‘awapuhi	P
	DICOTS	
ANACARDIACEAE (Mango Family)		
Schinus terebinthifolius Raddi	Christmas berry	X

Species	Common Names	Status[1]
ASTERACEAE (Sunflower Family)		
Ageratum conyzoides L.	ageratum	X
Bidens alba (L.) DC.	beggar's-tick	X
Conyza canadensis (L.) Cronq.	Canada fleabane	X
Elephantopus mollis Kunth	elephant's-foot	X
Galinsoga parviflora Cav.	----------	X
Gnaphalium japonicum Thunb.	cudweed	X
Pluchea carolinensis (Jacq.) G. Don	pluchea	X
Youngia japonica (L.) DC.	Oriental hawksbeard	X
BEGONIACEAE (Begonia Family)		
Begonia hirtella Link	----------	X
BIGNONIACEAE (Bignonia Family)		
Spathodea campanulata P. Beauv.	African tulip tree	X
BUDDLEIACEAE (Butterfly-bush Family)		
Buddleia asiatica Lour.	dogtail, heulo'ilio	X
CRASSULACEAE (Stonecrop Family)		
Kalanchoë pinnata (Lam.) Pers.	air plant	X
EUPHORBIACEAE (Spurge Family)		
Codiaeum variegatum (L.) Juss.	variegata croton	X
FABACEAE (Pea Family)		
Caesalpinia decapetala (Roth) Alston	wait-a-bit	X
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X
Crotalaria pallida Aiton	smooth rattlepod	X
Desmodium incanum DC.	Spanish clover	X
Desmodium intortum (Mill.) Urb.	----------	X
Indigofera suffruticosa Mill.	indigo, 'iniko	X
Mimosa pudica L.	sensitive plant	X
Pterocarpus indicus Willd.	narra	X
Senna septemtrionalis (Viv.) H. Irwin & Barneby	kolomona	X
LAMIACEAE (Mint Family)		
Hyptis pectinata (L.) Poir.	comb hyptis	X
LYTHRACEAE (Loosestrife Family)		
Cuphea carthagenensis (Jacq.) Macbr.	tarweed	X
Cuphea hyssopifolia Kunth	false heather	X
MALVACEAE (Mallow Family)		
Sida acuta N.L. Burm.	----------	X
Sida rhombifolia L.	Cuba jute	X
MELASTOMATACEAE (Melastoma Family)		
Clidemia hirta (L.) D. Don	Koster's curse	X
Heterocentron subtriplinervium (Link & Otto) A. Braun & C. Bouche	----------	X

Species	Common Names	Status[1]
MELIACEAE (Mahogany Family)		
Melia azedarach L.	Chinaberry tree	X
MYRSINACEAE (Myrsine Family)		
Ardisia crenata Sims	Hilo holly	X
MYRTACEAE (Myrtle Family)		
Metrosideros polymorpha Gaud.	ʻohiʻa lehua	E
Psidium cattleianum Sabine	strawberry guava	X
Psidium guajava L.	guava	X
PASSIFLORACEAE (Passionflower Family)		
Passiflora edulis Sims	passionfruit, liliko'i	X
PLANTAGINACEAE (Plantain Family)		
Plantago lanceolata L.	narrow-leafed plantain	X
POLYGALACEAE (Milkwort Family)		
Polygala paniculata L.	bubblegum plant	X
PROTACEAE (Protea Family)		
Grevillea robusta A. Cunn. ex R. Br.	silk oak	X
Macadamia ternifolia F. Muell.	macadamia	X
ROSACEAE (Rose Family)		
Eriobotrya japonica (Thunb.) Lindl.	loquat	X
Rubus rosifolius Sm.	thimbleberry	X
RUBIACEAE (Coffee Family)		
Spermacoce assurgens Ruiz & Pav.	buttonweed	X
SOLANACEAE (Nightshade Family)		
Solanum americanum Mill.	black nightshade, popolo	I?
STERCULIACEAE (Cacao Family)		
Melochia umbellata (Houtt.) Stapf	----------	X
TILIACEAE (Linden Family)		
Triumfetta rhombifolia Jacq.	burbush	X
URTICACEAE (Nettle Family)		
Pilea microphylla (L.) Liebm.	rockweed	X
VERBENACEAE (Verbena Family)		
Stachytarpheta cayennensis (Rich.) Vahl	blue rat's-tail	X
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	owi	X

Status[1]: I = Indigenous. E = Endemic. X = Alien (introduced). P = Polynesian introduction.

Fig. 3. Strawberry guava dominating the *Schinus/Psidium* forest at the study site.

Fig. 4. Christmas berry dominating the *Schinus/Psidium* forest at the study site.

Fig. 5. Ground cover in the *Schinus/Psidium* forest dominated by *Blechnum occidentale*.

Fig. 6. Ground cover in the *Schinus/Psidium* forest dominated by shampoo ginger.

Fig. 7. Streambed at the study site.

Fig. 8. Bamboo thickets dominating the northwest portion of the study site.

APPENDIX C

Fauna Survey

AVIFAUNAL AND FERAL MAMMAL SURVEY OF HAWAII HOUSING FINANCE AND DEVELOPMENT CORPORATION NUMBER FOUR WELL SITE, HONUAULA FOREST RESERVE, NORTH KONA, ISLAND OF HAWAII

Prepared for:

Belt Collins Hawaii Ltd.
Honolulu, Hawaii

Survey and Report by:

Phillip L. Bruner
Environmental Consultant
Fauna (Bird & mammal) Surveys
#1775 BYUH
55-220 Kulanui Street
Laie, HI 96762

14 January 2009

INTRODUCTION

The purpose of this report is to provide the findings of a two day (10, 11 January 2009) field survey of a 14 acre site for the proposed Hawaii Housing Finance and Development Corporation No.4 Well Site in the Honuaula Forest Reserve, North Kona, Island of Hawaii. In addition to the data obtained from the field survey, relevant published and unpublished sources are also noted in the report. These sources add a broader perspective of the wildlife resources in this region of the island. The goals of the survey were:

1- Document the species of birds and mammals observed on or near the property.

2- Devote special attention to documenting the presence and possible use of this property by native and migratory species particularly those that are listed as threatened or endangered.

SITE DESCRIPTION

The property is located mauka of Mamalahoa Highway between 1500-2000 ft. elevation. Hienaloli Drainage Way runs through the length of the property. The drainage was mostly dry with only a few potholes of stagnant water. Vegetation on the site is mostly alien species. The largest trees are Silk Oak (*Grevillea robusta*). Dense thickets of several species of Guava (*Psidium spp.*), Bamboo (*Bambusa spp.*), and Christmasberry (*Schinus terebinthefolius*) dominate the site. The adjoining lands include residential and ranching property.

SURVEY PROTOCOL

The field survey was conducted over two consecutive days (10, 11 January 2009). Avian data were collected in the early morning and late in the day when birds and mammals are most active and more easily detected. Observations of mammals were limited to visual sightings. No attempts were made to trap mammals in order to obtain relative abundance estimates. The evening of 10 January 2009 was devoted to a search for the presence of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). A Petterson Elektronic AB Ultrasound Detector D 100 was used to listen for echolocating bats at several sites on and near the property.

Weather during the survey was mixed with a calm clear morning on 10 January and cloudy afternoon/early evening. The second morning (11 January) was cloudy and calm until 0900 hours when a strong cold front brought high winds and heavy rain, Scientific and common vernacular names used in this report follow Honacki et al. (1982), Pratt (1998) and Pyle (2002).

RESULTS AND DISCUSSION

Native Land Birds:

No native land birds were observed on this survey. The only species that might on occasion occur in this area are the endangered Hawaiian Hawk or 'Io (*Buteo solitaries*) and the Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) (Pratt et al. 1987, Hawaii

Audubon Society 2005). Pueo are not listed as endangered or threatened on the island of Hawaii, however, the State of Hawaii does list the Pueo population on Oahu as endangered.

Native Waterbirds:

No native waterbirds were observed. The ephemeral nature of the Hienaloli Drainage Way is not suitable for any significant waterbird foraging opportunities.

Seabirds:

No nesting seabirds were seen on the survey nor would any be expected to nest in this area due to predators and human disturbance. Some species might on rare occasion be seen flying over the property (pers. observ.). If lights are used during construction of the well or as a security measure after the project has been completed the lights should be equipted with shields that direct the light downwards to avoid attracting and confusing seabirds particularly from September to November (the period when juveniles are leaving their mountain nests on their first journey out to sea).

Migratory Birds:

No migratory shorebirds were observed. No habitat suitable for shorebirds currently occurs on the property. Wandering Tattler (*Heteroscelus incanus*) use streams as well as rocky shorelines and wetlands for foraging but the drainage way is wet only following significant heavy, prolonged rain events.

Alien (Introduced) Birds:

Eleven alien species were detected on the survey. Table One notes these species. This array of species is similar to that recorded on property elsewhere in this region (Bruner 1989, 2008a, 2008b). None of these birds are listed as threatened or endangered. No unexpected alien species were discovered on the survey.

Mammals:

The only feral mammals observed were two pigs (*Sus scrofa*). Cat (*Felis catus*), Rats (*Rattus rattus spp.*) Mice (*Mus musculus*) and the Small Indian Mongoose (*Herpestes javanicus*) also likely occur on the site. No endangered Hawaiian Hoary Bats were detected by the ultrasound device during an evening search of the property on 10 January. The Hawaiian Hoary Bat generally roosts solitarily in trees. They forage for flying insects in a wide variety of habitats including forests, agricultural lands, urban areas, as well as over bays and ponds (Tomich 1986, Kepler and Scott, 1990, Jacobs 1991, 1993, Reynold et al. 1998, and Bonaccorso 2008 pers. com.)

EXCECUTIVE SUMMARY AND CONCLUSIONS

The only birds and mammals found on the survey were those to be expected in this region of the Island of Hawaii. All of these species were non-native (alien). No migratory shorebirds or seabirds were observed nor expected on this property. The endangered 'Io and the non-endangered Pueo occur in man-altered as well as native habitats throughout the Big Island. None were recorded on this survey but may on occasion forage in this area. No 'Io nests were found. The endangered Hawaiian Hoary Bat is more often seen on the Island of Hawaii and Kauai but is much less common on the other islands. No bats were detected on the survey, however, endangered species could forage and roost at this site. They utilize a wide spectrum of habitats from native forest to urban and agricultural lands. The breeding season runs from April to August. Trees should not be cut or disturbed during this period as young bats that are still dependent on the mother and are roosting in trees. Barbed wire fences are also a threat to both adult and juvenile bats (Bonaccorso pers. com.).

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APPENDIX D

Archaeological Survey

RC-0525

An Archaeological Inventory Survey of a Portion of TMK:3-7-5-13:022 for the Proposed Development of Well Site No. 4

Hienaloli 1st Ahupua'a
North Kona District
Island of Hawai'i

PREPARED BY:

Matthew R. Clark, B.A.,
J. David Nelson, B.A.,
Amy L. Ketner, B.A.,
and
Robert B. Rechtman, Ph.D.

PREPARED FOR:

Belt Collins Ltd.
2153 North King Street, Suite 200
Honolulu, HI 96819

June 2008

RECHTMAN CONSULTING, LLC
HC 1 Box 4149 Kea'au, Hawai'i 96749-9710
phone: (808) 966-7636 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

An Archaeological Inventory Survey of a Portion of TMK: 3-7-5-13:022 for the Proposed Development of Well Site No. 4

Hienaloli 1st Ahupua'a
North Kona District
Island of Hawai'i

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

At the request of Mary O'Leary, AICP of Belt Collins Hawaii Ltd., Rechtman Consulting, LLC conducted an Archaeological Inventory Survey of a roughly 17-acre portion of TMK:3-7-5-13:022 for the proposed development of production Well No. 4 within Hienaloli 1st Ahupua'a, North Kona District, Island of Hawai'i. The proposed well is part of the off-site development of infrastructure facilities associated with the proposed Keahuolu Affordable Housing project. The development was initiated by the Hawai'i Housing Finance & Development Corporation (HHFDC), which is the State's agency tasked with developing and financing low and moderate income housing projects and administering home ownership programs. The property currently contains a test well (Well No. 1) that will be developed into a production well (Well No. 4). Other improvements to the property may include the construction of a two million gallon reservoir. The parcel is owned by the State of Hawai'i Department of Land and Natural Resources.

Four previously conducted archaeological studies have included the current project area (Halpern and Rosendahl 1996; Kawachi 1994; and Yent 1991, 1999). As a result of the current inventory survey five previously recorded sites were relocated within the project area. The sites include four core-filled ranching/boundary walls (Sites 20754, 20755, 20757, 20758) and a terrace and wall located along the edge of a natural drainage that was likely utilized for agricultural purposes (Site 20759). A single test unit (TU-1) was excavated at Site 20759 revealing a soil deposit, but only modern cultural debris.

Sites 20754, 20755, 20757, 20758, and 20759 are all considered significant for information they have yielded relative to past use of the current project area. It is argued that the information collected during the previous studies and the current inventory survey is sufficient to document these sites and to mitigate any potential negative impacts that might result from the proposed development of Well No. 4. As such, no further work is the recommended treatment for all of the sites.

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INTRODUCTION

At the request of Mary O'Leary, AICP of Belt Collins Hawaii Ltd., Rechtman Consulting, LLC conducted an Archaeological Inventory Survey of a roughly 17-acre portion of TMK:3-7-5-13:022 for the proposed development of production Well No. 4 within Hienaloli 1st Ahupua'a, North Kona District, Island of Hawai'i (Figures 1 and 2). The proposed well is part of the off-site development of infrastructure facilities associated with the proposed Keahuolu Affordable Housing project. The development was initiated by the Hawai'i Housing Finance & Development Corporation (HHFDC), which is the State's agency tasked with developing and financing low and moderate income housing projects and administering home ownership programs. The property currently contains a test well (Well No. 1) that will be developed into a production well (Well No. 4). Other improvements to the property may include the construction of a two million gallon reservoir. The parcel is owned by the State of Hawai'i Department of Land and Natural Resources. The current project was undertaken in compliance with both the historic preservation review process requirements (HAR 13§13-275-5) of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the County of Hawai'i Planning Department.

This report contains summary background information concerning the project area's physical setting, cultural contexts, previous archaeological work, and current survey expectations based on the previous work. Also presented is an explanation of the project's methods, descriptions of the archaeological features encountered, interpretation and evaluation of those resources, and treatment recommendations for sites documented within the proposed development area.

Project Area Description

The current project area consists of a roughly 17-acre portion of TMK:3-7-5-13:022 located within Hienaloli 1st Ahupua'a, North Kona District, Island of Hawai'i (see Figures 1 and 2). The project area (Parcel 22) includes a dirt access road that runs *mauka* from Māmalahoa Highway between Parcels 13 and 21 (Figure 3). The parcel then widens, following the eastern boundary of Parcel 21 to the north, and the northern and eastern boundaries of Parcel 13 to the south. Rock walls are present along both of these parcels' boundaries, but the wall along Parcel 21 includes concrete and is of more recent construction than the other wall (Parcel 21 contains a modern residence, while Parcel 13 does not). At the southeastern corner of Parcel 13 and the northeastern corner of Parcel 21 the study parcel's boundaries turn east. A rock wall runs along the northern boundary and a wire fence line follows the southern boundary. The land to the south of the project area is mostly developed, and an area near the eastern end of the project area along the northern boundary was recently bulldozed. The eastern boundary of the project area follows the 1,780-foot contour across Parcel 22. At the time of the current fieldwork, this boundary had been recently marked with flagging tape (Figure 5).

A natural drainage runs through the center of the project area (Figure 6). Terrain within the project area slopes locally into this drainage, but overall it slopes fairly steeply and consistently to the west. Soils in the project area are classified as Honuaula extremely stoney silty clay loam where stones cover up to 15% of the surface (Yent 1999). The area receives 60-80 inches of rain per year, causing the aforementioned drainage to flow intermittently. Vegetation consists primarily of Christmas-berry (*Schinus terebinthifolius*) and guava (*Psidium guajava*), with an under story of grasses, ferns, and flowers over much of the project area, but a large patch of bamboo (*Bambusa*) is present in the western portion of the project area to the north of the drainage and an area to the south of the drainage that was previously bulldozed contains a plethora of grasses and non-native weeds (Figure 7). Yent (1999) indicated that this bulldozing took place sometime between 1997 and 1999. West of the bulldozed area is an existing well site with a rock retaining wall. The dirt road that accesses the parcel leads to this well site, and another branch runs east up the center of the parcel. The road is only wide enough for ATV access. Several wire fence lines are also present within the project area. The fences are no longer maintained, but their presence indicates that the parcel was formerly used for cattle ranching purposes.

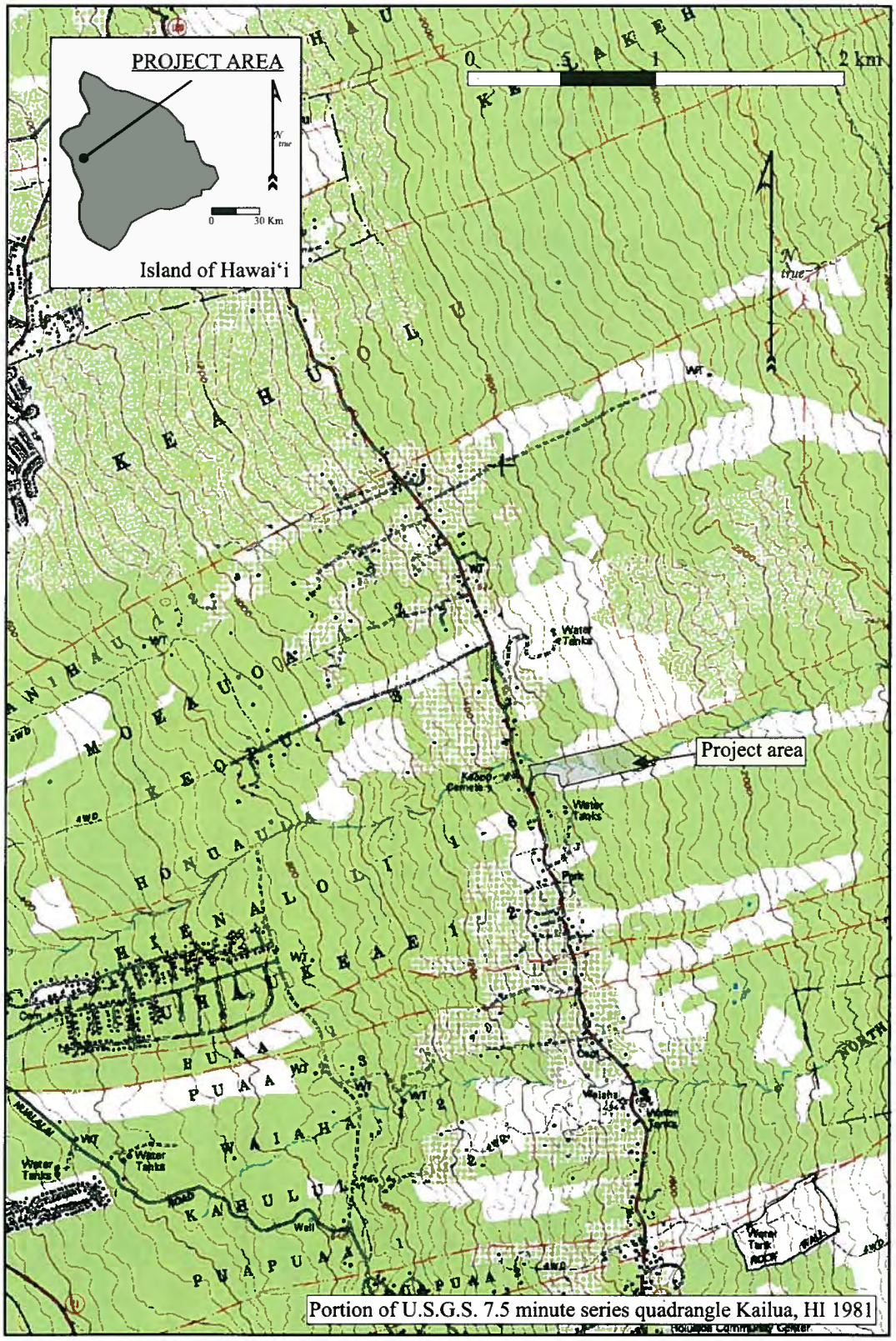


Figure 1. Project area location.

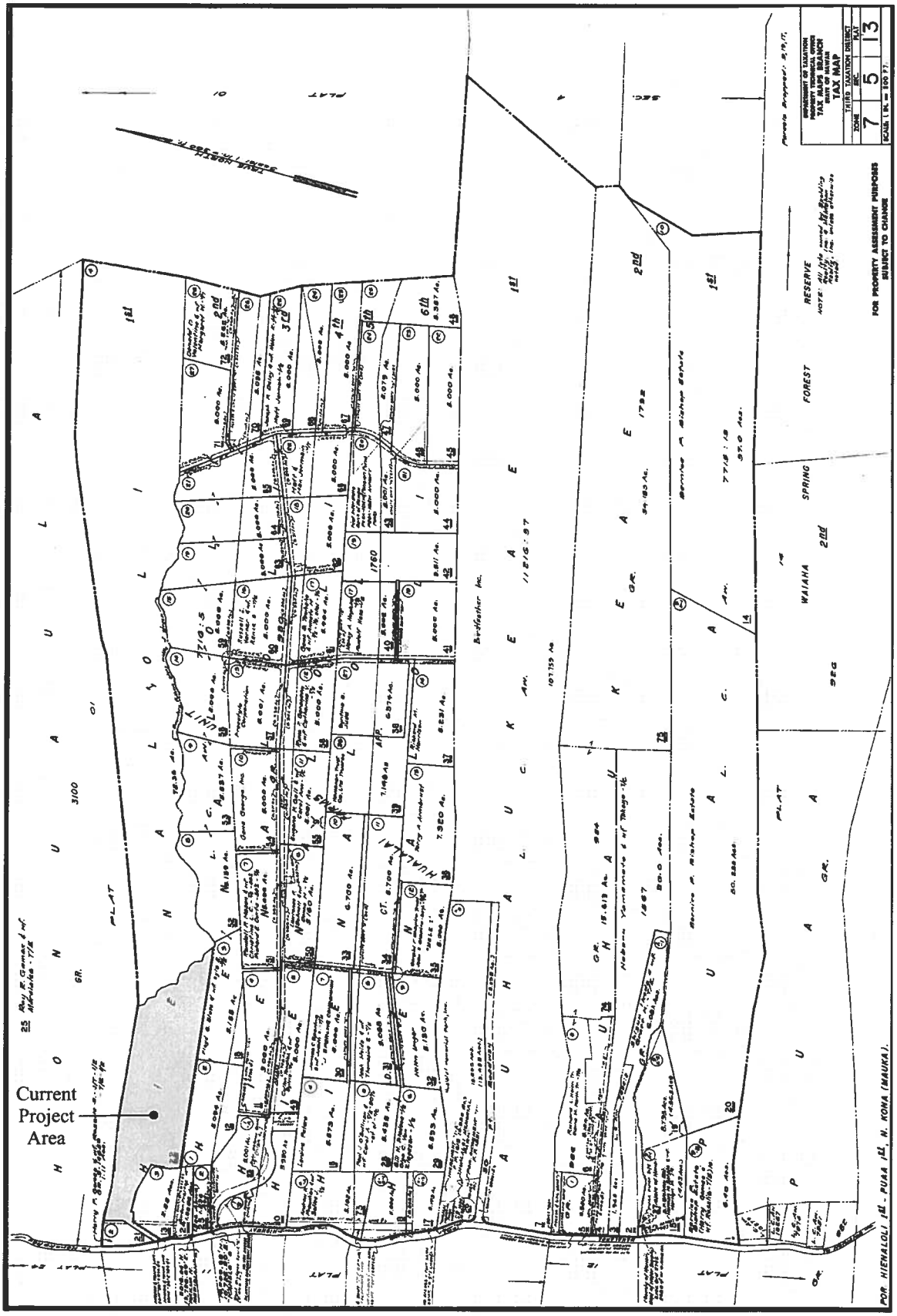


Figure 2. Tax Map Key (TMK): 3-7-5-13 showing current project area (portion of Parcel 22).

Figure 3. View to southwest (toward Māmalahoa Highway) of access road leading to Parcel 22.

Figure 4. View to northwest of rock wall with concrete along the eastern boundary of Parcel 21.

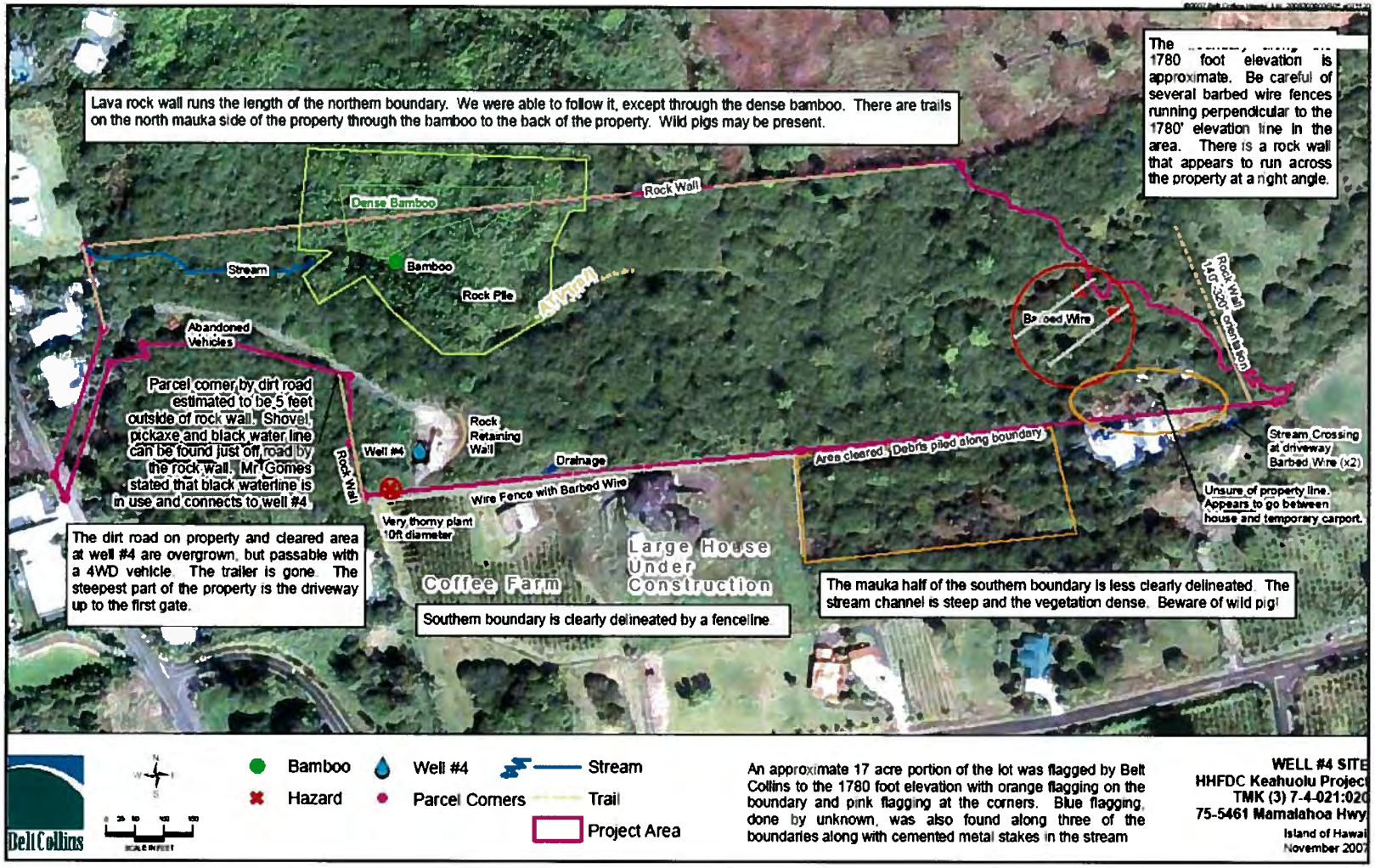


Figure 5. Aerial view and surveyor map of the current project area.

Figure 6. View to west of the natural drainage within the current project area.

Figure 7. View to east of the vegetation within the area bulldozed between 1997 and 1999.

BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the project area, and to establish an environment within which to assess the significance of any such resources, a general historical context for the region is presented and previous archaeological studies conducted within and near the current project area are summarized.

Cultural-Historical Context

In an effort to provide a comprehensive and holistic understanding of the current study area in order to generate a set of expectations for the subject parcel, archival and historical data relevant to Hienaloli 1st Ahupua'a, along with the general settlement patterns for the District of North Kona are presented.

A Brief Overview of Hawaiian Settlement and the Kona Field System

The current project area lies within what has been termed the Kona Field System (Cordy 1995; Newman 1970; Schilt 1984). This area of dry-land agricultural fields extends north from Ho'okena Ahupua'a to at least Kaū Ahupua'a and east from the coastline all the way to the forested slopes of Hualālai (Cordy 1995). A large portion of the field system is designated in the Hawai'i State Inventory of Historic Places (SIHP) as Site 50-10-37-6601 and has been determined eligible for inclusion in the National Register of Historic Places. The basic characteristics of this agricultural/residential system as presented in Newman (1970) have been confirmed and elaborated on by ethnohistorical investigations (Kelly 1983) and summarized by Cordy (1995). The construct is based on the Hawaiian terms for the major vegetation zones, which are used to define and segregate space within the region's *ahupua'a* (Table 1). These zones are bands roughly parallel to the coast that mark changes in elevation and rainfall.

Table 1. Traditional Hawaiian vegetation zone classification (after Newman 1970 and Kelly 1983).

Zone	*Approx. Elevation Limits (ft)**	*Agricultural uses*
kula	Sea level – 500	Sweet potato, paper mulberry, gourds
kalu'ulu	500-1000	Breadfruit, sweet potato, paper mulberry
'āpa'a	1000-2500	Taro, sweet potato, sugar cane, ti
'ama'u	2500-4000	Banana, plantain

***above sea level.**

The current study area is located within what has been termed the *'āpa'a* zone. This zone lies between 300-750 meters (980-2460 feet) above sea level and has an average annual rainfall of 140 to 200 centimeters. Prehistorically, the dry-land cultivation of taro, sweet potato, ti, and sugar cane dominated this zone. There are, although infrequently recorded, also archaeological indications of temporary and permanent habitations within the *'āpa'a* zone (Barrera 1991; Burtchard 1995; Haun et al. 1998; Kaschko and Rosendahl 1987). Early European visitors to Kona recorded sparse habitation at higher elevations within the fields, especially the use of temporary field houses. Burial and ceremonial areas are rare in the upper elevations (Kawachi 1989), but not unheard of (Barrera 1992).

Kuaiwi are prominent features of the landscape within the *'āpa'a* (Cordy 1995; Newman 1970). These are low, broad, long multifunctional piles of rocks that were by-products of land clearing and rock removal from the planting areas. *Kuaiwi* are oriented upslope-downslope with shorter, perpendicular cross-wall segments connecting them. The cross-walls function as soil traps and retaining features, creating terrace-like areas to enhance planting. *Kuaiwi* can also function to move water downslope in a controlled manner, ensuring optimal distribution of the available runoff water (personal observation, Rechtman Consulting, LLC on going research in Kahalu'u Ahupua'a). The presence of *kuaiwi* is indicative of "formal walled fields," as opposed to the scattered planting mounds and terraces, or "informal fields." However, the distribution of soils suitable for agriculture determines, in part, the locations of the formal walled fields, and there is a direct relationship between suitable soils and older lava flows. Consequently, areas of young lava flow in the *'apa'a* do not always have *kuaiwi* (Burtchard 1995; Hammatt et al. 1987; Haun et al. 1998).

The archaeological record contributes to an understanding of how the Kona Field System developed over time. Precisely how the record is interpreted is reflected in the various chronologies proposed for the system (Burtchard 1995; Cordy 1995; Haun et al. 1998; Hommon 1986; Kirch 1985; Schilt 1984). The chronology and terminology outlined by Haun et al. (1998) is used in the present discussion, and the chronological summary below is abstracted from Rechtman et al. (1999).

The Kona Field System was not brought to Kona as a fully developed system; but rather, it reflects a developmental adaptation to the area that was concomitant with the evolving sociopolitical structure and increasing population of the island. The first inhabitants of Hawai'i Island probably arrived by at least A.D. 600, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). To date, there is no archaeological evidence for occupation of the Kona region during this initial, or Colonization stage of island occupation (A.D. 300 to 600).

There is also little indication that during the subsequent period, Early Expansion (A.D. 600 to 1100), much activity was taking place in Kona (Burtchard 1995). Through the first half of the Early Expansion Period, permanent habitation was still concentrated on the windward side of the island. It is likely that windward residents traveled to the leeward Kona coast for resource extraction purposes (Cordy 1995). By the latter half of the Early Expansion Period, permanent habitation was beginning in Kona (Cordy 1981; 1995; Schilt 1984). Habitation was concentrated along the shoreline and lowland slopes, and informal fields were probably situated in areas with higher rainfall.

Agricultural fields and habitation areas expanded across the slopes and coastal area of Hualālai during the Late Expansion Period (A.D. 1100 to 1400) (Burtchard 1995; Cordy 1995). The earliest fields may have been located in the southern portion of the system (Schilt 1984), with new fields expanding northward over time (Haun et al. 1998).

The development of extensive formal walled fields, sometime during the initial stages of the Intensification Period (A.D. 1400 to 1600), marks the beginnings of the Kona Field System (Schilt 1984). The growth of the fields may reflect the need of prehistoric Hawaiian populations to extract more subsistence resources from an increasingly limited agricultural base. Radiocarbon data indicates that the population in Kona increased dramatically during this period (Burtchard 1995; Haun et al. 1998; Schilt 1984).

By the time of the Competition Period (A.D. 1600 to 1800), the environment may have reached its maximum carrying capacity, resulting in social stress between neighboring groups. The resulting hostility is reflected archaeologically with the frequent occurrence of refuge caves dating to this period (Schilt 1984). This volatile period was probably accompanied by internal rebellion and territorial annexation (Hommon 1986; Kirch 1985).

The first historic period of Hawai'i's history, termed the Last of the Ruling Chiefs (A.D. 1778-1819), begins with Captain Cook's arrival in the islands and ends with King Kamehameha's death in 1819 (Haun et al. 1998). The end of this period also sees the overthrow of the old religion, which took place when Liholiho, Kamehameha's heir, broke the traditional *kapu* laws and won a battle against the supporters of the old religion at Kuamo'o, along the southern coastline of Keauhou. Early historical accounts emphasize that modern day Kailua Town was a significant political seat and population center during this period. Settlement and subsistence practices within the Kona Field System continued to operate much as it had prehistorically through the first few decades of the historic era (Handy and Handy 1972).

The second quarter of the 19th century, the Merchants and Missionaries Period (A.D. 1820-1847), was a time of profound social change in Hawai'i. Kamehameha I died in mid-1819, and a council of chiefs supported Kamehameha's son Liholiho as the successor (Kelly 1983). Within six months after Kamehameha's death, Liholiho, Ka'ahumanu, and the Queen mother Keopuolani broke the *kapu* prohibiting men and women eating together. This act of "free eating" symbolized the end of the entire traditional *kapu* system. Changes in the social and economic patterns then began to affect the lives of the common people. Liholiho moved his court to O'ahu, so the burden of resource procurement for the chiefly class lessened considerably on the Island of Hawai'i. However, some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods for trade to the early Western visitors. Introduced crops, such as yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas,

and grapes (Wilkes 1845) were grown specifically for trade with Westerners. Other commodities, especially sandalwood, were collected to purchase Western goods, often to the detriment of agricultural pursuits. The arrival of the missionaries to Hawai'i in the 1820s brought further changes to the social and religious systems of the islands.

The socioeconomic and demographic changes that took place in the period between 1790 and the 1840s, promoted the establishment of a Euro-American style of land ownership, and the Great *Māhele* became the vehicle for determining ownership of native lands. During this period, termed the Legacy of the Great *Māhele* (1848-1899), land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki,* were defined. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

During the *Māhele* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. All three types of land were subject to the rights of the native tenants therein. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai'i to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele.* Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele.* The information was collected primarily between A.D. 1873 and 1885. The testimonies were generally given in Hawaiian and transcribed in English as they occurred.

As a result of the *Māhele*, the *ahupua'a* of Hienaloli 1st was retained as Government Lands. These lands were usually later sold as grant parcels or leased by the government. No grants were sold in Hienaloli 1st Ahupua'a, but an 1880s map of the area shows the ruins of the Greenwell's house located south of the current project area (Figure 8), and a 1920s map shows that a large portion of Hienaloli 1st Ahupua'a (including the current project area) was leased (Lease No. 1691) to Manual Gomes (Figure 9). Both the Greenwells and Gomes were prominent early ranching families in Kona, so it is likely that the project area was used for ranching throughout the Historic Period. The above summary of Hawaiian settlement patterns and the Kona Field System provides a general context in which to assess information specific to Hienaloli 1st Ahupua'a and the current project area.

Hienaloli 1st Ahupua'a

Helen Wong-Smith, M.A., cultural resources specialist prepared a cultural impact assessment for the proposed current development area (Wong-Smith 2008). The assessment was "based on a review of a wide range of written material including archaeological reports, government and other historical records, Hawaiian language sources translated into English, and interviews with long-term residents, including native Hawaiians, familiar with the cultural history and resources of Hienaloli. The research utilized resources at the Hawai'i State Archives, Edwin H. Mo'okini Library of the University of Hawai'i-Hilo, the Hilo Public Library, online resources, and previous historical and cultural reports and interviews" (Wong-Smith 2008:A-1). The following discussion of Hienaloli 1st Ahupua'a is summarized from the Wong-Smith (2008) cultural impact assessment with information cited from other sources as deemed appropriate.

According to the cultural impact assessment, information on the *ahupua`a* of Hienaloli is scarce, and the usual references for translations of *ahupua`a* names are silent regarding the meaning of Hienaloli (Wong-Smith 2008:A-1). *Hiena* could mean a kind of soft porous stone used to smooth and polish utensils, and *loli* has several possible meanings including: 1. to turn, change, alter, turn over…2. sea slug…sea cucumber…3. Spotted, speckled, daubed; to color in spots, as tapa (Pukui and Elbert 1965:194). Wong-Smith (2008:A-1) also notes that Hienaloli is often written as Hinaloli and Hianaloli in various 19th and early 20th century documents.

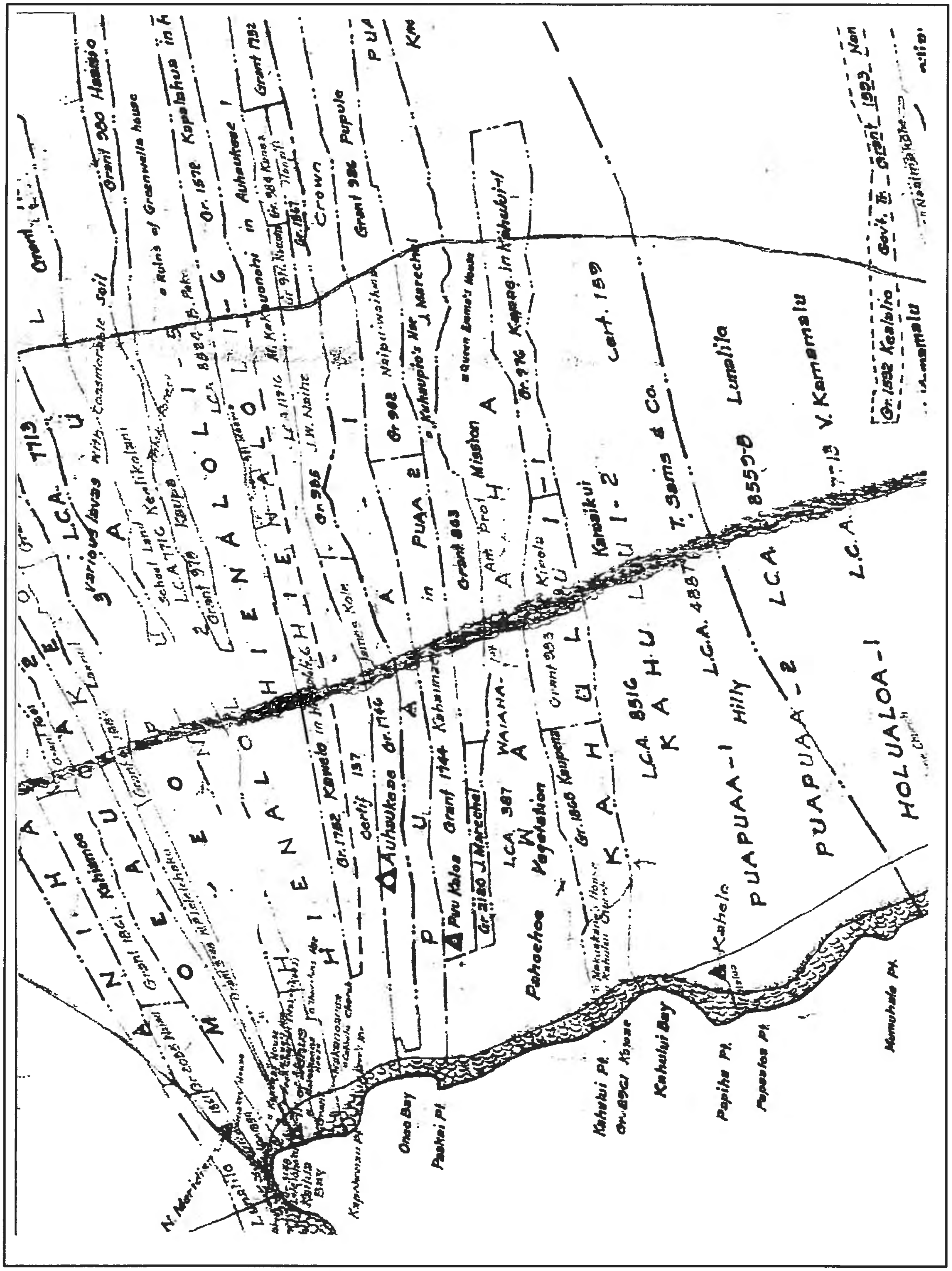


Figure 8. Portion of Emerson's Late 1880's Map of Kailua (from Haun and Henry 2001:11).

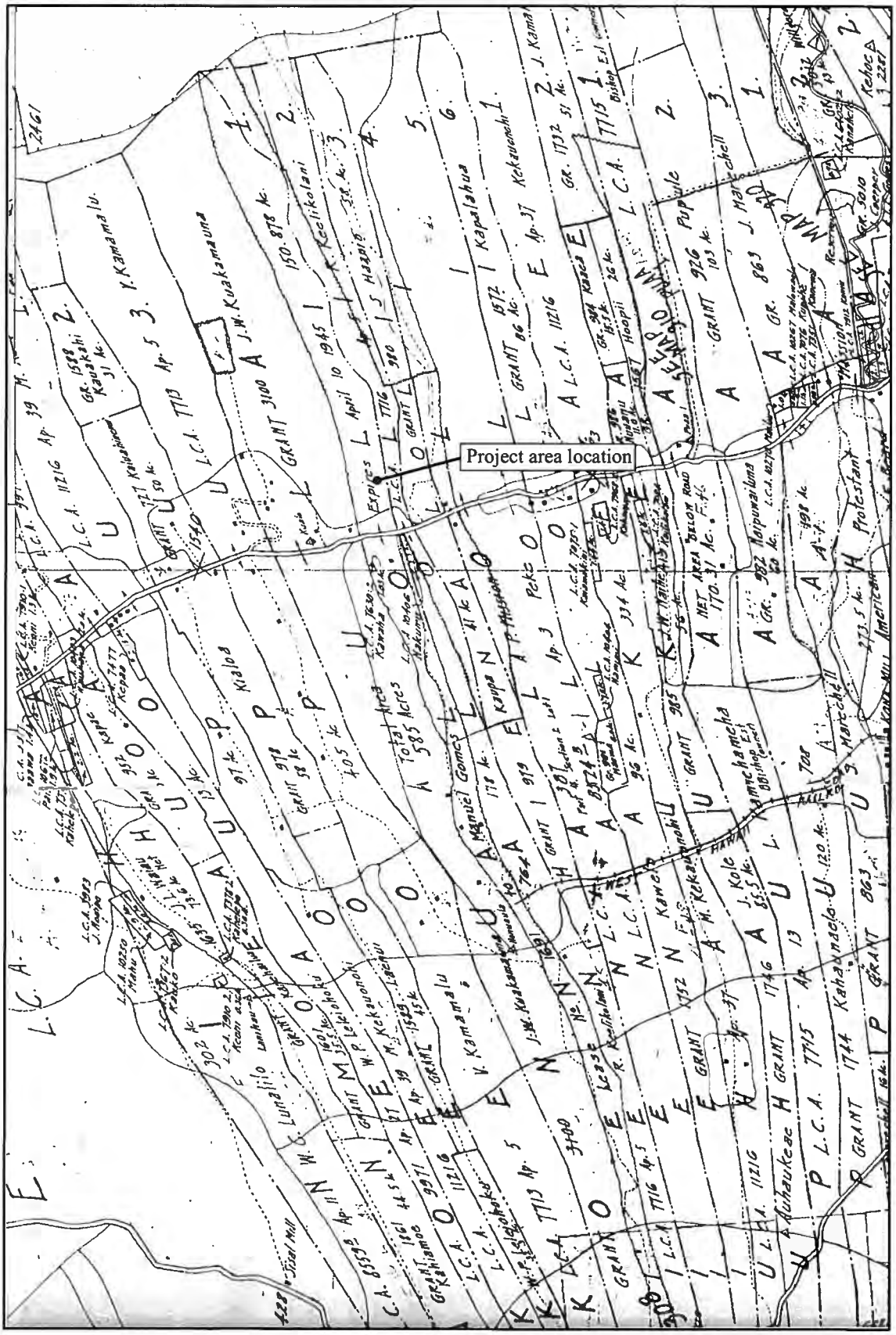


Figure 9. Portion of a 1928 Strip Map of North Kona.

A legendary reference to Hienaloli is found in *Ka`ao Ho`oniua Pu`uwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki) translated by Kepā Maly, a legendary account of two super-natural brothers, Ka-Miki and Maka-'iole, who traveled around Hawai'i Island set in the period when Pili-a-Ka'aiea was chief of Kona, ca. 12th-13th century). It was originally published in serial form between 1914 and 1917 in the Hilo-based Hawaiian language newspaper *Ka Hōkū o Hawai'i* by Hawaiian historians John H. Wise and John Whalley Hermosa Isaac Kihe (Maly 1996). Wong Smith (2008:A-5) provides two excerpts from Maly's translation:

> *Auhaukea'ē and Hinaloli* (meaning uncertain) – After an *'awa* ceremony, *Ka-Miki* and *Maka-'iole* ventured from *Kalama`ula* to visit some of the lands of Kona. Upon returning to Kalama'ula, *Ka-uluhe* described the nature of the lands they had visited; The *ahupua'a* of Auhaukea'ē borders *Oneō* bay, and sits between the *ahupua'a* of Hinaloli (Hienaloli) and Pua'a. Important features associated with these lands included: *Oneō* and *Niumalu* – with the *hālau ali'i* (chief's compound) and *hālau wa'a* (canoe sheds) of the chief *Pili-a-kapu-nui-Pai'ea; Huihā-a* – a surfing spot named for a war counselor of *Pili*; and *Ka māla 'uala* (sweet potato gardens) extended across the lands of Oneō bay and Hinakahua. [May 24, 1917 & June 14, 1917]
>
> *Waikūpua* (Supernatural [beings'] water) – land of Hinaloli – Following Ka-Miki's bold appearance before *Ahu'ena ma,* the stewards of the great chief *Pili-a-Ka'aiea*, Pili's royal court was astir with word that *Ka-Miki* was seeking rebellion. *Kamalokaimalino*, high war counselor of *Pili* and overseer of the games at *Hinakahua* (Puapua'a) sent *'Īliopi'il,* Pili's messenger, to summon *Waikūpua, Huihā, Ka'aipuhi, Kaho'oholoholo,* and *Ha'akona.* These individuals were the war counselor-generals of Pili, and guards to the arena of Hinakahua, and many of them became associated with place names, perhaps identifying places associated with the individuals. *Pili* wanted Waikūpua *mā* to bring *Ka-Miki* before the council to determine if he was a rebel. Waikūpua and the other *pūkaua* (war counselors) attempted to seize *Ka-Miki* but were defeated. [April 26, 1917]

The cultural impact assessment also provides several firsthand Historic accounts of Hienaloli and the general vicinity, as described in the logs and journals of early visitors to the area (between 1815 and 1902). The accounts describe the uplands of Kona as a fertile agricultural area. Around 1820, M. Gaimard, a member of de Freycinet's expedition, wrote the following description of the Kailua environs:

> In order to reach the mountain that lies to the southeast of the village...we first went across dry fields, where hardly any young growth was visible; but, after reaching a certain elevation; we found much richer terrain where the paper mulberry, breadfruit tree, the mountain apple, tobacco, cabbage, sweet potatoes and yams were cultivated. We were given water of a delicious coolness. [de Freycinet 1978:8]

In April of 1820, the first Protestant missionaries arrived in Hawai'i at Kailua. In 1823, one of the missionaries, William Ellis, reported on observations made by Reverends Thurston and Bishop who walked the coastline from Kailua toward Ka'iwi Point and explored the uplands (Wong-Smith 2008:A-9). Ellis wrote:

> The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses were built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots.
>
> The next morning, Messrs. Thurston, Goodrich, and Harwood, walked towards the mountains, to visit the high cultivated parts of the district. After traveling over the lava

> for about a mile, the hollows of the rocks began to be filled with a light brown soil; and about half a mile further, the surface was entirely covered with a rich mould, formed by decayed vegetable matter and decomposed lava.
>
> Here they enjoyed the agreeable shade of bread-fruit and ohia trees; the latter is a deciduous plant, a variety of Eugenia, resembling the Eugenia malaccensis, bearing red pulpy fruit, of the size and consistence of an apple, juicy, but rather insipid to the taste. The trees are elegant in form, and grow to the height of twenty or thirty feet; the leaf is oblong and pointed, and the flowers are attached to the branches by a short stem. The fruit is abundant, and is generally ripe, either on different places in the same island, or on different islands, during all the summer months. [Ellis 1963:31-32]

According to Wong-Smith, "the cultivation and environs described above fall within the zone the project area is located and dispenses the assumption this was all barren lava supporting little life" (2008:A-10). Wong-Smith goes on to relate that, "this type of gardening in lava is called *makaili* when even small pockets of semi-disintegrated lava are utilized, and potatoes are grown by fertilizing with rubbish and by heaping up fine gravel and stones around the vines" (2008:A-10).

By 1825, one of the missionary couples, Asa and Lucy Thurston, was given a house lot in Hienaloli 1st Ahupua'a by then governor of the island Kuakini (*makai* of the current project area; Rechtman et al. 2005). Ka'ahumanu, as *kuhina nui* [prime minister], acting on behalf of the government, gave a part of Hienaloli for the mission's support (Kelly 1983:10). The Thurston's homestead was called Laniākea, after the nearby cave used for refuge during times of war. The lot consisted of five acres straddling the border of Honua'ula and Hienaloli 1st. Ellis, who entered the cave in 1823 looking for water, provides the following description:

> ...they also explored a celebratory cave in the vicinity, called Raniakea [Laniākea]. After entering it by a small aperture, they passed on in a direction nearly parallel with the surface; sometimes along a spacious arched way, at other times, by a passage so narrow, that they could with difficulty press through, till they had proceeded about 1200 feet; here their progress was arrested by a pool of water, wide, deep, and as salt as that found in the hollows of the lava, within a few yards of the sea. This latter circumstance, in a great degree, damped their hopes of finding fresh water by digging through the lava. ...The mouth of the cave is about half a mile from the sea, and the perpendicular depth to the water probably not less than fifty or sixty feet....From its ebbing and flowing with the tide, it [the pool] has probably a direct communication with the sea. [Ellis 1963:30]

Ellis also described a fortification near the mouth of the cave, which at the time of his visit reached a height of 18 to 20 feet, with a base 14 feet thick:

> ...In the upper part of the wall are apertures resembling embrasures; but they could not have been designed for cannon, that being an engine of war with which the natives have but recently become acquainted.
>
> The part of the wall now standing is near the mouth of Raniakea [Laniākea], the spacious cavern already mentioned, which formed a valuable appendage to the fort. In this cavern, children and aged persons were placed for security during an assault or sally from the fort, and sometimes the wives of the warriors also, when they did not accompany their husbands to the battle.
>
> The fortification was probably extensive, as traces of the ancient walls are discoverable in several places; but what were its original dimensions, the native who were with us could not tell. They asserted, however, that the cavern, if not the fort also, was formerly surrounded by a strong palisade. [Ellis 1963:62]

In 1840, Commodore Wilkes of the U.S. Exploring Expedition wrote the following about the environs of Kailua:

> The natives during the rainy season...plant, in excavations among the lava rocks, sweet potatoes, melons, and pineapples... The...staple commodities are sweet potatoes, upland taro, and yams. Sugar cane, bananas...bread-fruit, cocoa-nuts, and melons, are also cultivated. The Irish potato, Indian corn, beans, coffee, cotton, figs, oranges, guavas, and grapes, have been introduced....[Two miles from the coast, in a belt half a mile wide, the bread-fruit is met with in abundance, and above this the taro is cultivated with success...A considerable trade is kept up between the south and north end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of other south, for food and clothing. [Wilkes 1845:4, 91-92, 95-97 in Kelly 1983:19]

The cultural impact assessment prepared for the current proposed development also provides a chronological history of residency and land ownership in Hienaloli. According to Wong-Smith, "the above description of subsistence farming and trading within the land divisions is characteristic of pre-contact Hawaiian culture", but, "with the introduction of a market system and the call for labor to harvest sandalwood, agriculture in the Kailua area changed greatly, as did the native population" (2008:A-11). Although early demographics for Hienaloli are difficult to ascertain (Wong-Smith 2008:A-11), Schmitt recorded four epidemics for the years 1848 and 1849, including measles, whooping cough, diarrhea, and influenza, which killed more than 10,000 of the perhaps 87,000 persons in little more than a twelve-month period (Schmitt 1968:37).

Also, by the early to mid-1800s, the growing number of feral animals running rampant in Kona (i.e. cattle, goats, dogs, and pigs) had made agriculture increasingly difficult (O'Hare and Wolforth 1998). In response to this problem, wall building flourished. One of these walls was recorded by John Papa I'i at Honua'ula (inland and slightly north of Hienaloli) in 1812; I'i writes, "A stone wall to protect food plots stretched back of the village from one end to the other and beyond" (1959:111). Kelly (1983) postulates this wall was later incorporated into what became known as Kuakini Wall, which may be traced from its starting point at Palani Road above Kailua Bay to beyond Kahalu'u Bay (Wong-Smith 2008:A-12). Although no record exists of Governor Kuakini having ordered the wall built, its final configuration was attributed to him. John Adams Kuakini was governor of Hawai'i Island between 1820 and 1844. According to Kelly (1983), prior to 1855 this wall was simply known as the Great Wall or the Great Stone Wall. It is perhaps a result of the Reverend Albert Baker's 1915 account of the wall that it has commonly become known as the Kuakini Wall:

> Just a little above [the stone church at Kahalu'u], and continuing all the way to Kailua, is a huge stone wall built in Kuakini's time to keep pigs from the cultivated lands above. (Baker 1915:83)

Other early references to this wall are contained in *Māhele* records for *kuleana* awarded bordering the wall. Typical of these is a ca. 1850 map (Figure 10) that accompanied the Land Commission Award to the ABCFM in the *makai* portion of Hienaloli 1st Ahupua'a. The wall is again documented crossing Hienaloli on a ca. 1880 map of Kailua town (Figure 11) prepared by J. S. Emerson and S. M. Kanakanui. In addition to the Great Wall of Kuakini, many smaller historic walls were also built at this time for similar purposes and to mark boundaries (Wong-Smith 2008:A-12).

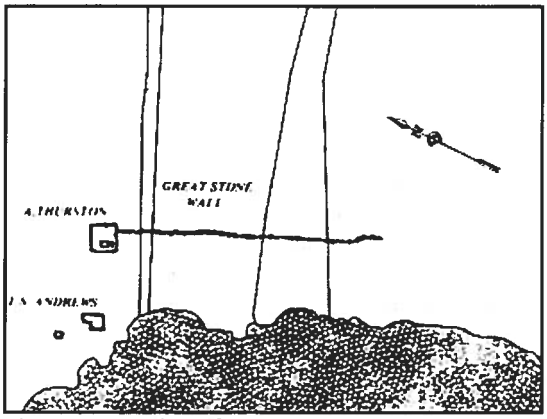


Figure 10. Portion of 1850 map that accompanied LCAw. 387 (from Kelly 1983:41).

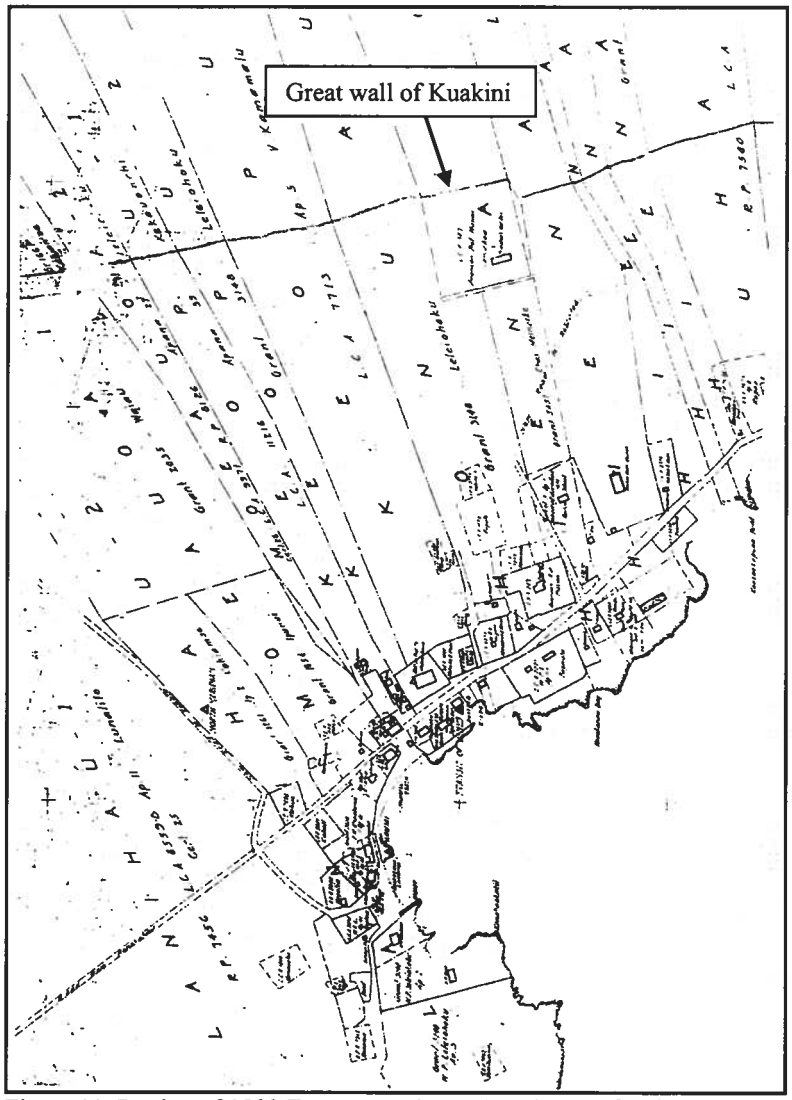


Figure 11. Portion of 1880 Emerson and Kanakanui map of Kailua town and vicinity (retraced by Lane in 1928).

As discussed above, in 1848, during the reign of Kamehameha III, the traditional Hawaiian land tenure system was replaced with a more Western-style of land ownership, this change was known as the The Great *Māhele* (division). As a result of the *Māhele*, the *ahupua'a* of Hienaloli 1st and 3rd and 6th were retained as Government Lands, Hienaloli 2nd was awarded to Ruth Ke`elikōlani (LCAw. 7716H), Hienaloli 4th was awarded to the American Protestant Mission (LCAw. 387, part 4, Section 2), and May Peke, daughter of Issac Davis, received Hienaloli 5th (LCAw. 8542B). Haun and Henry (2001:6) state that 31 LCAw. claims were made for a total of 60 parcels in Hienaloli (1-6), but that only 16 of the parcels were awarded. All of the LCAw. parcels are located *makai* of the current project area, with quite a few consisting of house lots clustered at the coast. Figure 12 shows all but three of the awarded parcels, which do not appear on the current tax maps (Haun and Henry 2001). The LCAw. testimonies provide some insight into the land activities and residency patterns of Hienaloli. Haun and Henry provide a summary of the land uses listed in the testimony of Hienaloli:

> House lots are described in the testimonies primarily for coastal parcels. Cultivated plots are described for the inland parcels. Fifteen claims included house lots with at least 24 houses. Enclosing walls are described for seven house lots. The testimonies refer to 167 *kihapai*. Named crops include taro (18 references), sweet potatoes (10), coffee (5), potato plots (3), coconut tree (2), and a gourd plot. Most claims for cultivated parcels include multiple parcels in two or more zones of the Kona field System. [2001:10]

The two parcels awarded closest to the current project area were LCAw. 7630:2 to Kawaha and LCAw. 10406 to Nakunu. Both are located across Māmalahoa Highway from the current project area, and one (LCAw. 10406) was subject to archaeological inventory survey and data recovery excavations conducted by Haun and Associates (Haun 2000; Haun and Henry 2000a, 2000b; see Previous Archaeology section above). The Native Testimony for these two parcels is presented below:

> LCA 10406 to Nakunu
> Kapule sworn: I've seen there in the land parcel of Ililoa, land of Hianaloli, 8 cultivated patches in two sections. 1. Upland, my land; toward Kau, Ulua's land; shoreward, mine also; towards Kohala, Ulua's also. 2. Sweet potato [patch]: upland, my land; towards Kau, Ulua's land; shoreward, mine also; towards Kohala, ulua's also. 1 cultivated patch. His land was from me in the year 1847, no one has objected. [Native Testimony v4:537]
>
> LCA 7630 to Kawaha
> Mose sworn: I have seen there in the land parcel of Ililoa, lands of Hianaloli 3; 14 cultivated patches as he claimed in the award document. There is the land parcel of Papa`awela, lands of Hinanaloli 2, are 8 cultivated patches, everything is under cultivation. His land was given by me at the time the Kingdom went to Kamehameha III. No one has objected to him. The cultivated patches in Hianaloli 2 are an old land [award] from Kamehameha I, and in his time, it is from Wahakane. No one has objected. He also has a house claim in the lot of Kaupa, when his life ended, Kaupa will receive his house claim. [Native Testimony v4:519] [from Wong Smith 2008:A-13]

Following the *Māhele*, many Government Lands were divided and sold as Grant Parcels. However, Government Land sales for Hienaloli between 1852 and 1853 are recorded for only Hienaloli 3 and 6 (Kelly 1983:43). Correspondence and other documents relating to holdings in Hienaloli were compiled from The Land File at the State Archives and are found in Wong-Smith (2008:A-16).

Although not listed above, a 1920s map of North Kona from Lanihau to Kahului (see Figure 9) shows that a large portion of Hienaloli 1st Ahupua'a (roughly 150 acres) including the current project area was leased to Manual Gomes as Lease No. 1691 (expired on April 10, 1945). Gomes, who had started ranching in the Kona area in the 1920s, created the Gomes Ranch, which at its peak included 8,500 acres of leased and purchased lands and 2,700 head of cattle (O'Hare and Wolforth 1998). The project area continued to be used as pasture into modern times.

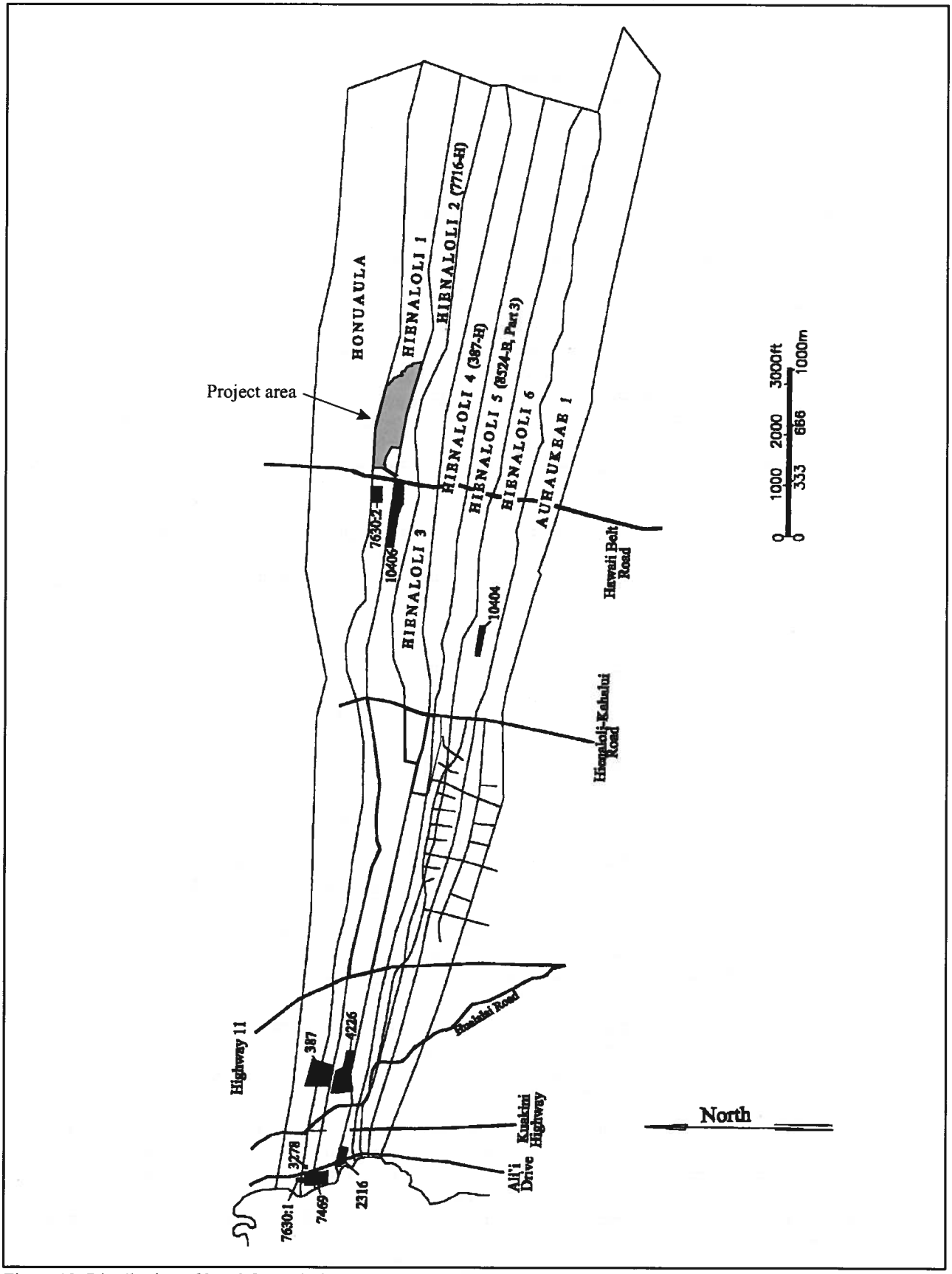


Figure 12. Distribution of Land Commission Awards within Hienaloli (adapted from Haun and Henry 2001:4).

Previous Archaeological Research

Several previous archaeological studies have been conducted in the *ahupua'a* of Hienaloli 1st through 6th (Donham and Kai 1990; Haun 2000; Haun and Henry 2000a, 2000b, 2001; Haun et al. 2003; Henry et al. 1996; Moore et al. 1997; Rechtman et al. 2005). In addition to these, four other studies have included the current project area (Halpern and Rosendahl 1996; Kawachi 1994; and Yent 1991, 1999). All of the aforementioned studies are discussed in detail below and their locations relative to the current project area are shown in Figure 13.

Yent (1991) conducted an archaeological reconnaissance survey of a portion of the current study parcel that extended from Māmalahoa Highway to an elevation of 2,424 feet above sea level. The study area encompassed approximately 80 acres and included all of the current project area. Yent (1991) noted, however, that the amount of area actually seen was limited due to dense vegetation and time constraints. As a result of the survey Yent (1991) identified several agricultural sites, a petroglyph, walls and a rock mound (Figure 14). These sites were only briefly described by Yent (1991), and they were not assigned state site numbers. One of the features recorded by Yent (1991) was an enclosure located at an elevation of 1,620 feet above sea level near the southern boundary of the current project area. Yent describes the site as follows:

> North-south wall that measures 80cm high on the upslope side (east), 120cm high on downslope (west), and 60cm in width [Figure 15]. This wall runs from the southern property line to the stream on the north. At approximately 30 meters north of the southern property line, there is a wide wall or 'ramp' that runs downslope (west) from the north-south wall. This 'ramp' measures 2.5m wide with walls 1m high on both sides. The length of the 'ramp' is approximately 50 meters and it meets another north-south wall on the west end.
>
> The lower north-south wall measures 1m high 60cm wide on the southern end. After this wall intersects the 'ramp', it changes to a retaining wall. The retaining wall measures 1m high. The southern property wall, the two north-south walls, and the 'ramp' create an enclosure feature. Within the enclosure is at least one low retaining wall running east-west. [Yent 1991:21]

Kawachi (1994) conducted an archaeological survey of a roughly 15-acre portion of TMK:3-7-5-13:22 for the proposed development of an exploratory well (Well No. 1) on the parcel at an elevation of 1,660 feet above sea level. The Kawachi (1994) survey area included nearly all of the current project area. Kawachi included a map of the sites previously recorded by Yent (1991) on the parcel (see Figure 13), but stated that no new sites were identified as a result of the survey and noted that "much of the area covered in the survey had been heavily disturbed by bulldozing and ranching" (1994:14).

Halpern and Rosendahl (1996) conducted an archaeological reconnaissance survey for a proposed Keopuolani Estates access road that traversed the current project area (see Figure 13). The proposed road corridor ran *mauka* from Māmalahoa Highway, at elevations ranging from 1,485 to 1,840 feet above sea level, across TMKs:3-7-5-13:13 and 22 to access the residential development. Although the road was never built, Halpern and Rosendahl (1996) recorded six sites within the corridor, five of which are included in the current project area. The sites consisted of three rock walls (Sites 20754, 20757, and 20758), a terrace (Site 20756), a terrace and wall complex (Site 20759), and a platform/wall feature (Site 20755). Site 20756 was the only site recorded by Halpern and Rosendahl (1996) not located within the current project area. Halpern and Rosendahl described the five sites recorded in the current project area as follows:

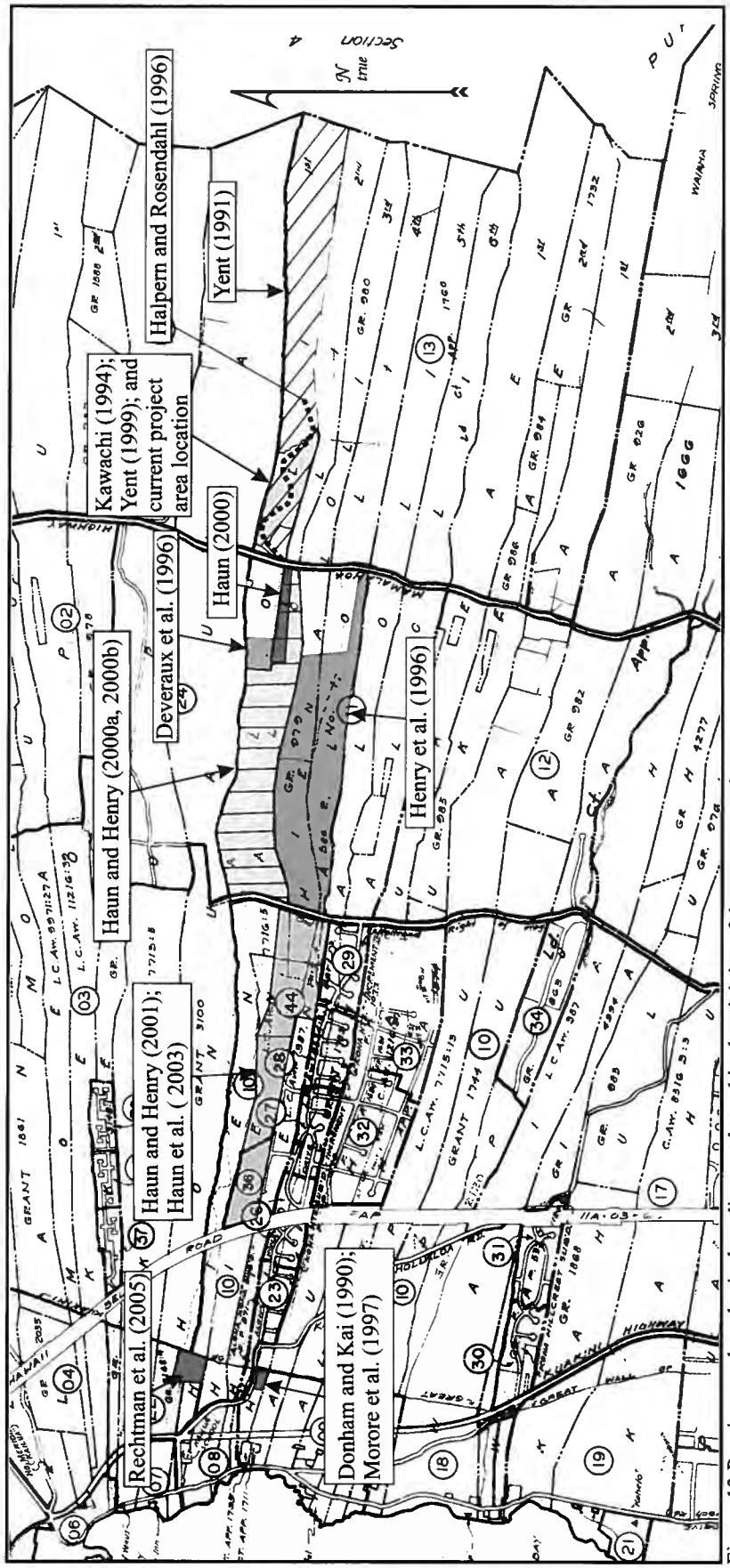


Figure 13.Previous archaeological studies conducted in the vicinity of the current project area.

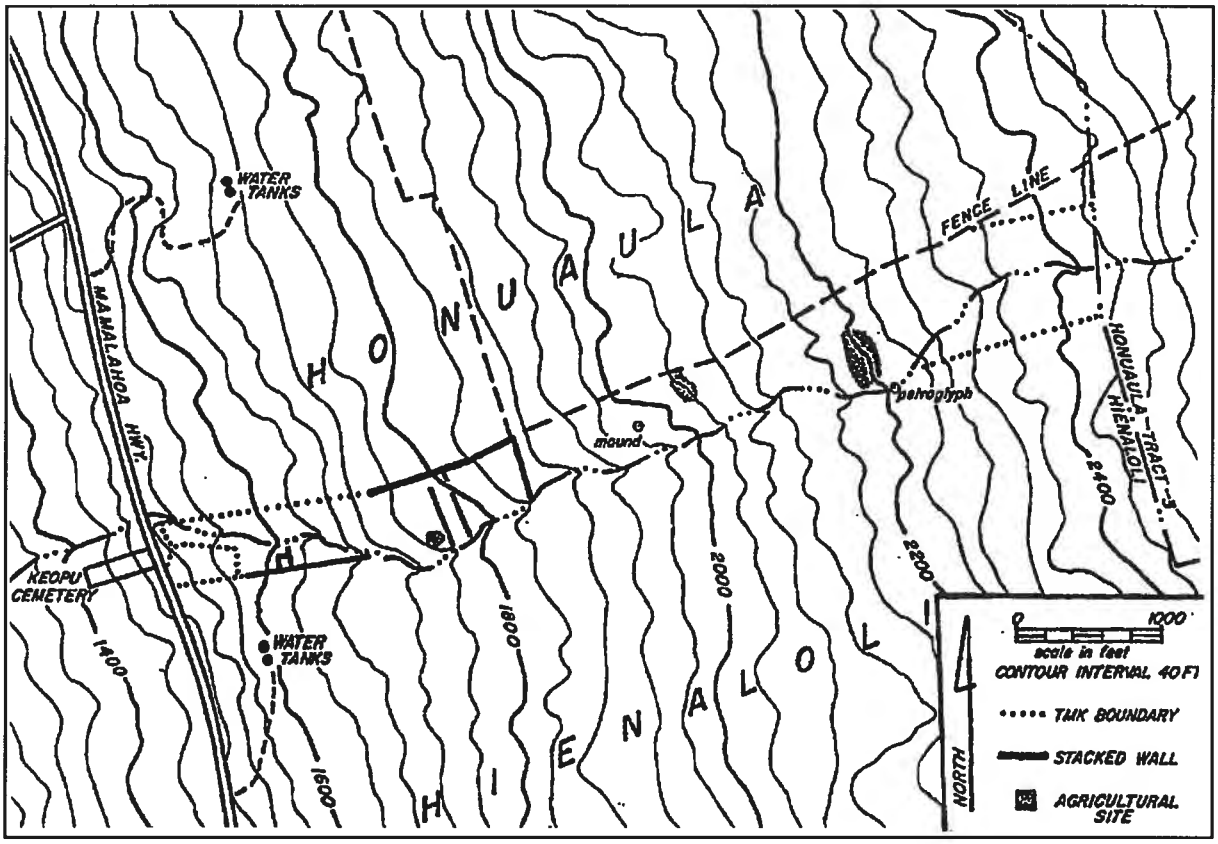


Figure 14. Site location map from Yent (1991:14).

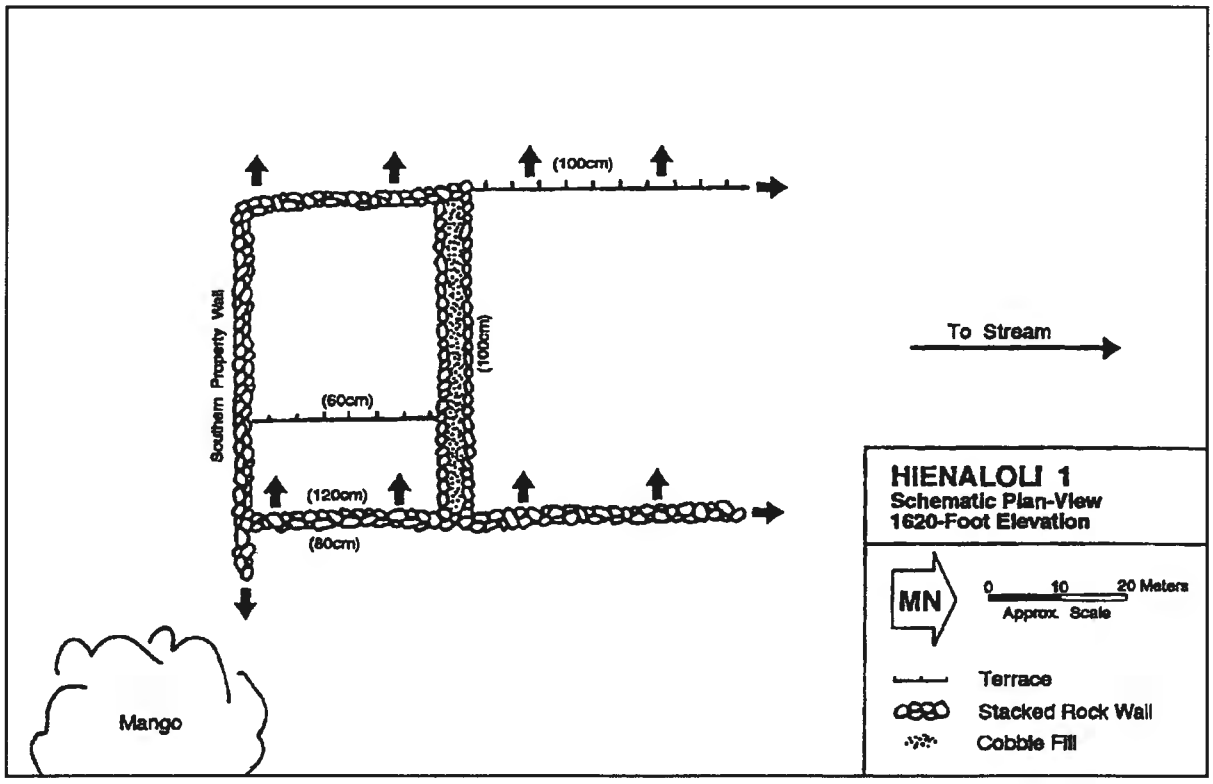


Figure 15. Plan view of site recorded at approximately the 1620-foot contour by Yent (1991).

SITE 20754 (PHRI T-1)

This wall of stacked basalt cobbles and boulders (four-five courses) stands c. 1.0 m high, c. 0.8 m wide and crosses the corridor on a bearing of 166°....Topped by barbed wire, it extends beyond the project boundaries both north and south, intersecting another wall (Site 20758) to the north. Its total length is unknown. Another barbed wire fence runs southwest from it near the northwest edge of the corridor. Some pahoehoe outcrops and loose cobbles are visible in the general area, which has undergone clearing and is now used as pastureland. A broken, modern carpenter's hammer was found in the vicinity of... About 30 m downslope of this site, a bulldozer berm crosses the corridor roughly parallel to the wall and intersects the aforementioned barbed wire fence. This is an area of dense strawberry guava growth. The wall probably dates to the historic period and was built as a boundary or in conjunction with ranching activities. [1996:9]

SITE 20755 (PHRI T-2)

Most of this L-shaped platform/wall lies outside the corridor to the south and is hidden under dense grass and foliage. Its broadest, platform-like end extends to within c. 3.0 m of the centerline...It is built of cobbles and boulders and is faced and stacked to five courses in some places. Its breadth reaches c. 3.0 m. The wall runs c. 20.0 m at 162°, narrowing as it goes. It then turns southwest, running c. 20.0 m downslope and terminating in a broad, low platform topped by a large plywood outhouse. The nature of this platform is uncertain as only its edges are visible. A bulldozer pushpile in roughly the same alignment as this site lies just outside the corridor to the north. Other, similar piles lie just *makai*... [1996:9]

SITE 20757 (PHRI T-4)

This stacked and faced cobble and boulder wall crosses the corridor on a bearing of c. 90°, though there is a short jog to the north and then east again... The wall stands over 1.0 m high (six-eight courses) and is 0.4-0.5 m wide. The area to the north has been cleared and is dominated by dense grass. Abandoned cars abound. Along the wall and to the south Christmas-berry trees form a dense canopy; there is little underbrush. Old chicken coops stand just south of the wall.

The contour map, supplied by Reid & Associates, indicates that this wall is part of a very large enclosure. Most of this enclosure lies well outside the project area and was not investigated. However, the east-west line was followed to its northeast corner where it is joined by a barbed-wire fence crossing the corridor. This fence turns west at the corner and tops the wall for a short distance. The long southwest-northeast segment from the junction of Sites 20756 and 20757 to the edge of the Mamalahoa Highway could not be found. [1996:9-10]

SITE 20758 (PHRI T-5)

This stacked and faced cobble and boulder wall stands over a meter high (to five courses). Bearing 62°... A barbed-wire fence on metal posts abuts and runs parallel to the wall's north side. Here, the vegetation is a mixture of pasture grass, ferns, Christmas-berry and strawberry guava...

Running downslope, the wall crosses the north end of Site 20754, where it continues to be coincident with a barbed-wire fence... A single opihi shell was noted near this section of the wall, lying on a gentle, cobble-strewn slope... Farther downslope it lies well north of the corridor (c. 25.0 m north of Site 20759) and forms the southern boundary of an extensive series of walls (including core-filled segments) enclosing platforms, terraces and other features extending at least 100 meters north. The entire landscape appears to have been modified in this area, which was examined briefly. This site may be a continuous wall but no attempt was made to follow its entire length.

> This site is probably a historic boundary or ranching wall and may represent the border between the ahupua'a of Hienaloli 1 and Honuaula. [1996:10]
>
> **SITE 20759 (PHRI T-6)**
>
> This wall and terrace complex occupies an area c. 7.0 by 7.0 m adjacent to the southern edge of the exposed pahoehoe stream bed mentioned above.... The wall borders the edge of the stream bed and is composed of stacked cobbles and boulders bearing 80°. The lower terrace face is an alignment of pahoehoe boulders paralleling the wall to the south. A large tree growing on the terrace has disrupted what might have been a second terrace face of cobbles.
>
> This site could be part of the Kona Field System. Its research value is moderate and detailed recording, surface collection, and testing of the architecture and adjacent surface deposit is recommended. [1996:10-11]

Based on the results of their survey, Halpern and Rosendahl concluded that:

> Six sites (20754-20159) were identified in or near the corridor. While three of these can probably be assigned to the historic period, three (20755, 20756, and 20759) may belong to the pre-contact Kona Field System. All sites present are preliminarily assessed as containing moderate research value and low interpretive and cultural value. Based on this provisional assessment, the recommended further data collection should consist of detailed inventory-level recording of all sites. Sites 20755, 20756 and 20759 will also require surface collection and test excavations. Once these additional tasks have been completed, it is unlikely that any further work would be recommended. [Halpern and Rosendahl 1996:12]

Henry et al. (1996) conducted an archaeological inventory survey of a roughly 50-acre parcel (TMK:3-7-5-11:2) located within Hienaloli 3rd and 4th *ahupua'a* to the west of Māmalahoa Highway at elevations ranging from 750 to 1,450 feet above sea level (see Figure 13). As a result of the survey nine archaeological sites were recorded on the parcel. The sites included two agricultural complexes (Sites 18658 and 18661), two Historic boundary walls (Sites 18659 and 18660), three Precontact habitation enclosures (Sites 18662, 20689, and 20691), a Precontact platform interpreted as a men's house (Site 20690), and a platform used for Precontact habitation (Site 18663).

One of the agricultural complexes (Site 18658) was interpreted as being used during Historic times. It contained 20 features including 15 mounds, 3 walls, an alignment, and a terrace. The other agricultural complex (Site 18661) was interpreted as being used during Precontact and Historic times. It contained 131 features including 21 mounds, 60 terraces, 4 modified outcrops, 11 enclosures, 34 walls, and one feature that was bulldozed beyond recognition. Both agricultural sites were interpreted as being part of the Kona Field System. In addition to the recording of surface features, forty shovel test pits were excavated in the vicinity surface features revealing a partially disturbed, Precontact cultural deposit that extended to a depth of 0.15 meters below ground surface. Cultural debris recovered from the test pits included volcanic glass flakes, charcoal, a stoneware ceramic fragment, and a metal nail.

Moore et al. (1996) conducted an archaeological data recovery at eight sites located on TMK: 3-7-5-09:48 (por.) within Hienaloli 6th Ahupua'a to the southwest of the current project area at elevations ranging from 50 to 120 feet above sea level (see Figure 13). The property was previously the subject of an inventory survey conducted by Donham and Kai (1990) during which thirteen sites containing a total of seventeen features were recorded. The features consisted of modified outcrops, stone alignments, a terrace, walls, caves, a *pāhoehoe* excavation, and a rock concentration. Donham and Kai (1990) concluded that their project area had been utilized during both Precontact and Historic times for agriculture and temporary habitation purposes. During the data recovery, a total of 48.0 m^2 were excavated. The findings of the data recovery generally supported the findings of the inventory survey, concluding that:

> Utilization of the sites on the subject property would have been minimal with some domestic activities occurring at the temporary habitation features, the cultivation of a few crops at the agricultural features, and the control of livestock in the post-contact period (Moore et al. 1996: 123).

Artifacts recovered during the data recovery excavations included volcanic glass, adzes, abraders, utilized shark teeth, pig tooth ornaments, modified bones, basalt flakes, worked shell, basalt weights, anvil stones, hammer stones, and *'ula maika*, along with a conch shell fragment, gourd fragments, marine shell, fish, mammal, and bird bone, and a large amount of Historic debris. A single radiocarbon sample analyzed during the data recovery had a 1 sigma calibrated age range of 1518-1596 and a 2 sigma calibrated age range of 1471-1676.

Yent (1999) conducted an archaeological inspection of a Keopu-HFDC Exploratory Well No. 1 prior to its development within the current project area. The well site is located on TMK:3-7-5-13:22 at an elevation of 1,590 feet above sea level. Yent conducted a field inspection on June 24, 1999, and noticed several changes in the project area vicinity since her 1991 survey (Figure 16). Yent noted that:

- A new residence has been constructed to the south of he project area in Hienaloli 2 (TMK: 7-5-13: 12). In addition, grubbing and grading has occurred in the area of the new residence with subsequent planting of trees. It is believed that the grubbing, grading, and construction occurred sometime in the past 2 years as it was not mentioned in the [Kawachi] 1994 or [Halpern and Rosendahl] 1996 survey reports.
- Apparently in conjunction with this grubbing and grading, a portion of Hienaloli 1 was also bulldozed. This area measures approximately 100' (N-S) by 500' (E-W) and is along the Hienaloli 1-2 boundary of parcel 13. The area affected by the grubbing and grading is marked by growth of 3-foot high grasses and weeds and the lack of Christmas berry or guava trees that previously grew in the area.
- Erection of a new fenceline along the boundary of Hienaloli 1 and 2.
- The absence of the walled platform site at the 1620-foot elevation (approximate contour). It appears that this site was destroyed when the area was grubbed and graded. In addition, there was no evidence of the stacked rock wall on the southern property line of Hienaloli 1 that ran from the 1600-foot to 1680-foot elevation (approximate)...[Yent 1999:6, 9]

Yent (1999) believed that the walls of parcel 13 were Historic, probably built as property boundaries, and possibly associated with ranching in h area. She recommended that the walls be flagged and a 10-foot buffer established during drilling associated with Well No. 1. Also that Site 20759, although out of the potential area of impact, be pointed out to the construction crew, so that they could avoid the area. Yent (1999) did not recommend monitoring due to the shallow nature of the soils and the lack of significant surface features in the area. As a result of the Yent (1999) work, Well No. 1 was constructed on the parcel without any further destruction of archaeological sites.

Haun (2000) conducted an archaeological inventory survey of TMK:3-7-5-11:23 (por.) located within Hienaloli 2nd Ahupua'a to the west of the current project area, across Mamālahoa Highway (see Figure 13). The survey identified one site (Site 21848) with 17 features corresponding to the boundaries of LCAw. 10406. The features consisted of a modern house, a probable animal pen, an enclosure, and an enclosing wall with a series of subdividing walls and a terrace forming at least ten formal agricultural fields. LCAw. testimony for the parcel indicated that the property was used for the cultivation of taro, sweet potatoes, and coffee during the early to mi 1800s. As a result of the survey Site 21848 was recommended for data recovery.

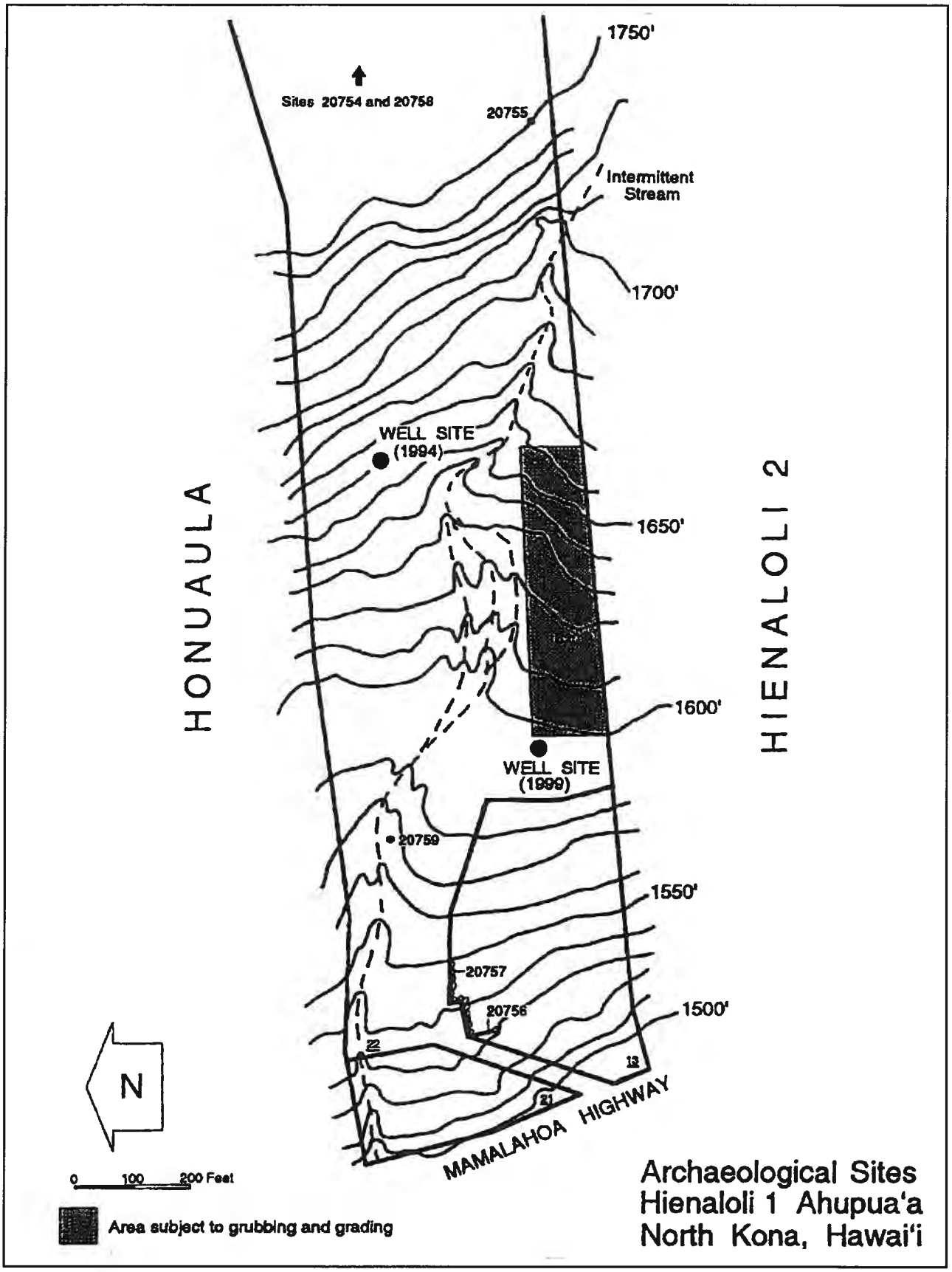


Figure 16. Map from Yent (1999) showing the approximate area impacted by grubbing and grading prior to 1999.

Haun and Henry (2000a) conducted an archaeological inventory survey of a roughly 56-acre property (TMK:3-7-5-11:3, 4 and 24) located west of the current project area, across Mamālahoa Highway, within Hienaloli 1st and 2nd *ahupua'a* (see Figure 13). Elevations within the project area ranged from 750 to 1,480 feet above sea level. As a result of the survey Haun and Henry (2000a) identified eight archaeological sites containing a total of thirty-nine features. The recorded sites included five Historic ranch walls (Sites 5085, 18659, 20846, 21878, and 21879), a railroad bed (Site 7214), a *heiau* (Site 21880), and an agricultural complex (Site 21881). The agricultural complex contained thirty-two features including mounds, modified outcrops, *kuaiwi*, platforms, and terraces that were concentrated in areas least affected by mechanical clearing. Haun and Henry (2000a) suggested that Site 21880 was probably a small agricultural *heiau* based on its setting, and that its construction and initial use likely dated to sometime between A.D. 1400 and 1600. As a result of the inventory survey Site 21881 was recommended for data recovery, Site 21880 was recommended for preservation, and the remaining sites were recommended for no further work.

Haun and Henry (2000b) conducted the data recovery excavations at Site 21848 located on TMK: 3-7-5-11:23 (por.) and Site 21881 on TMK:3-7-5-11:3, 4 and 24. The data recovery consisted of mechanical sectioning of selected terraces and *kuaiwi* to obtain stratigraphic data and radiocarbon samples. In all seven trenches that bisected five terraces and a *kuaiwi* were excavated. The results of the data recovery suggested that, "initial agricultural use of the area began in the early 1400s with the formation of *kua'iwi* (sic) followed by the construction of terraces within a few decades", and that, "the agricultural features probably continued in use until at least the early to mid-1800s" (Haun and Henry 200b:ii).

Haun and Henry (2001) conducted an archaeological inventory survey of a roughly 51-acre property (TMK:3-7-5-10: 52, 65, and 66) located southwest of the current project area within Hienaloli 2nd-5th *ahupua'a* (see Figure 13). Elevations within the project area ranged from 270 to 740 feet above sea level. As a result of the survey, Haun and Henry (2001) identified twenty-two archaeological sites containing a total of 134 features. The recorded sites included thirteen walls (Sites 5086, 22947, 22950, 22953, 22954, 22955, 22956, 22957, 22959, 22960, 22962, 22963, and 22964), a railroad bed (Site 7214), an agriculture complex consisting of 111 features (Site 22946), a livestock loading chute (Site 22948), a temporary habitation enclosure (Site 22949), a permanent habitation terrace (Site 22951), a temporary habitation complex consisting of three features (Site 22952), a permanent habitation platform (Site 22958), a livestock enclosure (Site 22961), and a platform used as a foundation in the Historic Period (Site 22965). The 111 features of the agricultural complex (Site 22946) consisted of modified outcrops, terraces, mounds, and *kuaiwi*, which were only located in the *makai* portion of the project area. Haun and Henry (2001) surmise that this is because of modern disturbances to the area above the 520-foot elevation contour. The inventory report recommended that five sites (Sites 22949, 22946, 22951, 22952, and 22958) undergo data recovery, while the other seventeen were recommended for no further work.

Haun et al. (2003) conducted the data recovery excavations at the five sites located on TMK:3-7-5-10: 52, 65, and 66. During the data recovery seven agricultural features were sectioned with a backhoe at site 22946, and 11.0 m^2 were excavated within the habitation features at Sites 22949, 22951, 22952, and 22958. Eleven radiocarbon samples were submitted for dating, indicating construction and use of the features from A.D. 1400 to 1890. Haun et al. concluded that:

> Artifacts, midden debris, and structural modifications indicate a variety of on-site and off-site activities. Widespread marine resources indicate that people using the area were in direct contact with the coastal region. Evidence of animal husbandry is inferred from domesticated dog bones in the faunal assemblage from Site 22958. traditional Hawaiian artifacts, a radiocarbon calibrated rang of A.D. 1440 to 1640 and commercial items, including a coin from the Republic of Mexico indicate that multicomponent deposits are preserved at Site 22958. On site activities include feature and fire construction, food preparation and consumption; stone, bone, and shell tool use and manufacture; and crop cultivation. Inferred off-site activities include marine food procurement, animal husbandry, and procurement of stone for construction and raw material for tool. [Haun et al. 2003i]

Rechtman et al. (2005) conducted an archaeological inventory survey of three adjoining parcels (TMK:3-7-5-04:2, 35, and TMK:3-7-5-22:173) comprising roughly 5.3 acres in Honua'ula and Hienaloli 1st *ahupua'a* to the west of the current project area at elevations ranging from 80 to 120 feet above sea level (see Figure 13). The project area roughly corresponded to the 5 acres given to the Reverend Asa Thurston and his family in 1825. Although the bulk of the study area was extensively grubbed and graded in 1991, the survey revealed the presence of three previously known sites within the project area. The sites included a homestead initially occupied around A.D.1825 as the parsonage for the Reverend Asa Thurston and his family (Site 7248), Laniākea Cave (Site 24385), a traditional cultural site that was a fortified defensive location used during the Precontact Period as a secure location in times of conflict, and the Kuakini Wall (Site 6302). The Historic residential complex contained ten features including the ruins of two stone and mortar structures, a stone terrace, a stone-lined pit used for the manufacture of coral/lime mortar and plaster, and several wall remnants. Scattered human remains were found within Laniākea Cave, indicating that the cave was also used for burial. As a result of the survey all three sites were recommended for preservation.

AHUPUA'A SETTLEMENT PATTERNS AND CURRENT SURVEY EXPECTATIONS

Archaeological studies undertaken within the greater North Kona District indicate that initial prehistoric settlement was concentrated primarily along the coast (Cordy 1981, Cordy et al.1991). As coastal populations increased, so did the development of agricultural fields in the upland areas, reaching their greatest extent in the late 1700s. As the fields expanded so did native populations in the upland resource areas. By the sixteenth century temporary and permanent habitations were found at higher elevations within the *'apa'a* zone (Barrera 1991).

In Historic times, with the shift to a market economy and a western style of land ownership in Hawai'i, populations shifted from the coast to the upland areas (Cordy 1985, Ellis 1963). Much of the old style of agriculture was abandoned in favor of coffee farms and cattle ranches, which have had a significant impact on the Prehistoric archaeological record.

Based on the previous archaeological work undertaken within the current project area, a fairly detailed set of project expectations can be arrived at. Yent (1999) and Halpren and Rosendahl (1996) both list five sites as being extant within the current project area. A sixth site, recorded by Yent (1991) at the 1,620 foot contour within the project area was destroyed prior to the Yent (1999) study and was outside the Halpern and Rosendahl (1996) study area. The previously recorded sites include core-filled walls and wall complexes dating to the Historic Period that were constructed for ranching and boundary purposes, along with a wall and terrace site that was suggested by Halpern and Rosendahl (1996) to be a remnant Precontact agricultural feature.

If other Precontact features (that were not previously recorded) are discovered within the project area, they may include mounds, modified outcrops, terraces, and low rock walls (*kuaiwi*) related to agricultural use of the area, or enclosures, platforms, or lava tubes that were used for habitation purposes, and perhaps trails that once connected these sites with other sites, and the upland areas with the coastal areas. If any burials are present, they may be found within lava tubes or neatly constructed platforms. The construction of Historic features for ranching purposes likely had a negative impact on any Precontact features that were once present, as stones were taken to build walls and corrals, and cows trampled them. If any unrecorded Historic Features are encountered they could include additional core-filled walls used for ranching and boundary purposes, roads, habitation features (i.e. enclosures, platforms, cisterns, etc.), or possibly agricultural features similar to those described above. If any Historic Period burials are encountered they may be located in above ground mausoleums. Many of the features within the project area are likely to have been negatively impacted by mechanical clearing for ranching and residential purposes during modern times.

FIELDWORK

Fieldwork for the current inventory survey was conducted on February 12-14 2008 by Matthew R. Clark, B. A., J. David Nelson, B.A., Christopher S. Hand, B.A., Olivier M. Bautista, B.A., Ashton K. Dircks, B.A., Johnny R. Dudoit, B.A., and Michael K. Vitousek, B.A. under the direction of Robert B. Rechtman, Ph.D.

Methods

During the inventory survey fieldwork the entire project area was subject to north-south pedestrian transects with fieldworkers spaced at 10-meter intervals. When archaeological features were encountered, they were plotted on a map of the study area using Garmin 76s handheld GPS technology (with sub five-meter accuracy). They were then cleared of vegetation, mapped in detail, photographed (with a meter stick for scale), and described using standardized site record forms. With the aid of the previous survey reports for the project area, the identified features were then matched to their existing SIHP site numbers. The features were also evaluated at that time for the need of subsurface testing.

All test units (TUs) excavated during the current project measured 1 x 1 meter. Excavation of test units proceeded following natural stratigraphic layer. Where applicable, the layers were excavated in arbitrary 10-centimeter levels. The recovered soil matrix was passed through quarter inch mesh screen, and all recovered cultural material was remanded to the laboratory for detailed analysis. Level record forms, filled out for each level of each layer in each unit, were used to record soil descriptions, Munsell color notations, cultural constituents collected, and a general description of the level. Upon completion of a unit, photographs were taken, profile drawing was prepared, and the unit was back filled as close to its original specifications as possible.

Recovered cultural material was processed at the Rechtman Consulting, LLC laboratory facility and is currently curated at that location. The recovered cultural material was first washed and then separated by level into material classes. An accession number (ACC #) was then sequentially assigned to each group of related items; and the material encompassed by an individual accession number was quantified by the number of identified specimens (NISP), weighed, and when applicable considered for the minimum number of individuals (MNI) present. The findings of the inventory survey along with detailed descriptions of the encountered archaeological resources and the subsurface testing are presented below.

Findings

As a result of the current inventory survey five previously recorded sites were relocated within the project area (Table 2). The sites include four core-filled ranching/boundary walls (Sites 20754, 20755, 20757, 20758) and a terrace and wall located along the edge of a natural drainage that may have been utilized for agricultural purposes (Site 20759). A single test unit (TU-1) was excavated at Site 20759 revealing a soil deposit, but only modern cultural debris. The location of each of these sites, relative to the boundaries of the current project area, is shown in Figure 17, and detailed descriptions of each of the sites follow below.

Table 2. Archaeological sites recorded within the current project area.

Site No.	*Formal Type*	*Functional type*	*Temporal Affiliation*	*Test unit*
20754	Core-filled wall	Ranching/boundary	Historic	-
20755	Core-filled wall	Ranching/boundary	Historic	-
20757	Core-filled wall	Ranching/boundary	Historic	-
20578	Core-filled wall	Ranching/boundary	Historic	-
20759	Terrace and wall	Agriculture	Precontact/Historic	TU-1

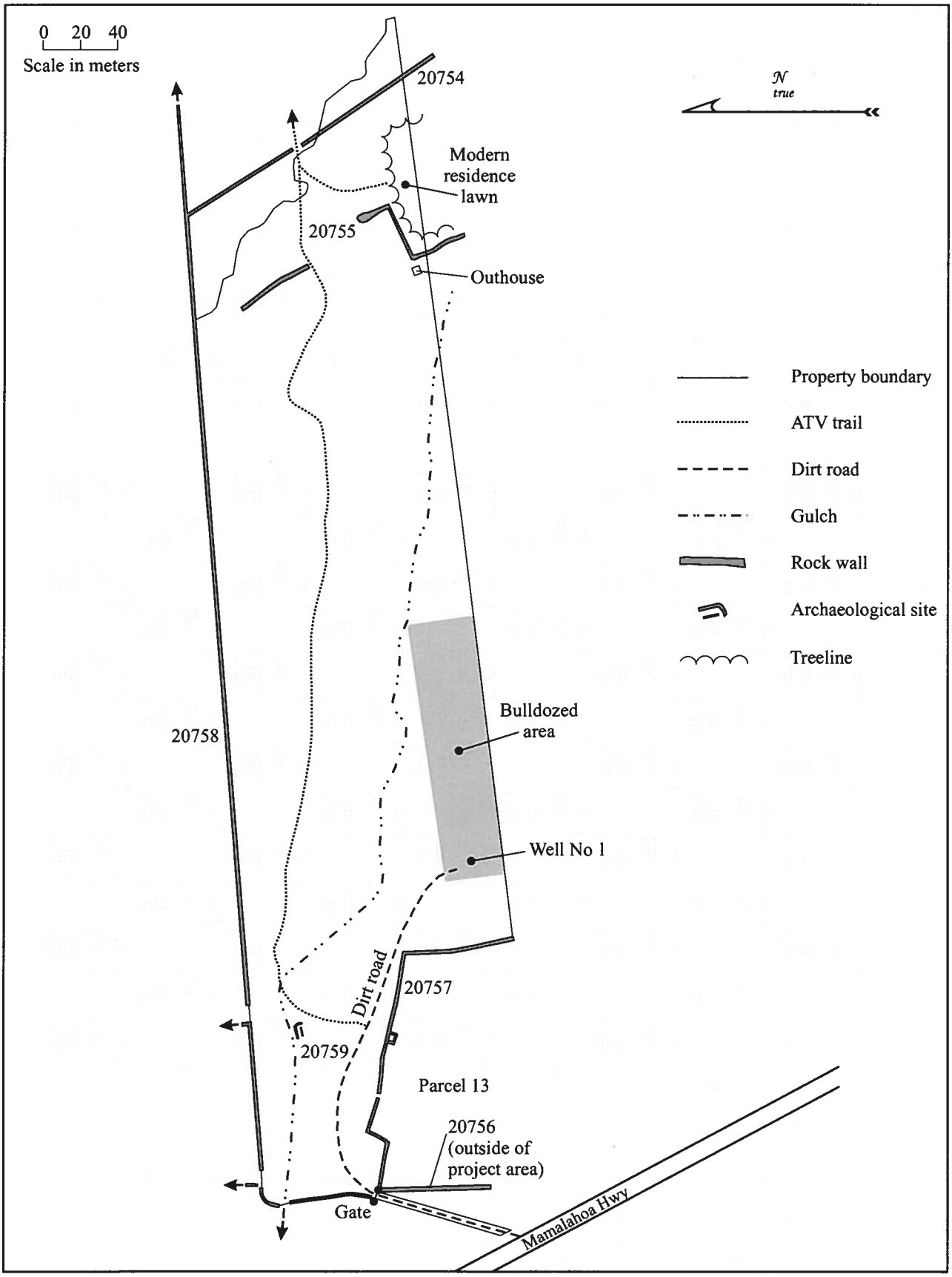


Figure 17. Site location map.

SIHP Site 20754

SIHP Site 20754 is a core-filled wall that runs in a northwesterly/southeasterly direction across the eastern portion of the current project area (see Figure 17). The wall was previously recorded by Yent (1991, 1999), Kawachi (1994), and Halpern and Rosendahl (1996). The Halpern and Rosendahl (1996) description of Site 20754 presented in the Previous Archaeology section of this report accurately describes the wall as it appeared during the current study.

Site 20754 crosses the eastern end of the current project area in a northwesterly/southeasterly direction the 1,800-foot elevation contour. The section of wall located within the project area measures 55 meters long but it continues for an undetermined distance to both the northwest and southeast. The wall is constructed of medium to large sized *pāhoehoe* cobbles standing 2-5 courses high along each edge, with small cobbles filling in the interior space. The wall averages 70 centimeters tall and has an average width of 75 centimeters (Figure 18). The wall is mostly intact and a barbed wire fence runs along its top edge. A break appears in the wall where the ATV trail crosses its length. To the north (outside of the current project area) Site 20754 continues to Site 20758 (another core-filled wall). As mentioned by Halpern and Rosendahl (1996), and based on its formal attributes and location, Site 20754 was likely built during the Historic Period for cattle control and boundary marking purposes.

Figure 18. SIHP Site 20754, view to east.

SIHP Site 20755

SIHP Site 20755 is a core-filled wall located in the southeastern portion of the current project area (see Figure 18). The wall was previously recorded by Yent (1991, 1999), Kawachi (1994), and Halpern and Rosendahl (1996). Halpern and Rosendahl (1996) called Site 20755 a platform/wall (see Previous Archaeology section of this report). Although the wall does not appear to be a platform, just an unusually wide wall, the description generally describes Site 20755 as it appeared during the current study, but some of the wall's component sections are not mentioned.

The wall is located in the eastern portion of the current study parcel, approximately 50 meters west of, and running parallel to Site 20754. The site is located adjacent to the northwestern corner of the lawn of a modern residence that encroaches into the current study parcel. Based on its formal attributes and location (parallel to Site 20754 near a fence line and property boundary) it is likely that Site 20755 was constructed during Historic times for ranching and/or boundary purposes.

Beginning at its southernmost end, outside of the current project area, Site 20755 runs from a modern concrete and stone retaining wall in a northwesterly direction for 35 meters. This section of the wall averages 1.6 meters wide by 0.6 meter tall. It is constructed of 2-3 courses of medium sized cobbles, but is mostly collapsed. At a point approximately 10 meters north of the project area's southern boundary, the wall makes a 90° turn and runs northeast for an additional 35 meters to another corner.

The plywood outhouse (Figure 19) mentioned by Halpern and Rosendahl (1996) is located just to the west of the first turn in the wall. It is built over a natural depression in the bedrock terrain that has been modified with stacked cobbles. The cobbles used to build the outhouse may have been taken from Site 20755, as the two are not contemporaneous, and the outhouse was clearly built later. Based on the construction materials, it is likely that the outhouse is no more than 25 years old. A walking path, leading in the direction of the modern residence has been cleared through Site 20755.

At the second (easternmost) corner, the wall once again makes a 90° turn and continues northwest for an additional 20 meters, gradually increasing in stature as it proceeds, and eventually terminating at bulldozed pasture and a fence line. At the southeastern end of this section, the wall is core-filled, neatly stacked 3-4 courses (up to 1.1 meters) tall, and measuring 1.6 meters wide. The wall increases in size as it proceeds to the northwest reaching a maximum width of 3.6 meters and a maximum height of 1.6 meters (5-7 courses) (Figures 20 and 21). Although this portion of Site 20755 was described as a platform by Halpern and Rosendahl (1996), bulldozer scaring on some of the rocks indicates that the wall was likely restacked and consequently widened for clearing purposes subsequent to the bulldozing of the nearby pasture. Some exposed bedrock was also present in the wall, suggesting that it was perhaps built over a raised outcrop, which would have contributed to its size. Where the wall terminates at the fence line and pasture, a 35-meter gap is present in the wall before a rough alignment of bulldozed cobbles picks up continuing in the same general direction as the wall was where it terminated. It is possible that this alignment represents a former continuation of Site 20755, but it has been so thoroughly destroyed by bulldozing that this is difficult to determine with any certainty.

Figure 19. View to southwest of the plywood outhouse near Site 20755.

Figure 20. SIHP Site 20755, view to east of western edge.

Figure 21. SIHP Site 20755, view to northwest of the top surface of the widest section of the wall.

SIHP Site 20757

SIHP Site 20757 is a core-filled wall that runs along the southwestern boundary of the current study parcel where it borders Parcel 13 (see Figure 17). The wall was previously recorded by Yent (1991, 1999), Kawachi (1994), and Halpern and Rosendahl (1996). The Halpren and Rosendahl (1996) description of Site 20757 presented in the Previous Archaeology section of this report generally describes the wall as it appeared during the current study.

Site 20757 runs a meandering course east for approximately 130 meters, from the gate across the access road in the southwestern corner of the parcel to the northeastern corner of Parcel 13 (Figure 22). The wall then turns south and runs for approximately 50 meters along the eastern boundary of Parcel 13 to the southern boundary of the current project area. Site 20757 is constructed of medium to large sized *pāhoehoe* cobbles that are stacked 3-4 courses (0.8 to 1 meter) high. It has an average width of 1 meter. A constructed gap, 1.3 meters wide, is located in the center of the east-west trending section of Site 20757, and small rectangular enclosure is constructed along the southern edge of the wall, approximately 35 meters east of the constructed gap, outside of the current project area (see Figure 17). The enclosure measures 2 meters (east-west) by 1.5 meters (north-south), by 0.5 meter tall, and the interior is partially filled with loose cobbles. A modern barbed wire fence runs along the wall in places and black PVC water line follows the north edge of the wall for its entire length. It is likely, based on its formal attributes and location (along parcel boundaries), that Site 20757 was built during the Historic Period for ranching and/or boundary purposes.

Figure 22. SIHP Site 20757, view to southwest at the northeastern corner of parcel 13.

SIHP Site 20758

SIHP Site 20758 is a core-filled wall that runs along the northern boundary of the current project area (see Figure 17). The wall was previously recorded by Yent (1991, 1999), Kawachi (1994), and Halpern and Rosendahl (1996). The Halpern and Rosendahl (1996) description of Site 20757 presented in the Previous Archaeology section of this report generally describes the wall as it appeared during the current study.

Site 20758 is the northern boundary wall of the current project area. Although the wall runs east-west along the parcel boundary for the entire length of the study area, it appears to have been constructed in sections corresponding to parcel boundaries to the north of the project area (two core-filled walls run north from Site 20758 and constructed gaps are present in Site 20758 at both of these intersections). The wall is of core-filled construction with stacked edges standing 4-5 courses (1.0 to 1.2 meters) high, by 0.8 to 1-meter wide (Figure 23). The wall is fairly intact for its entire length, but erosion has caused soil to build up along its northern edge and caused it to collapse downhill to the south where it runs along steep terrain. At its western end, also due to erosion, the wall has collapsed where it follows along the natural edge of the drainage that crosses the property. Site 20758, based on its formal attributes and location (along the parcel boundary) was likely built in the Historic Period for boundary delineation and cattle control purposes.

Figure 23. SIHP Site 20758, view to north of intact southern edge.

SIHP Site 20759

SIHP Site 20759 consists of a wall and terrace located in the western portion of the current project area (see Figure 17) The site was previously recorded by Halpern and Rosendahl (1996), and Yent (1999). The Halpern and Rosendahl (1996) description of Site 20759 presented in the Previous Archaeology section of this report generally describes the wall as it appeared during the current study.

Site 20759 consists of a wall and terrace located south of the drainage in the west-central portion of the project area. The site occupies a roughly 15 meter by 15 meter area directly adjacent to the drainage edge (Figure 24). The wall is constructed along the edge in a north/northeasterly direction (Figure 25). It measures roughly 6.0 meters long by 0.8 to 1.5 meters wide, and has an average height of 0.5 meters along its southern edge (Figure 26). Along its northern edge, where it borders the drainage, the wall is loosely stacked up to 4 courses (up to 1.5 meters) tall, with areas of collapse (Figure 27). The northern end of the wall fades into the natural terrain. At its southern end the wall follows a bedrock contour that runs south toward the terrace. Ground surface to the south of the wall consists of level soil covered by ferns and organic material.

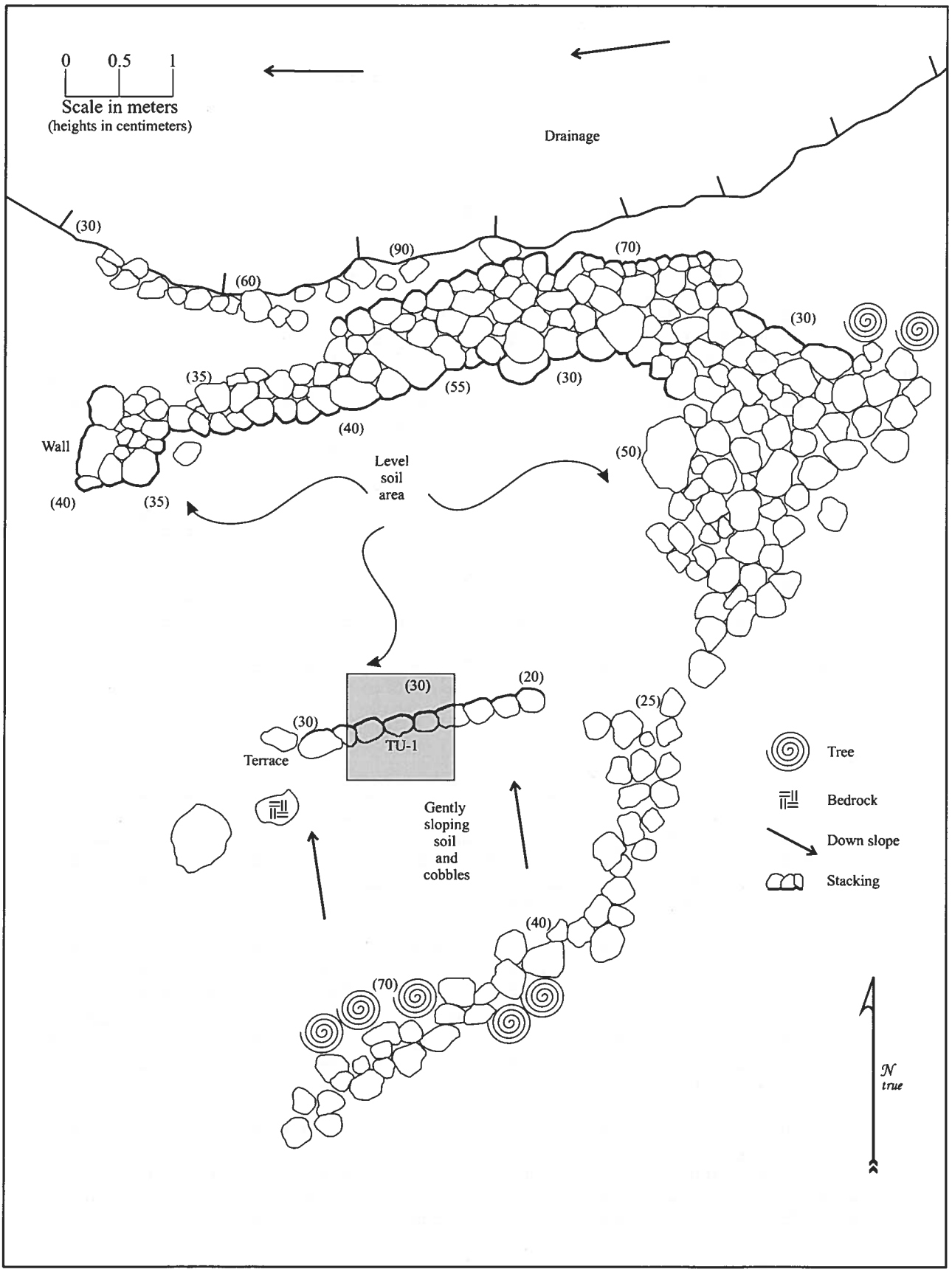


Figure 24. SIHP Site 20759 plan view.

The terrace is located 2.9 meters south of the wall, and its northern edge parallels the southern edge of the wall. The terrace edge faces north and is constructed of a single course of medium to large sized, angular *pāhoehoe* cobbles on soil ground surface (Figure 28). The terrace edge measures 3.0 meters long and averages 30 centimeters tall. To the south, the terrace surface measures 4 meters (north-south) by 6 meters (east-west) and slopes gently down to the north. The terrace surface consists of soil with a few cobbles present. A possible second terrace is located at the southern end of the first, but it is obscured by the roots of a large Christmas-berry tree growing out of it. A 1 x 1 meter test unit (TU-1) was excavated into the northern portion of the terrace so as to include the terrace wall and area north of the wall.

Excavation of TU-1 revealed a single stratigraphic soil layer (Layer I; Figure 29). Layer I consisted of very dark brown (10YR 3/2) granular silt with very little gravel present. The terrace wall consisted of 5 medium to large cobbles running east-west through the center of the unit. The terrace wall was only a single course high and it was constructed on the Layer I soil (Figure 30). Layer I was excavated to approximately 65 centimeters below the terrace surface in the southern portion of TU-1, and to approximately 35 centimeters below the lower ground surface in the northern portion. A fragment of a black plastic grow bag was encountered in the southwestern corner of the unit at approximately 60 centimeters below the surface. Modern debris at that depth suggests recent soil deposits from the flooding of the nearby seasonal stream. No other cultural material was observed. TU-1 was terminated at 65 centimeters below the terrace surface following the excavation of six sterile 10-centimeter levels (Figure 31).

As mentioned by Halpern and Rosendahl (1996), the formal attributes Site 20759 suggests that it is the remains of a Precontact feature of the Kona Field System. Excavation of TU-1 revealed a deep soil deposit within the site, and its location near the intermittent drainage would have provided easy access to water, and perhaps even the opportunity for irrigation. However, cultural material recovered from the unit was limited to a fragment of black plastic from a modern grow bag. This debris was found beneath the terrace portion of Site 20759, suggesting that at least that portion of the site was constructed during modern times. The black plastic could have either flowed down the drainage during an episode of flooding, or been deposited during the construction of the terrace. The wall and interior space between the wall and the Christmas-berry tree to the south of the terrace may be part of an older feature perhaps used for agriculture during the Precontact and Historic Periods.

Summary

As a result of the current inventory survey five previously recorded sites were relocated within the project area. The sites include four core-filled ranching/boundary walls (Sites 20754, 20755, 20757, 20758) and a terrace and wall located along the edge of a natural drainage (Site 20759) that was likely used for agricultural purposes. An additional enclosure site recorded by Yent (1991) near the southern boundary of the project area at the 1,620-foot elevation contour was destroyed prior to the Yent (1999) study. No evidence of this site was observed during the current study.

A 1920s map of North Kona from Lanihau to Kahului (see Figure 9) shows that a large portion of Hienaloli 1st Ahupua'a (roughly 150 acres) including the current project area was leased to Manual Gomes as Lease No. 1691 (expired on April 10, 1945). Gomes, who had started ranching in the Kona area in the 1920s, created the Gomes Ranch, which at its peak included 8,500 acres of leased and purchased lands and 2,700 head of cattle (O'Hare and Wolforth 1998). It is likely that many of the core-filled walls were built during the Gomes Leasehold to delineate boundaries and to control livestock. Some of the walls could also be later, as the project area continued to be used for cattle pasture into modern times.

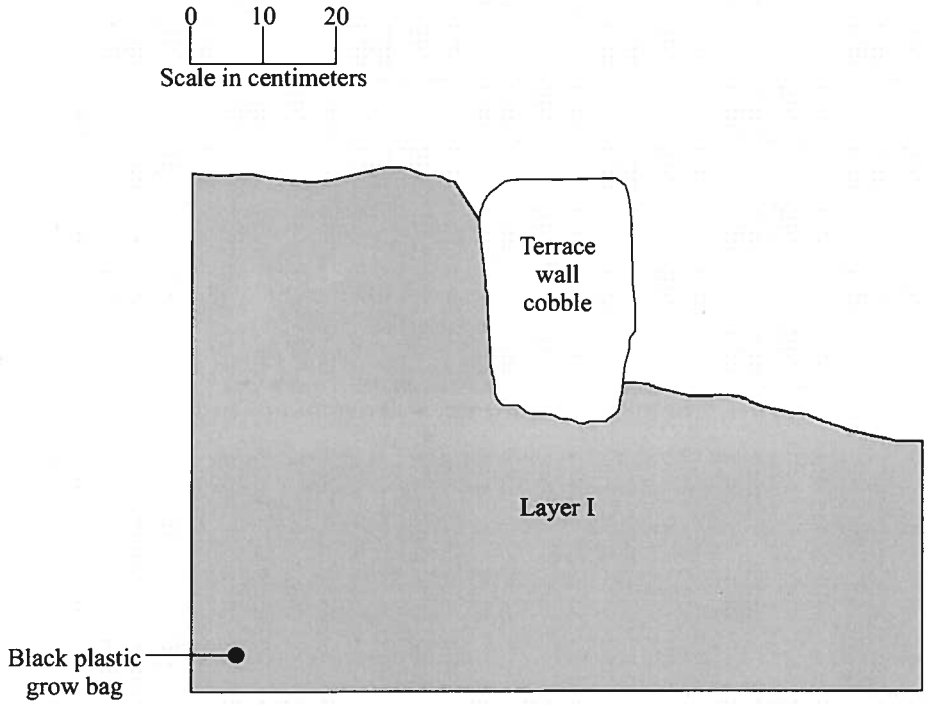
A single test unit (TU-1) was excavated at Site 20759 revealed a deep soil deposit with only modern cultural debris present. Based on these findings, it is suggested that the terrace portion of Site 20759 was likely constructed during modern times, but that the remainder of the site could have been utilized for agriculture purposes during Precontact and Historic times. The site is located near the intermittent drainage that would have provided easy access to water, and perhaps even the opportunity for irrigation.

Figure 25. SIHP Site 20759, view to southwest.

Figure 26. SIHP Site 20759, view to north of the southern edge of the wall.

Figure 27. SIHP Site 20759, view to southeast of the northern edge of the wall along the drainage.

Figure 28. SIHP Site 20759, view to southwest of the terrace's northern edge.



Layer I - Very dark brown (10YR 3/2) granular silt soil with roots and approximately 1% gravel content.

Figure 29. SIHP Site 20759, TU-1 west wall profile.

Figure 30. SIHP Site 20759, TU-1, view to south of the terrace wall construction on the Layer I soil.

Figure 31. SIHP Site 20759, TU-1, base of excavation view to south.

SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The sites recorded during the current study are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai'i Administrative Rules 13§13-284-6. These significance evaluations should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be considered significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A Be associated with events that have made an important contribution to the broad patterns of our history;

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

C Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D Have yielded, or is likely to yield, information important for research on prehistory or history;

E Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The significance and recommended treatments for the sites are discussed below and are presented in Table 3.

Table 3. Site significance and treatment recommendations.

Site No.	*Site Type*	*Temporal Affiliation*	*Significance*	*Treatment*
20754	Core-filled wall	Historic	D	No further work
20755	Wall complex	Historic	D	No further work
20757	Core-filled wall	Historic	D	No further work
20578	Core-filled wall	Historic	D	No further work
20759	Terrace and wall	Precontact/Historic	D	No further work

Sites 20754, 20755, 20757, 20758, and 20759 are all considered significant under Criterion D for information they have yielded relative to past use of the current project area. It is argued that the information collected during the previous and current inventory surveys is sufficient to document these sites and to mitigate any potential negative impacts resulting from the proposed development of Well No. 4. As such, no further work is the recommended treatment for these sites.

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APPENDIX E

Cultural Impact Assessment

Report 2667-062508

Cultural Impact Assessment
Well No. 4 Site
TMK: 7-5-013:Por.022

Land of Hienaloli, North Kona District
Island of Hawai'i

PHRI
Paul H. Rosendahl, Ph.D., Inc.
Archaeological • Historical • Cultural Resource Management Studies & Services

Report 2667-062508

Cultural Impact Assessment
Well No. 4 Site
TMK: 7-5-013:Por.022

Land of Hienaloli, North Kona District
Island of Hawai'i

BY

Helen Wong-Smith, M.A. • *Cultural Resources Specialist*

PREPARED FOR

State of Hawai'i
c/o Belt Collins Hawaii, Ltd.
2153 North King Street, Suite 200
Honolulu, Hawai'i 96819-4554

JULY 2008

PHRI **Paul H. Rosendahl, Ph.D., Inc.**
Archaeological · Historical · Cultural Resource Management Studies & Services

HAWAII: 224 Waianuenue Avenue • Hilo, Hawaii 96720 • (808) 969-1763 • GUAM: P.O. Box 23305 • G.M.F., Guam 96921 • (671) 472-3117

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INTRODUCTION

BACKGROUND

At the request of Mary O'Leary of Belt Collins Hawaii, Ltd., on behalf of the State of Hawai'i Housing Finance and Development Corporation (HFDC), Paul H. Rosendahl, Ph.D., Inc. (PHRI) prepared a cultural impact assessment (CIA) in connection with preparation of an Environmental Assessment (EA) for Well No. 4 Site – TMK:7-5-013:Por.022, located in the land of Hienaloli, North Kona District, Island of Hawai'i (*Figure 1*). The well site is part of the infrastructure to be built in support of a planned approximately 272-acre community of affordable housing (Kona Non-Ceded Lands project; Corbin and Wong-Smith 2007; labeled "Project Parcel" on *Figure 1*). The overall objective of the current project was to comply with the current historic preservation requirements of the Hawai'i State Historic Preservation Division (SHPD).

SCOPE OF WORK

Based on (a) project specifications provided by Belt Collins Hawaii, (b) prior PHRI work within the Land of Hienaloli, and (c) our familiarity with both the general project area and the current regulatory review requirements of the SHPD and the Hawai'i County Planning Department (HCPD), the following tasks were determined to constitute an adequate and appropriate scope of work for the current project:

1. Conduct (a) appropriate archaeological and historical documentary background review and research; and (b) identification of and consultation with appropriate local informants and agency staff;

2. Conduct informal (non-taped) interviews with identified knowledgeable informants;

3. Preparation of draft and final reports; and

4. Coordination and consultation with client, client representatives, local informants, agency staff, etc.

PURPOSE, GOALS, AND OBJECTIVES

The purpose of this cultural impact assessment is to comply with the requirements of *Chapter 343 (Haw. Rev. Stat.),* as amended by H.B. No.2895 H.D. 1 of the Hawai'i State Legislature (2000) and approved by the Governor as *Act 50* on April 26, 2000, and which among other things requires that environmental assessments (EA) and environmental impact statements (EIS) identify and assess the potential effects of any proposed project upon the "...cultural practices of the community and State...." *Chapter 343 (Haw.Rev.Stat.)* was amended by the State legislature because of the perceived need to assure that the environmental review process explicitly addressed the potential effects of any proposed project upon "...Hawai'i's culture, and traditional and customary rights." Guidelines previously prepared and adopted by the State Office of Environmental Quality Control (OEQC 1997) provide compliance guidance. Both *Act 50* and the OEQC *Guidelines for Assessing Cultural Impacts* mandate consideration of all the different groups comprising the multi-ethnic community of Hawaii. This inclusiveness, however, is

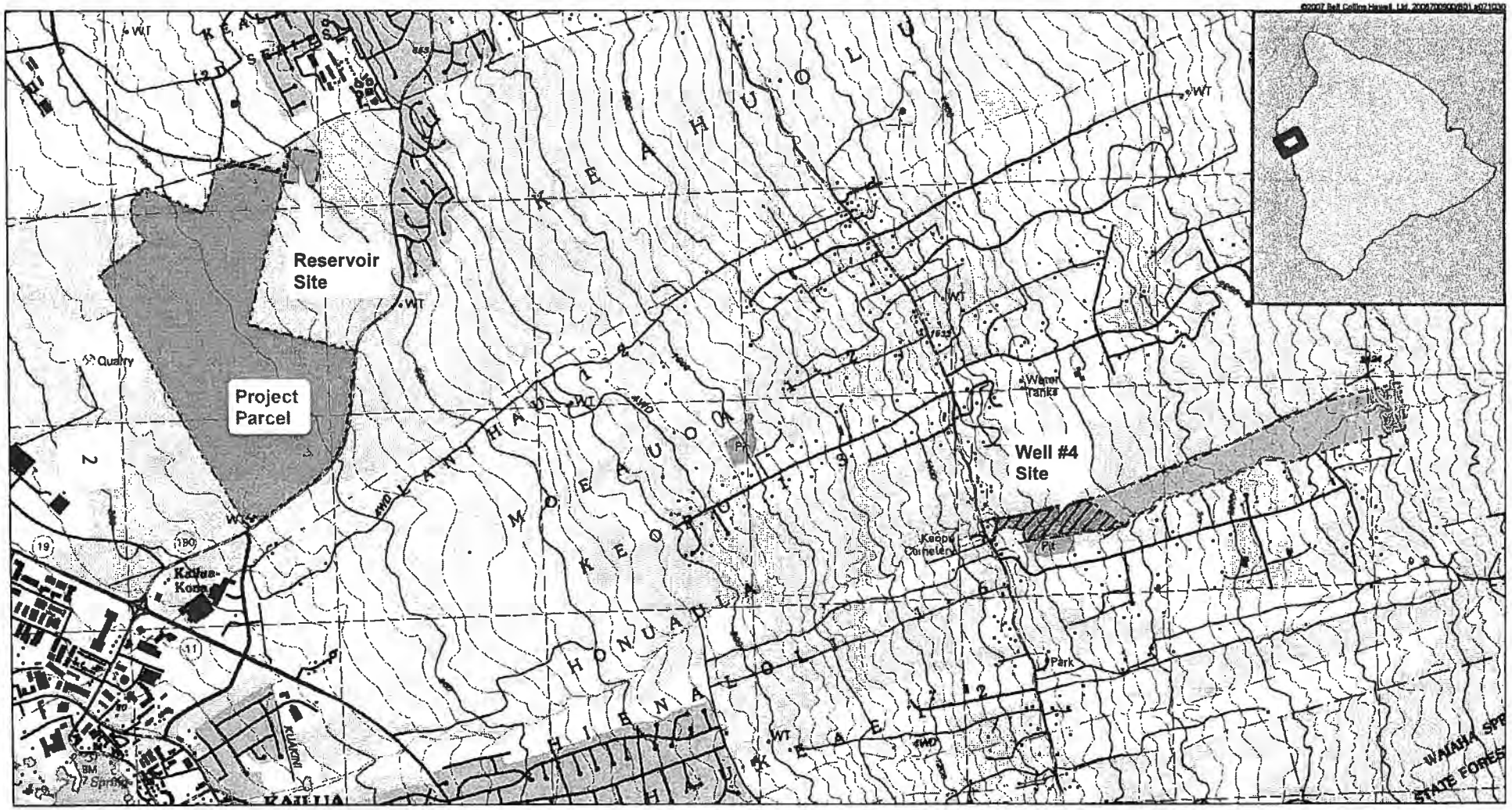

Figure 1: Project Location

generally understated, and the emphasis – as indicated by a background review (*Appendix A*) of the cultural impact assessment issue, and the intent and evolution of both the legislative action and the guidelines – is clearly meant to be primarily upon aspects of Native Hawaiian culture – particularly traditional and customary access and use rights.

Cultural resources include a broad range of often overlapping categories of cultural items – places, behaviors, values, beliefs, objects, records, stories, and so on. A traditional cultural property ("TCP") is one specific type of cultural resource that falls within the purview of the historic preservation review process. A "TCP" is a historic property or place that is important because it possesses "traditional cultural significance":

> "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices....
>
> A traditional cultural property, then, can be defined generally as one that is...[important/significant]...because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1990:1).

In addition, it is important to realize that sometimes a traditional cultural property may not have a visible physical manifestation:

> Although many traditional cultural properties have physical manifestations that anyone walking across the surface of the earth can see, others do not have this kind of visibility, and more important, the meaning, the historical importance of most traditional cultural properties can only be evaluated in terms of the oral history of the community (Sebastian 1993:22).

There are at least two significant differences that distinguish traditional cultural properties as a subset within the larger sphere of cultural resources. First, while cultural resources such as practices and beliefs may be spatially associated with general types of geographical areas, such as the exposed lava lands of the Keahole Point area, a traditional cultural property is a specific physical entity or feature with a definable boundary, such as a specific location within the current project site. Second, while cultural resources such as practices and beliefs can include general cultural behaviors such as the gathering of various natural resources for general subsistence, industrial, or ceremonial uses, a traditional cultural property is a specific place or feature directly associated with specific behaviors the continuity of which over time, in either actual practice or remembrance, can be demonstrated.

Based on these two significant distinctions, it is possible to suggest three types of practitioner claims relating to cultural practices, beliefs, and features that are likely to be encountered in the course of conducting a cultural impact assessment study. These claims can be referred to as (a) traditional cultural property claims, (b) traditional and customary cultural practice claims, and (c) contemporary or neo-traditional cultural practice claims.

Traditional cultural property claims would be those which lie within the purview of the current historic preservation review process (DLNR 2002a,b); that is, they are claims involving the traditional practices and beliefs of a local ethnic community or members of that community that (a) are associated with a definable physical property (an entity such as a site, building, structure, object, or district), (b) are founded in the history of the local community, (c) contribute to the maintenance of the cultural identity of the community, and (d) demonstrate a historical continuity of practice or belief up to the present–through either actual practice or historical documentation. Furthermore, to qualify as a legitimate traditional cultural property within the historic preservation context, a potential traditional cultural property must be able to demonstrate its historical significance in terms of established evaluation criteria, such as those of the National Register of Historic Places and/or the Hawai'i Register of Historic Places.

Traditional and customary cultural practice claims would be those native Hawaiian claims which lie within the purview of Article XII, Section 7, of the Hawai'i State Constitution ("Traditional and Customary Rights"), and various other state laws and court rulings, particularly as reaffirmed in 1995 by the Hawai'i State Supreme Court in the decision commonly referred to as the "PASH decision," and as further clarified more recently in its 1998 decision in State of Hawai'i v. Alapa'i Hanapi and its 2000 decision in Ka Pa'akai o Ka 'Aina et al. v. Land Use Commission, State of Hawai'i et al. The notable points of the decisions in PASH and in Hanapi can be summarized as follows: (a) the reasonable exercise of ancient Hawaiian usage is entitled to protection under Article XII, Section 7 of the Hawai'i State Constitution; and (b) those persons claiming their conduct is constitutionally protected must prove that they are a native Hawaiian as defined in PASH, that the claimed right is constitutionally protected as a traditional or customary native Hawaiian practice, and that the exercise of the right is occurring on undeveloped or less than fully developed property. Ka Pa'akai generally reaffirms the same points as in the PASH and Hanapi decisions and, in addition, (a) indicates the explicit responsibility of the regulatory agency involved in any application review to arrive at affirmative and substantive conclusions regarding potential impacts upon traditional and customary native Hawaiian cultural practices and resources, and (b) suggests an "analytical framework" for the identification of and potential impacts upon any such cultural practices and resources.

Traditional native Hawaiian cultural practices can be categorized as two general types: (a) practices with active behaviors involving both observable activities with material results and their inherent values or beliefs; and (b) practices with more passive behaviors that seek to produce nonmaterial results. The former type of behaviors – practices with active behaviors, for example, would involve practices like the gathering and collecting of different animal and plant resources for various purposes, such as subsistence, medicinal, adornment, social, and ceremonial possibly other uses. Uses such as these usually have associated beliefs and values (both explicit and implicit) relating to a pervasive general theme that flows throughout traditional native Hawaiian culture and binds it together. To native Hawaiians, the natural elements of the physical environment–the land, sea, water, winds, rains, plants, and animals, and their various embodied spiritual aspects–comprise the very foundation of all cultural life and activity – subsistence, social, and ceremonial; to native Hawaiians, the relationship with these natural elements is one of family and kinship. The latter type of behaviors – practices with more passive behaviors – involves more experiential activities focused on "communing with nature"; that is, behaviors relating to spiritual communication and interaction that reaffirm and reinforce familial and kinship relationships with the natural environment.

While traditional cultural property claims, as defined above, would certainly fall within the general domain of traditional and customary cultural practice claims, not all traditional and customary cultural practice claims would necessarily qualify as traditional cultural property claims. Traditional and customary cultural practice claims subsume a broad range of cultural practices

and beliefs associated with a general geographical area or region, rather than a clearly definable property or site–for example, the gathering of marine resources from along a section of shoreline for traditional subsistence or ceremonial purposes, in contrast to the gathering of a specific marine resource species for a specific use by current generation members of a family that had obtained the same resource from the same recognized site for several generations.

Contemporary, or "neo-traditional", cultural practice claims overlap with neither traditional property claims nor traditional and customary practice claims. Contemporary cultural practice claims would be those made by cultural practitioners relating to current practices or beliefs for which no clear specific historical basis in traditional culture can be clearly established or demonstrated; for example, the conducting of ritual ceremonies of uncertain authenticity at sites or features for which no such prior use can be demonstrated.

The specific purpose of the present cultural impact assessment study is to assess the potential impacts of the proposed project upon the cultural resources – the practices, features and/or beliefs – of native Hawaiians or any other ethnic group that might be associated with project area. To accomplish this purpose, several specific objectives were established:

1. Identify any native Hawaiian or other ethnic group cultural practices currently being conducted by individual cultural practitioners or groups;

2. Collect sufficient information so as to define the general nature, location, and authenticity of any identified cultural practices;

3. Assess the potential impacts of the proposed project upon identified cultural practices; and

4. Recommend appropriate mitigation measures for any potentially adverse impacts upon identified cultural practices.

Thus, the overall goal or objective of the present cultural impact assessment study was to identify any native Hawaiian or other cultural practices currently being conducted within or immediately adjacent to present project area that might potentially be in some manner constrained, restricted, prohibited, or eliminated if the proposed project were to be approved. The types of practices to be identified would be inclusive; that is, claims for all three types of practices – traditional cultural property, traditional and customary cultural practices, and contemporary cultural practices – would be identified and considered. More specifically, the objectives of the cultural impact assessment were to determine the following: (a) if the project area is currently being accessed by native Hawaiian cultural practitioners for any traditional and customary cultural uses; (b) if the proposed project would have any adverse impacts upon any identified current native Hawaii cultural uses of the area; and (c) what measures might be proposed to mitigate any adverse impacts the proposed project might have upon any identified current native Hawaiian uses of the area. The present study scope and methodology is discussed in detail in relation to cultural impact assessment issues and the OEQC guidelines in *Appendix A*.

CIA STUDY BY HELEN WONG-SMITH

Cultural Resources Specialist Helen Wong-Smith, M.A., conducted the current CIA study. Ms. Wong-Smith has extensive experience in historical documentary and informant research, having worked for many years as a Historical Researcher/Cultural Resources Specialist for PHRI. She is currently the Hawaiian and Pacific Collection Librarian at University of Hawaii at Hilo.

The informant research for this project initially involved compiling a list of potential informants for the project area and the general vicinities of Keahuolu and Kealakehe. The list of potential informants was compiled by contacting informants known through past projects, and through inquiries with departments and cultural specialists such as Kepâ Maly, OHA, Ruby McDonald, and Keola Lindsey, formerly of the Hawaii Island SHPD office. One contact usually led to another until a list of over thirty potential informants was compiled (*Table 1*). The potential informants were contacted by phone and e-mail and those responsive were interviewed preliminarily to assess their potential to and willingness to provide information. To further assess informants, informants were asked to fill out written forms to answer some preliminary questions such as: Who are in your immediate family? What was your previous occupation and education? What is your family background? What are your residential ties? Do you know of any specific historic/cultural properties, practices, and/or beliefs relevant to the project area? This was followed up with phone conversations. Helen Wong-Smith then conducted further interviews with a few selected individuals who had potential to provide further information, and to provide further documentary information on the Hienaloli project area.

Table 1. List of Potential Informants

	Name	Status/Expertise	Affilliation
1	Ruby P. Keana'aina McDonald	Native Hawaiian, executive director	OHA, NAHKHAC
2	Elaine Watai	Native Hawaiian	KCA/SAFIS
3	Craig "Bo" Kahui	Native Hawaiian, president of organization	KCAVL
4	Wally Lau	Native Hawaiian, executive director	NPK
5	Reginald Lee	Native Hawaiian	DOCARE
6	Elizabeth Lee	Native Hawaiian, *lauhala* weaving master	
7	Michael Ikeda	Community Building Facilitator IV	QLCC
8	Mahealani Pai	Native Hawaiian, cultural specialist	BHI
9	J. Curtis Tyler III	Native Hawaiian, cultural resource specialist	KCDPSC
10	Geraldine Bell	Native Hawaiian, park superintendent	KHNHP, NAHKHAC
11	Kahu Akahai	Native Hawaiian, *kahu*, minister, pastor	MZCC
12	David Garcia	Counselor	QLCC
13	Clarence Medeiros, Jr.	Native Hawaiian, journeyman mason	
14	Lily Kong	Native Hawaiian	KOONKOK
15	Ulalia Ka'ai-Berman	Native Hawaiian, *kumu hula*	NAHKHAC
16	Taro Fujimori	Native Hawaiian	N/A
17	Zachary Kanuha	Native Hawaiian	N/A
18	Clement "Junior" Kanuha	Native Hawaiian	N/A
19	Raeanne Kahaiali'I	Native Hawaiian	N/A
20	Clarence Rapoza	Native Hawaiian	N/A
21	E. Kalani Flores	Native Hawaiian, *kumu olelo* Hawaii	HL-HCCW
22	Gail Souza-Save	General knowledge	QLCC
23	Lydia Mahi	General knowledge	KCDPSC,HCEOC
24	Arthur "Uncle Aka" Mahi	Native Hawaiian	N/A
25	Rae Ann (Fujimori) Godden	Native Hawaiian	N/A
26	Gloria Muraki	General knowledge	N/A
27	Violet Leihulu Mamac	General knowledge	N/A
28	Angel Pilago	Native Hawaiian	HCC
29	Kelly Greenwell	General knowledge	N/A
30	Michael Keala Ching	General knowledge	N/A
31	Iris Nalei Napaepae-Kunewa	General knowledge	N/A
32	Dr. Frank Sayre	General knowledge	N/A
33	Robert Kawaiula Brancp	General knowledge	N/A
34	Kahu Henry Kanoelani Boshard	Native Hawaiian, *kahu*, minister, pastor	MC
35	Kahu Brian Boshard	Native Hawaiian, *kahu*, minister, pastor	MC
36	Ka'ea Lyons Alapai	Native Hawaiian, *kumu olelo* Hawaii	KAPA, EHES

TABLE KEY:

Affiliation:

N/A	Not Available
KCA	Kealakehe Community Association
SAFIS	Salvation Army Family Intervention Services
OHA	Office of Hawaiian Affairs
QLCC	Queen Liliuokalani Children's Center
BHI	Bishop Holdings, Inc.
MZCC	Mauna Ziona Congregational Church
KHNHP	Kaloko-Honokōhau National Historical Park
NPK	Neighborhood Place of Kona
NAHKHAC	Na Hoapili o Kaloko Honokōhau Advisory Commission
KCAVL	Kaniohale Comm. Association at the Villages of La'I 'Ōpua
DOCARE	State of Hawaii DLNR – Department of Conservation and Resources Enforcement Division
KCDPSC	Kona Community Development Plan Steering Committee
KOONKOK	Ka 'Ohana O Na Kupuna O Kona
HCEOC	Hawaii County Economic Opportunity Council
HL-HCCW	Hawaiian Lifestyles – West Hawaii Community College
MC	Mokuaikaua Church
HCC	Hawaii County Council
KAPA	Kapa Radio
EHES	Ehunuikaimalino Hawaiian Immersion School

CULTURAL IMPACT ASSESSMENT STUDY

by Helen Wong-Smith, M.A., Cultural Resources Specialist

ABSTRACT

This report provides a cultural impact assessment for TMK 7-5-013:022, in Hienaloli. The assessment is based on a review of a wide range of written material – archaeological reports, government and other historical records, Hawaiian language sources translated into English, and interviews with long-term residents, including native Hawaiians, familiar with the cultural history and resources of Hienaloli. The research took place between August 17 and December 15, 2007 and utilized resources at the Hawai'i State Archives, Edwin H. Mo'okini Library of the University of Hawai'i-Hilo, the Hilo Public Library, online resources, and previous historical and cultural reports and interviews.

INTRODUCTION

Information on the *ahupua`a* of Hienaloli is scarce. Further, the usual references for translations of *ahupua`a* names are silent regarding the meaning of Hienaloli. One of the meanings given for *hiena* is a kind of soft porous stone used to smooth and polish utensils. There are several meanings of *loli* including: 1. to turn, change, alter, turn over…2. sea slug…sea cucumber…3. Spotted, speckled, daubed; to color in spots, as tapa[1]. *Hienaloli* is often written as *Hinaloli* and *Hianaloli* in various 19th and early 20th century documents. In his decades-long compilation of place names, archaeologist Lloyd Soehren refers to the *ahupua'a* as *Hianaloli* and lists 26 place names within it[2].

Hienaloli is located in the *moku o loko* (district) of Kona, a bit south of Keahuolu. This northern section of Kona was divided into two regions, Kona kai `opua (Maly provides the interpretive translations "Kona of the distant horizon clouds above the ocean[3]) and Kekaha-wai-`ole (the waterless place). Kekaha-wai-`ole-o-nā-Kona spans from Kalaoa ahupua`a (Keāhole Point) to Kealakehe ahupua`a. Kekaha is described as "a dry, sun-baked land[4]." Sheltered by the abrupt rise of Hualālai, Kekaha receives very little rain below the 1,000-ft elevation contour. Maly provides the following description of residential movement within Kekaha-wai-`ole-o-nā-Kona during the late 1800s and early 1900s in the Hawaiian Newspaper *Ke Hōkū o Hawai`i*:.

> "O ia ka wāe ne`e `ana ka lā iā Kona, hele a malo`o ka `āina i ka `ai kupakupa `ia e ka lā, a o nā kānaka, nā li`I o Kona, pūhe`e aku la a noho i kahakai kāhi o ka wai e ola ai nā kānaka. (It was during the season, when the sun moved over Kona, drying and devouring the land, that the

[1] Pukui and Elbert 1965:194
[2] Hawaiian Place Names – Ulukau http://ulukau.org/cgi-bin/hpn?a=q&r=1&hs=1&t=1&e=q-0mahele--00-0-0--010---4------0-0l--1haw-Zz-1---20-about---00031-00110escapewin-00&q=Hienaloli&h=dtx&summarise=0
[3] Maly IN O`Hare 1993:Appendix B1
[4] Kelly 1972:2

chiefs and people fled from the uplands to dwell along the shore where water could be found to give life to the people[5].

Hawaiian authority and *kumu hula* Pualani Kanaka`ole Kanahele states: "This clearly communicates that the natives of Kekaha-wai-`ole-o-nā-Kona had great knowledge of their land's cycles and its productive abilities. There were springs and brackish water ponds inland from the shore and the ocean was abundant. They planted in the *ma uka* or upland forest and had sufficient amount of rain for their crop. When the rainy season passed, they camped at the shore, grew sweet potato, and fished. Their basic needs were satisfied[6]."

Hienaloli is situated four *ahupua`a* south of Keahuolū (based on *ahupua`a* names, not the further division of each). By the time of the 1948 Mahele, the *ahupua`a* of Hienaloli had been divided into six smaller parcels, Hienaloli 1-6. The well site (TMK 7-5-013, Por.022) for this project is located within the *ahupua`a* of Hienaloli 1st. Soehren provides the following information on the general *ahupua`a* of Hianaloli [Hienaloli] with insight into the individual parcels. Information on place names specific to Hienaloli 1 and 2 are then provided:

Hianaloli[7]
Ahupuaa: Hianaloli 1-6
Feature: ahupuaa
Comments: Ahp 1 returned by Lunalilo, retained by aupuni. Ahp 2 retained by Keelikolani, LCAw 7716:5 but no RP. Ahp 3 returned by Asa Kaeo, retained by aupuni. Ahp 4 given to ABCFM, LCAw 387; had ancient fishing rights extending out to sea (BCT). Ahp 5 retained by Peke, LCAw 8524-B:3 but no RP. Ahp 6 retained by aupuni. Hianaloli 1 & 6 were named School Lands in 1850 (IDLL). Now called Hienaloli, (q.v.).
Lexicology: hiana-loli. PE: hole frequented by sea cucumbers.

Puu Koheu[8]
Ahupuaa: Hianaloli 1/2
Feature: boundary point
Comments: An oioina between Halulu & Mamalahoa Hwy on s. boundary Hienaloli 1.

Puu Hau[9]
Ahupuaa: Hianaloli 1/2
Feature: boundary point
Comments: "a grove of hau trees" on south boundary Hienaloli 1, between Wawaekeekee & Huaiahaula.

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[5] Hawaiian orthography will be employed by this author except when directly quoting. For this reason many of the quotations will lack diacritical and other marks as they are presented verbatim.
[6] Kanehele 2001:4
[7] Mahele Book 21,22,46,173; Boundary Commission Testimony 1:346; Indices of Awards, Land Commission 29,67,139,457; Interior Dept., Land, Letters (Incoming). Archives of Hawaii 1850 Dec. 23
[8] Boundary Commission Testimony 1:380; 2:282
[9] Boundary Commission Testimony 1:379; 2:281

Kaiuhu[10]
Ahupuaa: Hianaloli 1/2
Feature: kihapai
Comments: "a kihapai koele, where Honuaula cuts these lands off" on S boundary Hienaloli 1, between Wailoa & mauka boundary. Elev. about 2400 ft.

Hulia[11]
Ahupuaa: Hianaloli ½
Feature: kihapai
Comments: ""a kihapai on both sides of the iwi aina" mauka of Mamalahoa Hwy, along S boundary Hienaloli 1
Lexicology: hulia. PE: overturned; sought.

Wawaekeekee[12]
Ahupuaa: Hianaloli 1/2
Feature: boundary point
Comments: "where the land crooks" on south boundary Hienaloli 1, between Halulu & Puu Hau.
Lexicology: wāwae-ke'eke'e. PE: crooked leg.

Papakolea[13]
Ahupuaa: Hianaloli 1/2
Feature: boundary point
Comments: "a large hole of water in a kahawai among ferns" ("stream or gulch" PE] on south boundary Hienaloli 1, between Hulia & Wailoa.
Lexicology: papa-kōlea. PEM: plover flats.

Wailoa[14]
Ahupuaa: Hianaloli 1/2
Feature: pool
Comments: "another large pool of water in the gulch, there the boundary runs up the south pali and leaves the gulch." On south boundary Hienaloli 1, between Papakolea & Kaiuhu.
Lexicology: wai-loa. PEM: long water. Name of a star & a chief.

Hua[15]
Ahupuaa: Hianaloli 1/2
Feature: boundary point
Comments: "Boundary point at shore between Hienaloli 1 & 2 is Hua, a lua kii [lua kī; artesian spring] in the sea." (p.380) See also Kauhiawaawa.
Lexicology: hua. PE: fruit, egg.

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[10] Boundary Commission Testimony 1:380
[11] Boundary Commission Testimony BCT 1:380
[12] Boundary Commission Testimony 1:379; 2:281
[13] Boundary Commission Testimony BCT 1:380
[14] Boundary Commission Testimony 1:380; 2:282
[15] Boundary Commission Testimony 1:380; 2:282

MO`OLELO `AINA: NATIVE TRADITIONS AND HISTORIC ACCOUNTS OF HIENALOLI

Kekāhi Mo`olelo Hawai`i (Selected Hawaiian Traditions)

Legendary references to Hienaloli are few; therefore this report includes a few references to nearby Keahuolu and Lanihau, for which there is much more information available. From these references one can at least gain some general idea of activity in the vicinity.

A legendary reference to Keahuolū is found in *Ka`ao Ho`oniua Pu`uwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki) translated by Kepā Maly, a legendary account of two super-natural brothers, Ka-Miki and Maka-`iole, who traveled around Hawai`i Island set in the period when Pili-a-Ka`aiea was chief of Kona, ca. 12th-13th century). It was originally published in serial form between 1914 and 1917 in the Hilo-based Hawaiian language newspaper *Ka Hōkū o Hawai`i* by Hawaiian historians John H. Wise and John Whalley Hermosa Isaac Kihe. Here are excerpts from Maly's translation:

> ...Within the lands of Keahuolū you saw Hale-pa`u which is also near Ka-pā-wai (The water enclosure). Kapāwai is also known as Makā`eo (Look with anger), and a coconut grove encircled those places. Further on, between the lands of Keahuolū and Kealakehe was the *āhua* (Hillock-plantation mound) of Lae-oniau...[16]
>
> ...The priest who officiated over rituals of Keahuolū and Kealakehe was named Kalua`ōlapauila. He was the priest of the temple Kalihi, which is also called Kalua`ōlapauila. This temple is in the coastal area[17] along the border of Keahuolū and Kealakehe, near the old road into Kailua....[18]
>
> ...The district of Keahuolū and divisions of Lanihau (1 and 2) were under the rule of Kapohuku`imaile (kāne) and Papalūlā (wahine), and Papaumauma was their warriors champion. When Papaumauma competed with Ka-Miki at the contest site `Iwa`awa`a (at Kohana-iki), he was defeated. Papumauma was honorable, and he greatly admired the superior skills of Ka-Miki and asked to turn his status and land rights over to Ka-Miki, but Ka-Miki declined...[19]
>
> *Ka-noenoe* (The mist, fogginess) – The mound-hill called Pu`u-o-Kaloa sits upon the plain of Kanoenoe which is associated with both Keahuolū and Kealakeha. The setline of mists upon Pu`u-o-Kaloa was a sign of pending rains; thus the traditional farmers of this area would prepare their fields. This plain was referenced by Pili when he described to Ka-Miki the extent of the lands which Ka-Miki would over see upon marrying the sacred chiefess Paehala of Honokōhau. The inheritance lands

[16] April 2 and 9, 1914
[17] Boundary Commission Testimony places this place at the midpoint of Keahuolū rather than the coast.
[18] April 30, 1914
[19] May 21, 1914

included everything from the uplands of Hikuhia above Nāpu`u and the lands of the waterless Kekaha, which spanned from the rocky plain of Kanikū (Keahualono) to the plain of Kanoenoe at Pu`uokaloa[20].

*Pu`u-okaloa* (Mound, or hill of Kaloa) – The narratives of Ka-Miki identify Pu`uokaloa as *"Pu`uokaloa I ka malo o Ka`eha e waiho ala..."* Pu`uokaloa where Ka`eha's loin cloth (symbolic of the mists) was spread out[21].

References to Hienaloli within *The Legend of Ka-Miki* as translated by Maly follow:

Auhauke`ē and Hinaloli* (meaning uncertain) – After an *`awa ceremony, *Ka-Miki* and *Maka-`iole* ventured from *Kalama`ula* to visit some of the lands of Kona. Upon returning to Kalama`ula, *Ka-uluhe* described the nature of the lands they had visited; The *ahupua`a* of Auhaukea`ē borders *Oneō* bay, and sits between the *ahupua`a* of Hinaloli (Hienaloli) and Pua`a. Important features associated with these lands included: *Oneō* and *Niumalu* – with the *hālau ali`I* (chief's compound) and *hālau wa`a* (canoe sheds) of the chief *Pili-a-kapu-nui-Pai`ea*[22]*; Huihā-a* – a surfing spot named for a war counselor of *Pili*; and *Ka māla `uala* (sweet potato gardens) extended across the lands of Oneō bay and Hinakahua[23].

Waikūpua (Supernatural [beings'] water) – land of Hinaloli – Following Ka-Miki's bold appearance before *Ahu`ena ma*[24], the stewards of the great chief *Pili-a-Ka`aiea*, Pili's royal court was astir with word that *Ka-Miki* was seeking rebellion. *Kamalokaimalino*, high war counselor of *Pili* and overseer of the games at *Hinakahua* (Puapua`a) sent *`Īliopi`il,* Pili's messenger, to summon *Waikūpua*[25], *Huihā, Ka`aipuhi, Kaho`oholoholo,* and *Ha`akona.* These individuals were the war counselor-generals of Pili, andguards to the arena of Hinakahua, and many of them became associated with place names, perhaps identifying places associated with the individuals. *Pili* wanted Waikūpua *mā* to being *Ka-Miki* before the council to determine if he was a rebel. Waikūpua and the other *pūkaua* (war counselors) attempted to seize *Ka-Miki* but were defeated[26].

Ka Hōkū o Hawai`i published another legendary account provided by J.W.H.I. Kihe entitled "Nā Ho`onanea o ka Manawa, Kekāhi mau wahi pana o Kekaha ma Kona" (A pleasant passing of time, [stories from] some of famous places of Kekaha in Kona]. This section describing agricultural practices as related to Pu`uokaloa is translated by Maly:

*Pu`u-o-kaloa* is a mound-hill site in the lands of Keahuolū – Kealakehe, not far from the shore of Kaiwi and Hi`iakanoholae. During periods of dry weather (*ka lā malo`o*) when planted crops, from the grassy plains to the *`āma`auma`u* (fern forest zone), and even the ponds (*ki`o waī*) were dry,

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[20] October 25, 1917
[21] October 25, 1917; Maly 1996:12-13
[22] 4/9/1914 IN Maly .xxx:A-3
[23] 5/24/1917 & 6/14/1917 c/2 IN Maly A-3
[24] *mā* - A Hawaiian word meaning "and companions or associates"
[25] 4/5/1917
[26] 4/26/1917

people would watch this hill for signs of coming rains. When the *lihau* (light dew mists) sat atop the hill of Pu`u-o-kaloa, rains were on the way. Planters of the districts agricultural fields watched for omens at Pu`uokaloa, and it was from keen observation and diligent work that people prospered on the land. If a native of the land was hungry, and came asking for food, the person would be asked:

Ua ka ua I Pu`uokaloa, ihea `oe?
When rains fell at Pu`uokaloa, where were you?

[If the answer was…]

I Kona nei no!
In Kona!

[There would be no sweet potatoes for this person.]

[But if the answer was:]

I Kohala nei no!
In Kohala!

[The person would be given food to eat for they had been away, thus unable to accomplish the planting[27].]

Within S.N. Hale`ole's epic *Ka Mo`olelo o Lā`ieikawai* (The Hawaiian Romance of Lā`ieikawai a short reference to Keahuolū and Lanihau as parents is found in the story of *Hiku and Kawelu*:

> The son of Keaauolu [sic] and Lanihau, who live in Kaumalumalu, Kona, once sends his arrow, called Puane, into the hut of Kawelu, a chiefess of Kona. She falls violently in love with the stranger who follows to seek it, and will not let him depart. He escapes, and she dies of grief for him, her spirit descending to Milu. Hiku, hearing of her death, determines to fetch her thence. He goes out into mid-ocean, lets down a *koali* vine, smears himself with rancid *kukui* oil to cover the smell of a live person, and lowers himself on another vine. Arrived in the lower world, he tempts the spirits to swing on his vines. At last he catches Kawelu, signals to his friends above, and brings her back with him to the upper world. Arrived at the house where the body lies, he crowds the spirit in from the feet up. After some days the spirit gets clear in. Kawelu crows like a rooster and is taken up, warmed, and restored[28].

Fornander provides a longer version of this tradition providing the father's name as Keahuolū[29]. *Figure 1 shows the project area in relation to* place names compiled by Lloyd Soehren and presented as *Hawaiian Place Names*[30]. Soehren assigned their locations from Boundary Commission testimonies, surveyor field books, and a myriad of primary resources.

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[27] May 19, 1914; 1996:13
[28] Hale`ole 1997:660
[29] Fornander 1919 v5:182-184
[30] http://www.ulukau.org/cgi-bin/hpn?

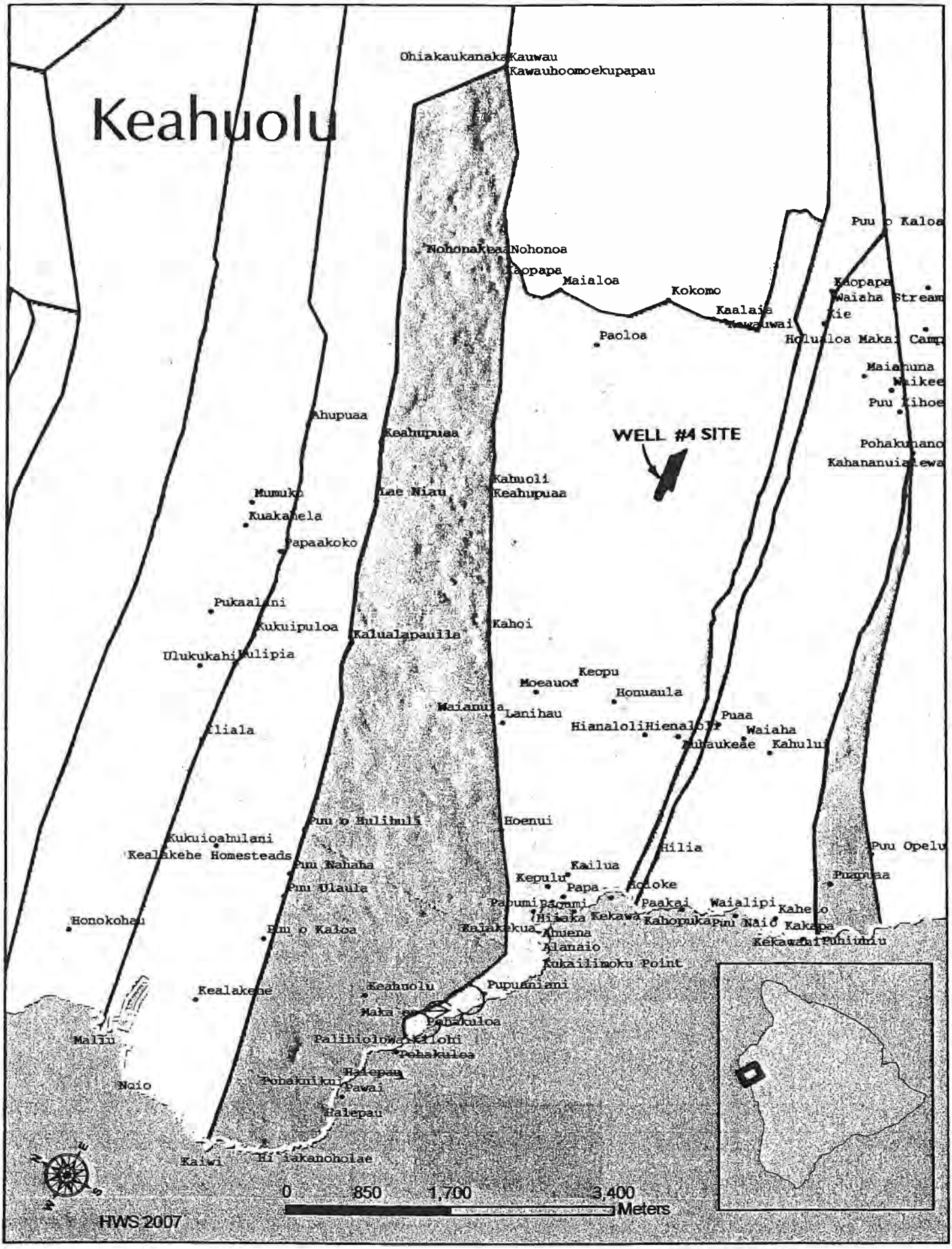

Figure 2. Place Names in the Vicinity of the Project Area

Hienaloli and General Vicinity Described in the Journals and Logs of Historic Visitors (1815 to 1902)

The earliest reference to Kailua concerns Kamehameha's residence there after his unification of the islands:

> In 1812, two years after all the islands and finally been united under his rule, Kamehameha returned to Hawai`i island from O`ahu, where he had lived for the past nine years. Kamehameha lived most of his remaining years in Kailua, at his principal residence at Kamakahonu in Lanihau ahupua`a [Lanihau is between Keahuolū and Hienaloli][31].
>
> The accounts of early visitors at Kailua were, in the main, those of explorers...The *Columbia* came to Kailua Bay five times between 1815 and 1818, and then was sold to Kamehameha for sandalwood. The ship [was] renamed the *Laholile*...
>
> On its first visit to Kailua, in January of 1815, the *Columbia* took on board "hogs, vegetables, rope, and cloth of the country" (Corney 1896:35). Peter Corney, one of its officers, who remained in Hawai`i when the ship was sold and left descendants here, remarked that "island rope" made excellent running rigging[32]. Corney noted that the American ship *Milwood* was then at Kailua, "purchasing sandalwood at the rate of 7 dollars for 133 pounds (a picul)[33]" ...Corney provides a unique and graphic account of the sea traffic at Kailua Bay in the early 1800s.
>
> At the time of Kamehameha's death in May 1819, and for the early months of Liholiho's reign, the court households at Kailua apparently were very large[34].
>
> It was at Kailua in November 1819, approximately six months after the death of Kamehameha, that the "free eating" (*`ai noa*) incident took place, symbolizing the end of the kapu system....The act of "free eating" at Kailua was followed by a general purging and burning of god images from the large heiau[35].

Hawaiian historian Samuel Kamakau offers this reference to the life in the area at the time of Liholiho:

> Many of the old chiefs were alive in Liholiho's day...The sands of Kaiakeakua were worn down like a dromedary's back by the many feet of

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[31] Kelly 1983:3
[32] Ibid:48
[33] Ibid:47
[34] Ibid:5
[35] Ibid:6

> chiefs and chiefesses tramping over them, and at Kamakahonu could be seen at night the sparkle of lights reflected in the sea like diamonds, from the homes of the chiefs from Kahelo [in Puapua`a *ahupua`a*] to Lanihau. The number of chiefs and lesser chiefs reached into the thousands[36].

At this time M. Gaimard, a member of de Freycinet's expedition, wrote the following description of the Kailua environs:

> In order to reach the mountain that lies to the southeast of the village...we first went across dry fields, where hardly any young growth was visible; but, after reaching a certain elevation; we found much richer terrain where the paper mulberry, breadfruit tree, the mountain apple, tobacco, cabbage, sweet potatoes and yams were cultivated. We were given water of a delicious coolness[37].

Missionary occupation of Hawai`i had its beginnings at Kailua. Kelly notes that:

> Liholiho...[was] at Kailua when the first band of Protestant missionaries arrived there in April of 1820...the missionaries were granted permission to remain in the kingdom on trial for a year. Two missionary families remained in Kailua, while the rest went on to Honolulu[38].

It was at Kailua that Liholiho entrusted the island to Kuakini, younger brother of Ka`ahumanu and faithful aide of Kamehameha I. Three years into Kuakini's stewardship, the Reverend William Ellis began his tour around the island at Kailua in 1823. This passage from his journal reflects the population and resources of Kailua:

> Kairua, though healthy and populous, is destitute of fresh water, except what is found in pools, or small streams, in the mountains, four or five miles from the shore[39].

Ellis reports the observations made by Reverends Thurston and Bishop who walked the coastline from Kailua toward Ka`iwi Point crossing the entire coastline of Keahuolū:

> The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses were built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots.
>
> The next morning, Messrs. Thurston, Goodrich, and Harwood, walked towards the mountains, to visit the high cultivated parts of the district. After traveling over the lava for about a mile, the hollows of the rocks began to be filled with a light brown soil; and about half a mile further, the surface was entirely covered with a rich mould, formed by decayed vegetable matter and decomposed lava.

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[36] Kamakau 1961:221-222
[37] de Freycinet 1978:8
[38] Kelly 1983:7
[39] Ellis 1969:29

> Here they enjoyed the agreeable shade of bread-fruit and ohia trees; the latter is a deciduous plant, a variety of Eugenia, resembling the *Eugenia malaccensis*, bearing red pulpy fruit, of the size and consistence of an apple, juicy, but rather insipid to the taste. The trees are elegant in form, and grow to the height of twenty or thirty feet; the leaf is oblong and pointed, and the flowers are attached to the branches by a short stem. The fruit is abundant, and is generally ripe, either on different places in the same island, or on different islands, during all the summer months[40].

The cultivation and environs described above fall within the zone the project area is located and dispenses the assumption this was all barren lava supporting little life.

This type of gardening in lava is called *makaili*[41] when even small pockets of semi-disintegrated lava are utilized, and potatoes are grown by fertilizing with rubbish and by heaping up fine gravel and stones around the vines. Handy writes, "Such cultivation produces inferior potatoes; they are said to be rather tasteless and ridged (*`awa`awa*) or wrinkled[42].

Kuakini gave the aforementioned missionary couples houselots in the Kailua area. Ka`ahumanu, as *kuhina nui* [prime minister], acting on behalf of the government, gave a part of Hienaloli for the mission's support[43]. The Thurston's homestead was called Laniakea, after the nearby cave, and consisted of five acres straddling the border of Honua`ula and Hienaloli 1st. Ellis provides a description of the cave:

> ...they also explored a celebratory cave in the vicinity, called Raniakea. After entering it by a small aperture, they passed on in a direction nearly parallel with the surface; sometimes along a spacious arched way, at other times, by a passage so narrow, that they could with difficulty press through, till they had proceeded about 1200 feet; here their progress was arrested by a pool of water, wide, deep, and as salt as that found in the hollows of the lava, within a few yards of the sea. This latter circumstance, in a great degree, damped their hopes of finding fresh water by digging through the lava....The mouth of the cave is about half a mile from the sea, and the perpendicular depth to the water probably not less than fifty or sixty feet....From its ebbing and flowing with the tide, it [the pool] has probably a direct communication with the sea[44].

While describing an old military fortification for the *maka`āinana* (commoners) Ellis speaks of the remaining wall, which at his visit reached a height of 18 to 20 feet, with a base 14 feet thick:

> The part of the wall now standing, is near the mouth of Raniakea,...which formed a valuable appendage to the fort. In this cavern, children and aged persons were placed for security during assault or sally forth from the fort, and sometimes the wives of the warriors also, when they did not accompany their husbands to battle[45].

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[40] Ellis 1963:31-32
[41] Fornander 1919-1920, Vol. 6:164
[42] Handy 1972:129
[43] Kelly 1983:10
[44] Ellis 1963:30
[45] Ibid:62

Historian James Jarves explored the cave in 1840, and swam in the pool. Adding to Ellis' description, he noted the water was cold and that it held a sulfurous odor and taste[46].

Commodore Wilkes of the U.S. Exploring Expedition made these comments about the environs of Kailua in 1840:

> The natives during the rainy season...plant, in excavations among the lava rocks, sweet potatoes, melons, and pineapples... The...staple commodities are sweet potatoes, upland taro, and yams. Sugar cane, bananas...bread-fruit, cocoa-nuts, and melons, are also cultivated. The Irish potato, Indian corn, beans, coffee, cotton, figs, oranges, guavas, and grapes, have been introduced....[Two miles from the coast, in a belt half a mile wide, the bread-fruit is met with in abundance, and above this the taro is cultivated with success...A considerable trade is kept up between the south and north end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of other south, for food and clothing[47].

CHRONOLOGICAL HISTORY OF RESIDENCY AND LAND OWNERSHIP IN HIENALOLI

The above description of subsistence farming and trading within the land divisions is characteristic of pre-contact Hawaiian culture. With the introduction of a market system and the call for labor to harvest sandalwood, agriculture in the Kailua area changed greatly, as did the native population. Early demographics for Hienaloli are difficult to ascertain. Schmitt recorded epidemics for the years 1848 and 1849 as follows:

> Four devastating epidemics occurred in rapid succession in 1848 and 1849: measles, whooping cough, diarrhea, and influenza. Together, these four diseases killed more than 10,000 of the perhaps 87,000 persons in little more than a twelve-month period[48].

Kelly presents population demographics for North Kona between 1836-1980 reflecting what she suspects reflects successes and failures of various commercial agriculture ventures dependent on the rise and fall of world prices of crops[49]:

Table 2. Population Demographics for North Kona Between 1836-1980

Year	Population	% Increase/Decrease	Year	Population	% Increase/Decrease
1836	5,957	----	1884	1,773	-9.8
1853	4,110	-31.0	1890	1,753	-1.1
1860	3,488	-15.1	1896	3,061	+74.6
1866	3,268	-6.3	1900	3,819	-24.7
1872	2,218	-32.1	1910	3,377	-11.5
1878	1.967	-11.3			

[46] Jarves 1844:215-216
[47] Wilkes 1845:4, 91-92, 95-97 IN Kelly 1983:19
[48] Schmitt 1968:37
[49] Kelly 1983:92

During Kuakini's stewardship of the island, walls were built to protect the cultivated lands from the ravages of free-roaming dogs and pigs kept near the coastal habitations[50]. One of these walls was recorded by John Papa I`i at Honua`ula (inland and slightly north of Hienaloli) in 1812; I`i writes, "A stone wall to protect food plots stretched back of the village from one end to the other and beyond[51]." Kelly postulates this wall was later incorporated into what became known as Kuakini Wall, which may be traced from its starting point at Palani Road above Kailua Bay to beyond Kahalu`u Bay. It has long been presumed this wall built sometime during Kuakini's governorship (1820-1844) to protect the cultivated uplands from the depredations of cattle, introduced to the island by Captain George Vancouver in 1793. It was not known by this name until after 1855. Until that time it was consistently referred to as the Great Wall, or the Great Stone Wall by surveyors. The Emerson-Kanakanui map of Kailua Town & Vicinity (Reg. Map No. 1676, dated c.1880) identifies it as the "Kuakini Great Wall." The following reference to what is no doubt Kuakini Wall was made by the Reverend Albert Baker:

> Just a little above [the stone church at Kahaluu], and continuing all the way to Kailua, is the huge stone wall built in Kuakini's time to keep pigs from the cultivated lands above[52].

In his reconnaissance survey of Keahuolū, Rosendahl (1972) notes, "...the Great Wall of Kuakini...is a historic period structure built during the period A.D. 1830-1840 at the direction of Kuakini, Governor of the Island of Hawaii..." Kelly writes of Kuakini Wall:

> It has long been presumed that this wall was built sometime during the governorship of John Adam Kuakini (1820-1844) to protect the cultivated uplands from the depredations of cattle. However, as the wall is at all points less than a mile from the seacoast, only the food plots in the coastal region would have been protected by it. It probably would have only kept cattle and horses grazing on the kula away from the houselots and small gardens along the shoreline[53].
>
> Unnecessarily high as a barrier to roaming...the Kuakini wall may have been the Pa'aina named as the makai boundary in several claims to land along its course. At times, the wall reaches a height of 8 or 9 feet, which seems cattle or pigs...The fact that the term used in the register of claims is "papipi," which refers to to a wall or enclosure for cattle, not pigs, should answer the question of what kind of animal the wall was meant to restrict in the 1840s. Perhaps in more recent years it served other purposes. Why it is located between the grazing land and the gardens, or why it is so high in places, we can only surmise[54].

In addition to this notable structure were smaller historic walls for similar and boundary purposes. In her report of subsistence lifestyles in Kona, Schilt writes of the *ahupua`a* in this vicinity:

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[50] *Ke Au `Ōkoa*, March 19, 1868
[51] I`i: 1959:111
[52] Baker 1915:83
[53] ibid:75
[54] ibid:76

> 62 historic walls listed....23 walls trending *mauka-makai* pass through the ROW, defining *ahupua`a* boundaries. All are double-faced and core-filled, in good to excellent states of repair. Functioning today as portions of cattle range boundaries, theses walls probably originated in historic times, as early as the mid-1800s, having been built for that purpose[55].

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership system was replaced with a more Western-style system. This radical restructuring was called The Great *Mahele* (division). The *Mahele* separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were originally in charge of tracts of land on behalf o the king or a chief[56]. More than 240 of the highest-ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this division.

Although Soehren cites above Hienaloli 1 was "returned by Lunalilo" it is not listed as one of his awards in the *Indices of Awards* but is listed as a Government land along with Hinaloli 2[57]. Hienaloli 3 was awarded to Ruth Ke`elikōlani; portions of Hienaloli 4 to the American Protestant Mission and May Peke, daughter of Issac Davis, received Hienaloli 5[58]. As royal claimants and awardees were not required to provide documentation for their claims, and due to the nature of government and royal claims for much of Hienaloli, there is little information in the LCA of the *Mahele*. The few LCA testimonies for Hienaloli are provided here to give some insight to the land activities and residency patterns:

> LCA 10406 to Nakunu
> Kapule sworn: I've seen there in the land parcel of Ililoa, land of Hianaloli, 8 cultivated patches in two sections. 1. Upland, my land; toward Kau, Ulua's land; shoreward, mine also; towards Kohala, Ulua's also. 2. Sweet potato [patch]: upland, my land; towards Kau, Ulua's land; shoreward, mine also; towards Kohala, ulua's also. 1 cultivated patch. His land was from me in the year 1847, no one has objected[59].

> LCA 7630 to Kawaha
> Mose sworn: I have seen there in the land parcel of Ililoa, lands of Hianaloli 3; 14 cultivated patches as he claimed in the award document. There is the land parcel of Papa`awela, lands of Hinanaloli 2, are 8 cultivated patches, everything is under cultivation. His land was given by me at the time the Kingdom went to Kamehameha III. No one has objected to him. The cultivated patches in Hianaloli 2 are an old land [award] from Kamehameha I, and in his time, it is from Wahakane. No one has objected. He also has a house claim in the lot of Kaupa, when his life ended, Kaupa will receive his house claim[60].

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[55] Schilt 1984:44
[56] Chinen 1958:vii and Chinen 1961:13
[57] Board of Land Commissioners 1929:29
[58] Kelly 1983:22
[59] Native Testimony v4:537
[60] Native Testimony v4:519

LCA 10735 to Pupule
Mose sworn: I have seen in the land parcels of Ililoa I, Kaauelua, Paohale, Kaumeo 1 and Kaumeo 2 of Kamuku ahupuaa. Section 1: mauka, banana patch of Kemeki; Kau, Hianaloli 4 ili; makai, land of Waihou; Kohala, Hianaloli 2 ili. 5 cultivated *paukū* (garden plots), no house. Section 2 – house lot: mauka, Wahineiki's lot; Kau, Mikakina's [Meineke's] trail (*ala nui*); makai, Keawelawaia's lot; Kohala, a pathway. He has the lot enclosed with 4 houses for himself there, 1 stone house. I have him the house; the agricultural plots and house lot is an old place from the elders. No one has objected to him to this day[61].

LCA 4226 to Kuae
Keawelawaia sworn: I have seen one section in Hianaloli 2 and in Hianaloli 4 ahupuaa the other section. Section 1 – house lot: towards the uplands, Kau, and shoreward is idle land; towards Kohala is Mikakina's lot. Keawekolohe fenced the lot, 1 house if for Keawekolohe, all this work was done by Keawekolohe, and it was acquired by Kuae in the year 1842. Section 2 – house lot: towards the uplands is idle land; towards Kau is the lot of Manunu [spelling?]; towards the shore is the *alanui aupuni* [government road]; towards Kohala is Haleokau's lot. Keawekolohe fenced houses in the lot, one for Keawekolohe and for the foreigner. Kuae has no house at this time. He acquired all the work in the year 1842, he is in possession of it now, no one has objected. Kawaha sworn; we both have known alike[62].

LCA 2334 to Kupuna
Greetings to you commissioners who quiet [land] titles. I claim here my house lot; here in Kailua, it is not surveyed on all sides. This is an old residence of ours from the time of Kamehameha I, before our living there, our parents lived there, when our parents and relatives died we returned and live there. So we remain at this time. It is our claim[63].

LCA 2316 to Haleokane
Kuia sworn: He has seen in Hianaloli 4 ahupuaa a house lot. Mauka, idle land; Kau, Kaupa's land; makai, Kupeina's land; Kohala, Catholic's lot. Lot has been enclosed, 3 houses in there, Haleokane lives there. Kimo sworn: both have known similarly[64].

[61] Native Testimony v4:523
[62] Native Testimony v5:552
[63] Native Register v3:456
[64] Native Testimony v5:555

LCA 7469 to Kaupa
Mose Mo`o (landlord) sworn: He has seen one section in Hianaloli 2 and another in Hianaloli 1. House lot boundaries are: upland, Waikele's lot; towards Kau, Palaumu's lot; shoreward, Malo's lot. The lot is enclosed, Kaupa has 3 houses and a land claim; it is not accurately surveyed, when the land surveyor comes he will set the boundaries right. Certain sections are cultivated, one section is left undone. I gave him his agricultural parcels in the land parcel of Kaumeo; the house lot was left empty so Kaupa built his house there. No one has objected[65]. [Kaupa is identified as Kaupu on the March 1928 R. Lane tracing of the J.S. Emerson – S.M. Kanakanui Map of "Kailua Town and Vicinity" Reg. Map 1676 ca. 1880.]

LCA 10404 to Namimi
Makaole (*wahine*) sworn: she has seen in Hianaloli ahupuaa, 25 kihapai [*kīhāpai* (agricultural lots)] partially cultivated and no house. Two kihapai are not cultivated in Hianaloli 5 ahupuaa. The boundaries are not known to Makaole but the surveyor will establish the correct boundaries. The interest had been from Papakai at the time at the Mokuaikaua Lai [Moku`aikaua La`i] Chapel had been built. Land from Makaole at this time, no one has objected. Inoaole sworn: we both have known in the same way[66].

LCA 10698 to Pupuka
Kuae (Konohiki) sworn he has seen in Hianaloli 5 ahupuaa: Section 1 – mauka, Kamahiwahine's land, Kau, Hianaloli 6 ahupuaa; makai and Kohala, Kuae's land. 6 partially cultivated kihapai patches, and 1 house for Pupuka, no fence. Section 2 – mauka, Kiooaiopua's land; Kau, Hianaloli 6 ahupuaa; makai, Kiooaiopua's land; Kohala, Kuae's land. 7 cultivated kihapai patches. Section 3 – mauka, Kamahiwahine's land; Kau, Hianaloli 6 ahupuaa; makai, Keiooaipua's land; Kohala, Kuae's land. 3 partially cultivated kihapai. Section 4 – mauka, Kiooaiopua's land; Kau, Hianaloli 6 ahupuaa; makai, Kiooaipua's land; Kohala, Kuae's land. 1 uncultivated kihapai. Section 5 – mauka, idle land; Kau, Hianaloli 6 ahupuaa; makai, Konohiki; Kohala, Hianaloli 4 ahupuaa. 1 cultivated kihapai patch. Section 6 – mauka, Kamahiwahine's land; Kau, Kuae's land; makai, Kamahiwahine's land; Kohala, Hianaloli 4 ahupuaa. 4 kihapai patches, land from Kuae in 1826. No one has objected to him to the present day[67].

LCA 3278 to Waikele
Napela (*wahine*) sworn she has seen in Hianaloli ahupuaa, a house lot. All Konohiki boundaries, 1 enclosed house lot for Waikele. Land from Lapalaau by a sale in cloth costing $3.00 in 1844, no one has objected. Keliimaikai sworn, both have known in the same way[68].

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[65] Native Testimony v4:519
[66] Native Testimony v5:556
[67] Native Testimony v5:559
[68] Native Testimony v5:561

Government land sales for Hienaloli between 1852 and 1853 are recorded for only Hienaloli 3 and 6[69]. When the Provisional Government and the Republic of Hawaii were in control of Crown Lands which were now considered Government Lands, 192.16 acres were sold in Hienaloli 6[70].

The Land File at the State Archives provides correspondence and other documents relating to holdings in Hienaloli. One can recognize awardees mentioned previously:

Hienaloli 1 - Interior Department 1855 June 25
Application by Isaaka to the Minister (Lot Kamehameha) for the above *ahupua`a* and offering 50¢ per acre.

Hienaloli 1 – Interior Department 1894 December 10
George McDougall to Minister offering $250 for the above *ahupua`a*

Hienaloli 1 – Executive Office 1911 January 19
Commissioner of Public Lands to Governor Frear submitting land patent #5451 in name of Charles Maineckeon for makai portion for his proposal.

Hianaloli – Interior Department Document 365
Showing 2 acres in North Kona had been leased by the Minister of the Interior.

Hianaloli – Interior Department 1863 January 1
In report to S.C. Wiltse that part of the above ili was sold to...

Hianaloli – Interior Department 1853 July 9
Awarded to the American Board of Commissioners for Foreign Missions

Hienaloli – Privy Council Vol. 3:99
Land set off to Peke as heir of John Young[71].

Hienaloli – Public Instruction 1852 February 11
Wahineiki to Minister of Public Instruction. Desires to secure 300 acres of land in settlement of debt due to him.

Hienaloli – Interior Department Book 6:12, 1852 August 5
Letter to Minister from J. Fuller informing him Keelikolani [Ruth Ke`elikōlani] and Peke own each one Hienaloli, the mission [ABCFM] one, Thomas Hopu one.

Hienaloli 1 & 2 – Interior Department 1850 November 25
Letter from Governor Kapeau to Minister of Interior John Young. To reserve the above lands for the use of the government.

Hienaloli 1 & 2 – Privy Council Vol. 6:220
Regarding resolution reserve the above land for educational purposes.

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[69] Kelly 1983:43
[70] Kelly 1983:44
[71] Although Peke was a child of Isaac Davis, after Davis' early death, John Young assumed guardianship for his children.

According to Kona historian Jean Greenwell the numerous grants in the *ma uka* section of Hienaloli indicate as good agricultural land[72]. This corroborates references cited in this report of land use patterns cited during the 19th and early 20th centuries.

The above examination of the history of residency and land ownership in Hienaloli indicates that Hienaloli land was used principally for agriculture. The texts refer to "food plots" and "cultivated patches." There is, however, no specific mention of the gathering or cultivation of any plants or other materials in any particular locale, or any other information that would be relevant to the current project area's cultural impact assessment.

SELECTED DOCUMENTATION OF THE ARCHAEOLOGY OF HIENALOLI

Archaeological surveys of Hienaloli 1st have been infrequent. On January 17, 1978 Soehren surveyed TMK 3-7-5-08:12, 22 within Hienaloli 1st. He identified artifacts (small waterworn coral and stone pebbles along with shellfish remains indicative of pre-contact habitation sites). Of note was a *hoana* a portable grindstone found in parcel 22. Helen Aiu pointed out a burial cave on the adjoining Catholic church property, the entrance to which had been closed and marked with a large wooden cross. According to Helen, the stone wall fronting the property on Ali`i Drive was constructed by her maternal grandfather, Samuel Benjamin Ka`omea. Ms. Aiu also recalled that sweet potatoes were formerly grown on much of parcel 22 and Soehren postulates the parcel was subject to periodic flooding by Keopu stream prior the construction of the present concrete channel, making it an ideal pre-contact garden site[73].

Another Soehren survey included both Hienaloli 1 and Honuaula (TMK 3-7-4-04:2), a portion of LCA 387 covered by Royal Patents 1600 and 1930. As the parcel had been recently bulldozed there were no features, but based on the presence of coral pieces, seashell and waterworn rocks, Soehren postulated the area formerly held habitation sites[74].

In 1980 Soehren conducted a survey of TMK 3-7-5-04:2. The area contained the *ma uka* portion of the Laniakea lava tube. Outside of the possible cultural uses of the lava tube and the cave itself, Soehren reported no other archaeological features[75].

In 1996 Halpern and Rosendahl conducted a survey of a road corridor (TMK 7-5-13:13,22), which includes the current project area. Six sites were identified within or near the corridor. The sites included three rock walls, a terrace, a terrace and wall complex, and a platform/wall feature. Three sites were historic and three were prehistoric and belonging to the Kona Field System. All sites were assessed as having moderate research value and further inventory-level recording was recommended.

[72] Pers. Comm. 12/4/89
[73] Soehren 1978:1-2
[74] Soehren 1979:1-2
[75] Soehren 1980:1-2

INFORMANT INTERVIEWS

Despite considerable effort expended, informant information on Hienaloli was scarce. Of the informants contacted, only Clarence Medeiros, Jr. could provide any clear information, and the information was not concerning any cultural practice in the vicinity. Two other informants, Mahealani Pai and Ulalia Berman, provided information not about Hienaloli specifically, but the general vicinity.

Clarence A. Medeiros, Jr. is a descendant of several well-known *kama`āina* families of the Kona region. The son of Clarence A. Medeiros, Sr. and Pansy Wiwoole Hua Medeiros, his grandparents include Frank C. Medeiros and Violet Mokuohai Parker and Charles Hua, Sr. and Annie Man Sing Zen Hua Weeks. He has familial ties to the lands of Honokua, South Kona and Haleki`i and Kanaueue, North Kona. Both of his parents were native speakers, his mother an accomplished weaver is a descendent of native fishermen and canoe builders; his father descended from two renowned canoe builders, John Mokuohai and Charlie Mokuohai Parker. Clarence Sr. repaired rock walls in Kona and Kohala including the walls of National Parks of Pu`uhonua o Hōnaunau and Pu`ukoholā. Clarence Sr. was recognized as a cultural and historical resource and it was from him and Earl Leslie, Sr. Clarence Jr. learned much of his knowledge of cultural practices and history. Clarence Jr.'s only comment regarding the lands of Heinaloli was his mother's family, the Kawaha `ōhana resided there some seven or eight generations ago. He postulates they cultivated coffee on the lands there.

Clarence, Jr. continues to harvest *maiapilo* or *pilo* (*Capparis sandwichiana)* within Keahuolū for the plant's medicinal properties. During an interview on December 17, 2007 he stated the *pilo* grew readily on the area currently being cleared by Queen Lili`ūokalani Trust, near the Queen Ka`ahumanu Highway. According to Clarence, *pilo* does grow *ma uka* of the highway and up to the 300' elevation, but at these elevations it is mixed in with other shrubs and harder to procure. Clarence, Jr. also referred to the sisal plants in Keahuolū used to make rope. Provided with maps of the project areas, Clarence voiced his concern that the environment will be compromised and the *pilo* will be endangered.

Mahealani Pai

Mahealani Pai, Cultural Specialist for Kamehameha Investment Corporation [Bishop Holding Corporation], is a descendent of an *'ohana* who traces their residence in the Kona district to the 1700s, specifically to Honokōhau-Kaloko. He is widely recognized as a cultural practitioner and authority representing the Royal Order of Kamehameha at many public hearings. He is also a contributor to published works, e.g., *Islands in Captivity: The International Tribunal on the Rights of Indigenous Hawaiians* and *All Our Relations: Native Struggles for Land and Life*[76]; and is tireless advocate for the preservation of Hawaiian sites and practices.

Mahealani's *`ohana* resided near the shoreline of Keahuolū during the 1930s, moving there from Honokōhau. They fished Keahuolū waters for *`ōpelu* and *aku*, selling their catch to George Kailiwai *mā*. Mahealani's young father found temporary employment at the sisal mill *ma uka* of the present Queen Ka`ahumanu Highway. Mahealani's grandfather utilized sisal for the making of *kaula* (rope), and he dyed the rope, and used it to secure and hang fishing implements.

[76] Churchill, W. et al. 2005; Laduke, W, 1999

Mr. Pai noted that *alahe`e* (*Canthium odoratum*) which was used for the batten of traditional thatched structures, was gathered in the *ma uka* lands of Keahuolū. Mahealani's concern for the present project is that cultural resources like *kauila* (*Alphitonia ponderosa* ), *uhiuhi* (*Mezoneuron kauaiense*), and *alahe`e* (*Canthium odoratum*) be preserved.

Mr. Pai was able to provide information on several places and geographical features in Keahuolū. Mahealani noted a trail his mother would utilize as recently as the 1950s. Starting in Kailua between the current Taco Bell and a car rental agency office, the trail went through Keahuolū onto Kealakehe and Honokōhau. When the seas were *mālie* (calm) they would take the canoe to reach Honokōhau, but when the seas were rough, they would take this trail. The home of Kaelemakule was located at the Kailua end of this trail.

Pai said that Makaeo is the place name for the stretch of area formerly known as the Kailua Kona Airport, where cattle were held before being shipped out on the steamer *Humu`ula*. Makaeo was identifiable by a large coconut grove.

A landmark known as *Pohakūloa* is located south of patches of sand beaches owned by Queen Lili`ūokalani Trust, stands as a lone sentinel for locating a nearby *`ōpelu ko`a*. The *'ōpelu ko`a* is known as *Halepao'o,* for the jumping fish *`o`opu* (general name for fishes included in the families Eleotridae, Gobiidae, and Blennidae).

Mr. Pai also noted that Kalualapauila Heiua is located on the northern *ma uka* boundary of the Kealakehe and Honokohauiki, in the vicinity of La'iopua near the Kealakehe Homestead [this would place the *heiau* outside the current project area]. If this *heiau* can be identified, he notes, it too should be preserved.

Ulalia Ka`ai-Berman

Ulalia Ka`ai-Berman is a *kupuna* with the Department of Education's Kūpuna Hawaiian Studies Program. A child of Ernest Kakihoku Ka`ai and Josephine Ulalia `Ikuwā Ka`ai, her family has over 70 years of residential ties with North Kona. Learned of the *mo`olelo* of Keahuolū from A`ala Roy Akoa between 1970-1981, she is knowledgeable regarding the fishing and farming traditions of the area. During conversations with Ms. Berman she noted the cultural practice of gathering grasses for thatching and the building a hālau at Pāwai in Keahuolū.

CULTURAL IMPACTS

The cultural impacts to any locale in Hawai`i are not always readily evident. What is assessed by Western eyes as "barren land" may be a rich resource to Hawaiians for harvesting material i.e. *pili* grass; spiritual aspects, i.e. the wind; or for the trails on which to travel. Cultural activities within Hienaloli indicate agricultural and residential usage in pre-contact times. The location of the well site within Hieanaloli is not in the vicinity of the Laniakea Lava Tube.

Based on previous and the current research, adaptations similar to those have been observed further north in North Kona, are likely to have occurred in Hienaloli. Permanent populations appear to have been present along the coast, the midlands were used for temporary habitation and were crossed by trails linking the coast to the uplands, and the uplands were used for agricultural cultivation.

SUMMARY AND RECOMMENDATIONS

The review of the information presented in this cultural impact assessment – historical documentation, archaeological surveys and research, and oral reminiscences – indicates development of the parcel will have little effect on Hawaiian cultural resources, beliefs and practices. It should be noted, however, that remnants of Hawaiian practices, be it agricultural, temporary habitation sites, or additional burials, may reveal themselves during development, as they have been identified in other areas of North Kona. In the event such resources are encountered during land-altering activities associated with construction, work in the immediate area of the discovery should be halted and DLNR-SHPD contacted, as outlined in the Hawaii Administrative Rules 13§13-280.

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APPENDIX A:

THE PRESENT STUDY SCOPE AND METHODOLOGY IN RELATION TO CULTURAL IMPACT ASSESSMENT ISSUES AND THE OEQC GUIDELINES

CULTURAL IMPACT ASSESSMENT AND OEQC GUIDELINES

To understand the cultural impact assessment issue, particularly as it is addressed by the present study, a summary review of the intent and evolution of the OEQC guidelines is necessary. The guidelines evolved out of what are commonly referred to as "PASH/Kohanaiki" issues – issues relating to native Hawaiian traditional and customary access and land use rights as they were reasserted by a State Supreme Court decision in August 1995 and further clarified in its 1998 decision in State v. Hanapi – and the need for appropriate means to address these issues within the State environmental impact review process. For a good discussion of the issues and options involved, the "Report on Native Hawaiian Traditional and Customary Practices Following the Opinion of the Supreme Court of the State of Hawai'i in Public Access Shoreline Hawai'i v. Hawai'i County Planning Commission" prepared by the PASH/Kohanaiki Study Group (1998) should be consulted.

Initial attempts to address various issues relating to native Hawaiian traditional and customary access and land use rights within the framework of the State environmental impact review process were made in the form of proposed changes to the State EIS law as contained in Chapter 343 (HRS). These attempts to require a formal cultural impact assessment failed to pass the State legislature in 1996 and 1997.

A subsequent, second attempt to address various issues relating to native Hawaiian traditional and customary access and land use rights was made in the form of proposed changes in the "Administrative Rules" for compliance with Chapter 343 (DOH Title 11, Chapter 200). This attempt to require an explicitly defined cultural impact assessment also failed, as the governor declined to approve the proposed amendments.

The third attempt to address various issues relating to native Hawaiian traditional and customary access and land use rights within the State environmental impact review process resulted in the current OEQC "Guidelines for Assessing Cultural Impacts" (OEQC 1997b). Draft guidelines were initially issued for public review and comment on September 8, 1997. The Environmental Council formally adopted the guidelines in their final form on November 19, 1997.

The relationship of the OEQC guidelines to the State Supreme Court "PASH decision" was clearly stated on the front page of the September 8, 1997 issue of the OEQC bulletin, *"The Environmental Notice,"* when the draft guidelines were first issued for public review and comment:

> For years, a controversy has simmered over developer's responsibility to perform a "Cultural Impact Study" prior to building a project. The recent Supreme Court "PASH" decision reaffirmed the state's duty to protect the gathering rights of native Hawaiians. In light of these events, the Environmental Council has drafted a guidance document to provide clarity on when and how to assess a project's impacts on the cultural practices of host communities.

It should be noted that the guidelines for cultural impact assessment are meant to include consideration of all the different groups comprising the multi-ethnic community of Hawai'i; however, this inclusiveness is generally understated, and the clear emphasis is meant to be upon aspects of native Hawaiian culture.

More than 20 letters were received by OEQC in response to the publication of the draft guidelines, and relevant comments were said to have been incorporated into a final version of the guidelines (OEQC n.d.). The Environmental Council formally adopted the final guidelines (OEQC 1997b) on November 19, 1997. The final guidelines are virtually identical to the draft guidelines initially published on September 8, 1997, and the degree to which any of the received comments on the draft guidelines were considered prior to issuance of the final guidelines is uncertain. In fact, the overall process through which the guidelines were prepared and adopted brings out several important questions relating to such topics as (a) the source or basis utilized for the content of the guidelines, (b) the background and qualifications of the preparer(s) of the guidelines, (c) the criteria to be used for the adequacy of cultural impact assessment studies prepared in response to the guidelines, and (d) the legal question of how compliance can be required when the standards are guidelines.

According to the Chair's Report contained in *The 1997 Annual Report of the Environmental Council*, the Cultural Impacts Committee drafted the guidelines:

> The Committee drafted guidelines recommending a methodology to assess the impact of proposed actions on cultural resources, including Native Hawaiian cultural resources, values, and beliefs. The guidelines also specify the contents of a cultural impact assessment.
>
> To prepare the Guidelines, the Committee reviewed public testimony and solicited input from interested parties. Expertise from the DLNR's Historic Preservation Division as well as Federal regulations governing the "Protection of Historic Properties" were used to model the draft guidelines.
>
> The draft cultural impact guidelines were published for review and comment in the Sept. 8 *Environmental Notice*, and over 20 letters were received. Relevant comments were incorporated into a final draft version of the guidelines, which were adopted as a policy document by the Environmental Council on November 19, 1997 (OEQC n.d.:5).

Direct inquiries to OEQC (Gary Gill, then-Director) and SHPD (Dr. Holly McEldowney, then-Staff Specialist in the History and Culture Branch) provided additional background information relating to the formulation of the cultural impact assessment guidelines. The principal author or compiler of the guidelines was Arnold Lum, Esq., a member of the Environmental Council's Cultural Impacts Committee. Mr. Lum was also a staff attorney at the Native Hawaiian Legal Corporation. OEQC staff also assisted in the preparation of the guidelines. Several internal drafts were prepared, reviewed, and revised. Preparation of the guidelines relied to some degree upon National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990) for basic content information. Other sources, including the SHPD draft rules for conducting ethnographic surveys and dealing with traditional cultural properties (DLNR n.d.), were consulted; in fact, a copy of the SHPD draft rules was provided to OEQC and the Cultural Impacts Committee by then-SHPD Administrator, Dr. Don Hibbard. Professional staff in the SHPD-History and Culture Branch took part in the preparation and review of the guidelines. Certainly the inclusion of such professional anthropological and historical expertise in the preparation of the guidelines was appropriate; however, much of the professional advice on the extent to which detailed expectations – regarding study scope, content, methodology, documentation, and impact assessment – should be explicitly addressed in the guidelines was apparently discounted.

The most recent attempt to address various issues relating to native Hawaiian traditional and customary access and land use rights within the State environmental impact review process resulted in the amendment to *Chapter 343 (Haw.Rev.Stat.),* as amended by H.B. No.2895, H.D.1 of the Hawai'i State Legislature (2000) and approved by the Governor as *Act 50* on April 26, 2000. While no specific administrative rules for the implementation of this amendment have been adopted, it is generally accepted that the *Guidelines* previously prepared and adopted by the State Office of Environmental Quality Control (OEQC 1997) are meant to provide general compliance guidance.

The OEQC *Guidelines* consist of three basic sections. The first section is an introduction which notes the various statutory and other bases for addressing potential impacts upon cultural resources within the context of the environmental assessment review process, and "...encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area" (OEQC 1997:1). The second section of the guidelines discusses methodological considerations for conducting cultural impact assessments, and presents a recommended six-step protocol to be followed by the assessment preparers. The third section of the guidelines outlines eleven topics or "matters" that a cultural assessment should address; these topics basically represent the desired content and organization of a cultural impact assessment report.

As "guidelines," the OEQC Guidelines would seem to have neither the specific statutory authority of law, nor the regulatory authority of administrative rules. As guidelines, they can be regarded as providing general guidance; that is, they represent general suggestions and recommendations as to how to approach the assessment of potential cultural impacts. The guidelines provide little or no guidance relative to many important questions, perhaps the most significant of which would be the following:

1. How would project-specific determinations be made as to whether or not a cultural impact assessment study might even be necessary or appropriate – given the specific nature and location of a proposed project;

2. If a cultural impact assessment study is to be conducted, how does one determine what constitutes an appropriate project-specific level of effort – that is, the general scope of work or objectives for the study, and the specific tasks or activities required to accomplish successfully the scope of work or objectives;

3. What criteria are to be used for determining the credibility and reliability of potential cultural information sources (generally referred to as "informants" or "knowledgeable individuals");

4. If specific cultural practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be applied for evaluating (a) the descriptive adequacy and (b) the cultural authenticity of the identified practices, beliefs, or features;

5. If specific culturally authentic practices, beliefs, or features are definitely identified as being associated with a project area, what criteria are to be used for assessing the nature and extent of potential impacts of a proposed project on the identified practices, beliefs, or features – that is, "no effect," "no adverse effect," or "adverse effect;"

6. If a project is determined to have potentially adverse impacts upon specific identified culturally authentic practices, beliefs, or features, what criteria are to be used for evaluating the adequacy and appropriateness of alternative potential mitigation actions;

7. Within the purview of what regulatory office or agency would the review and acceptance or rejection of a completed cultural impact assessment study legitimately fall; and

8. What standards or criteria are to be used to evaluate the overall adequacy or acceptability of a completed cultural impact assessment study?

Consideration of these questions, and their implications, has direct relevance to the present cultural impact assessment study. These implications relate most importantly to (a) the level of study effort believed appropriate for the project-specific context, and (b) the rationale adopted for both the study overall, as well as for the identification and evaluation of any identified cultural practice claims, the assessment of potential project-specific impacts, and the formulation of any specific recommendations for further study or other mitigation actions.

BASIC GUIDANCE DOCUMENTS

Several references are available to serve as basic guidance documents for carrying out cultural impact assessment studies of various scopes and intensities. The principal sources are the following:

1. The OEQC Guidelines for Assessing Cultural Impacts (OEQC 1997);

2. The Native Hawaiian Rights Handbook (MacKenzie 1991), and more specifically the discussions of traditional and customary rights contained in the two chapters on access rights (Lucas 1991a) and gathering rights (Lucas 1991b);

3. The Report on Native Hawaiian Traditional and Customary Practices Following the Opinion of the Supreme Court of the State of Hawai`i in Public Access Shoreline Hawaii v. Hawai`i County Planning Commission prepared by the PASH/Kohanaiki Study Group (1998);

4. The text of several relevant decisions of the Hawai'i Supreme Court, including the decision commonly referred to as the "PASH decision" (1995), and the more recent decisions in State of Hawai'i v. Alapa'i Hanapi (1998) and Ka Pa'akai o Ka 'Aina et al. v. Land Use Commission, State of Hawai'i et al. (2000);

5. The federal regulations of the Advisory Council on Historic Preservation for the National Register of Historic Places (CFR 1981) and the Protection of Historic Properties (CFR 1986);

6. National Register Bulletin No. 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1990); and

7. Recently approved versions of the State Historic Preservation Division (SHPD) administrative rules (effective December 11, 2003), including Chapter 275: Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS (DLNR 2002a), and

8. Chapter 284: Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42, HRS, Projects (2002b), as well as an earlier draft Chapter 284--Rules Governing Procedures for Ethnographic Inventory Surveys, Treatment of Traditional Cultural Properties, and Historical Data Recovery (DLNR n.d.).

While the general nature and content of the first four referenced sources are self-explanatory, further comment should be made regarding the final three items. In the absence of any formally adopted administrative rule specifically addressing the treatment of traditional cultural properties, SHPD currently utilizes National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990), as its principal source of guidance for reviewing and evaluating the adequacy and acceptability of traditional cultural property study reports prepared in connection with various permit applications for which SHPD regulatory review is required. Bulletin No. 38 provides detailed guidance for the assessment of traditional cultural properties within the framework of the National Register significance criteria evaluation process (NPS 1990).

The SHPD draft administrative rule relating to ethnographic surveys and traditional cultural properties (DLNR n.d.) has existed in finalized draft version since at least early 1997; however, it has never been circulated openly, much less formally provided for public review, comment, and eventual adoption by the Department of Land and Natural Resources. This situation is unfortunate because the draft rule goes well beyond National Register Bulletin No. 38 in providing detailed guidance for conducting traditional cultural property studies, and more specifically for dealing with the identification, evaluation, and documentation of native Hawaiian traditional cultural properties and their associated cultural practices and beliefs.

In the absence of any formally adopted administrative rule specifically addressing the treatment of traditional cultural properties, SHPD can also be said to basically follow the federal regulations of the Advisory Council on Historic Preservation for guidance in the evaluation of significance – as contained in Section 60.4 ("Criteria for evaluation") of the "National Register of Historic Places" (CFR 1981), and for guidance in the assessment of potential effects – as contained in Section 800.9 ("Criteria of effect and adverse effect") of the "Protection of Historic Properties" (CFR 1986).

PRESENT STUDY SCOPE AND METHODOLOGY

The scope of work and methodology for the current project is based on the general assumption that the level of study effort appropriate in any project-specific context should involve the consideration of several factors, the most relevant of which are the following: (a) the probable number and significance of known or suspected cultural properties, features, practices, or beliefs within or associated with the specific project area; (b) the potential number of individuals (potential informants) with cultural knowledge of the specific project area; (c) the availability of historical and cultural information on the specific project area or immediately adjacent lands; (d) the physical size, configuration, and natural and human modification history of the specific project area; and (e) the potential effects of the project on known or expected cultural properties, features, practices, or beliefs within or related to the specific project area.

Consideration of these factors within the specific nature and context of the proposed project, it was thought that the most appropriate level of study for an adequate assessment of potential cultural impacts would be a limited assessment study. Based on the location, project size, number and quality of sites, this study assumes that (a) potential cultural impact assessment issues would be moderate, (b) the results of the archaeological survey conducted for the project would confirm both the limited number and scope of cultural resources within or related to the project area, and (c) in the instance that any legitimate cultural impact assessment issues should arise during the environmental review period, they could be addressed

adequately within the framework of the review process (i.e., from Draft to Final Environmental Impact Statement).

Consideration of these factors within the specific nature and context of the proposed project indicated that the relatively greater levels of study effort that can be characterized as identification or documentation studies would be inappropriate and excessive. The distinctive characteristics of an identification study are that it would be restricted to (a) the identification of native Hawaiian or other ethnic group cultural practices, beliefs, properties, features, or exploitable natural resources associated with and/or present within or related to the specific project area that are currently being conducted by and/or known to individual cultural practitioners or groups, and (b) the collection of information reasonably sufficient so as to define the general nature, location, and likely authenticity of identified cultural claims. An identification study would not involve the considerably greater level of study effort – both calendar months and hours of labor – needed to carry out a full documentation study. The distinctive characteristics of the latter, which would commonly be referred to as a full ethnographic or oral history study, would be (a) the collection of detailed information regarding identified native Hawaiian or other ethnic group cultural practices by means of formal oral history interviews which are usually tape recorded and transcribed, and (b) the analysis and synthesis of all collected data – from interviews, as well as relevant historical documentary and archival research – within the general cultural-historical context of traditional native Hawaiian or other ethnic group culture and the defined specific geographical area of a specific project.

The overall rationale guiding the present limited assessment study has been that the level of study effort should be commensurate with the potential of the proposed project for making any adverse impacts upon any native Hawaiian or other ethnic group cultural practices currently conducted by cultural practitioners within the project area. The study presented in this report is believed to comprise a reasonable approach for the assessment of potential cultural impacts within this specific project area.

REFERENCES CITED

CFR (US Code of Federal Regulations)

1981 36 CFR Part 60: National Register of Historic Places. (Including Part 60.4: Criteria for evaluation.)

1986 36 CFR Part 800: Protection of Historic Properties. (Including Part 800.9: Criteria of effect and adverse effect.)

DLNR (Department of Land and Natural Resources, State of Hawai`i)

2002a Chapter 275: *Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS.* Hawaii Administrative Rules; Title 13, Department of Land and Natural Resources; Subtitle 13, State Historic Preservation Division Rules. (October) (Effective December 11, 2003)

2002b Chapter 284: *Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42, HRS, Projects.* Hawaii Administrative Rules; Title 13, Department of Land and Natural Resources; Subtitle 13, State Historic Preservation Division Rules. (October) (Effective December 11, 2003)

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