STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Land Division/Planning Branch

Ref.:PB:TC

File: HA-30129B

MEMORANDUM

To: Genevieve Salmonson, Director
Office of Environmental Quality Control

From: Harry Yada, Administrator
Land Division, Department of Land and Natural Resources

Subject: Final Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) for Ka'upulehu Infrastructure in the Conservation District at TMK parcel [3] 7-2-003:003, Ka'upulehu, North Kona, Hawaii

The Department of Land and Natural Resources has reviewed the comments received during the 30-day public comment period that began on April 24, 2001 for the subject project. We have determined that this project will not have significant environmental effects, and have therefore issued a FONSI. Please publish this notice in the August 8, 2001 OEQC Environmental Notice.

The applicant informs us that four copies of the Final EA, the project summary—on disk—, and a completed OEQC Bulletin Publication Form have been submitted to your office.

Please contact Traver Carroll of our Planning Branch at 587-0439 if you have any questions on this matter.

cc: Lee Sichter

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Ka'upulehu Infrastructure

Final Environmental Assessment

July 2001

Prepared for PIA - Kona Limited Partnership

Prepared by Belt Collins Hawaii Ltd.

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1. INTRODUCTION

1.1. Purpose, Applicant, Accepting Agency, and Applicable Law

This Environmental Assessment (EA) has been prepared in support of Conservation District Use Applications for four separate but related infrastructure projects situated within the ahupua'a of Ka'upulehu on the mauka side of Queen Ka'ahumanu Highway in North Kona, Hawaii. The property is owned by Kamehameha Schools and is leased to PIA-Kona Limited Partnership. The applicant for this EA is PIA-Kona Limited Partnership. The accepting agency is the Department of Land and Natural Resources (DLNR).

This document has been prepared in accordance with the provisions of the Hawaii Revised Statutes (HRS) Chapter 343 and Title 11, Department of Health, Chapter 200, Environmental Impact Rules, Sections 11-200-5 through 11-200-11. It is triggered by Section 11-200-6 paragraph b-1-b, which states that an EA is required when an action involves the use of land in a Conservation District. Agencies consulted during its preparation include the Department of Land and Natural Resources, State of Hawaii; the County of Hawaii Planning Department; and the Hawaii County Department of Water Supply.

1.2. Regional Setting

The impacted lands are located within the ahupua'a of Ka'upulehu, approximately 13 miles north of Kailua-Kona, and 17 miles south of Kawaihae in North Kona, on the island of Hawaii. The impacted lands are situated directly mauka of Queen Ka'ahumanu Highway and are designated as State Conservation District (General Subzone). County zoning for the Conservation District lands is Open. The lands are all contained within Tax Key Map Third Division, Zone 7, Section 2, Plat 3.

1.3. Development Overview

The proposed projects that are the subject of this assessment represent the expansion of existing infrastructure facilities which serve existing resort developments at Ka'upulehu, as well as the relocation of a previously permitted roadway corridor. The infrastructure expansion projects include the expansion of the non-potable irrigation system, the expansion of the potable water system, and the activities involved in conducting a series of percolation tests to determine the percolation rates associated with the soil types in the area.

The two resort areas related to the proposed project are located along the shoreline within the ahupua'a of Ka'upulehu. They are Kona Village Resort and Hualalai at Historic Ka'upulehu (formerly the Kaupulehu Resort). Kona Village is a forty-year old low density resort development. The Hualalai resort project is about six years old and consists of two phases. Phase I was approved in 1994 and is nearing completion. It contains a 243-room hotel, 189

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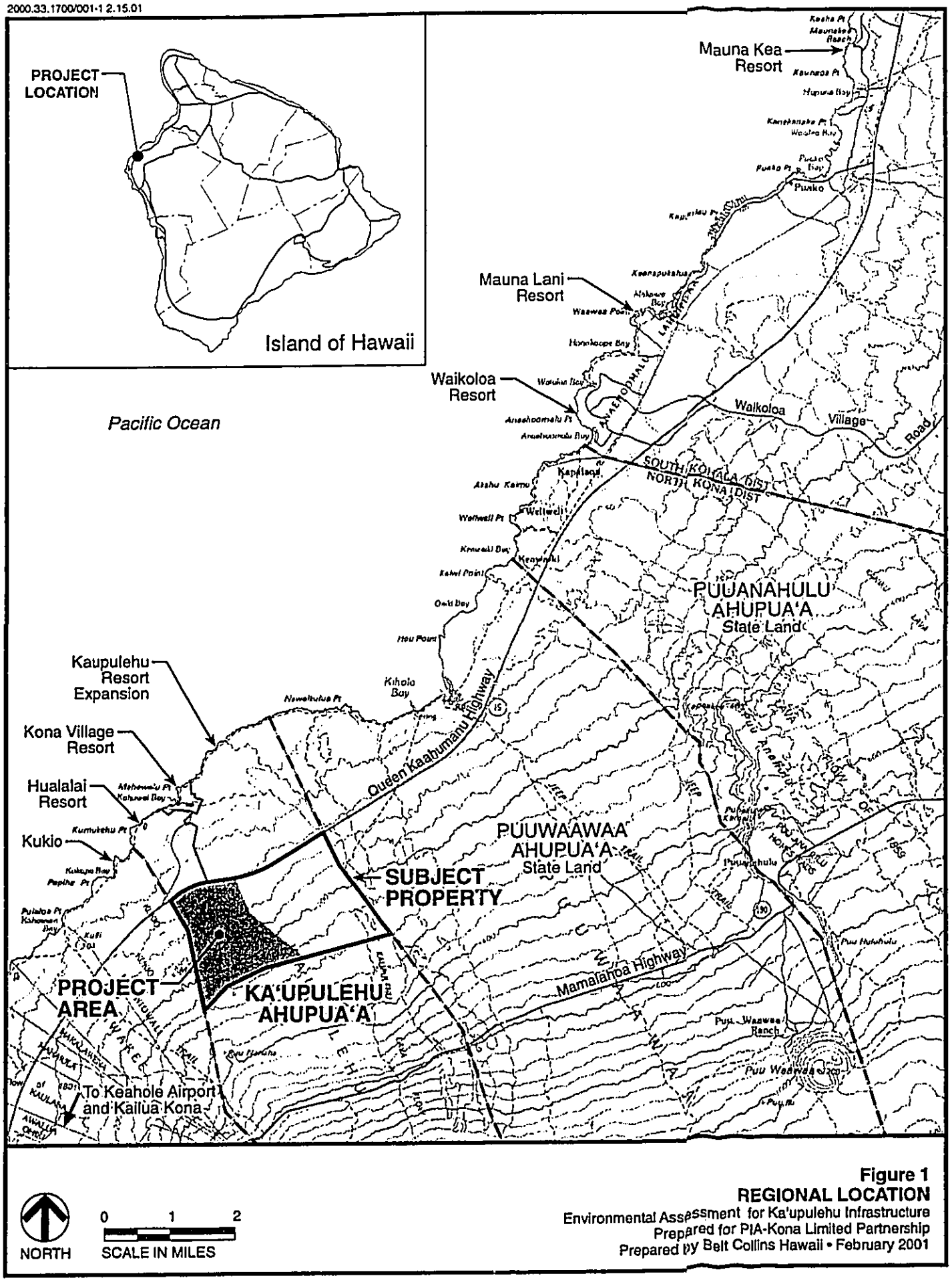

Figure 1
REGIONAL LOCATION
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
Prepared by Belt Collins Hawaii • February 2001

residential units, and an 18-hole golf course. Hualalai-Phase II, consisting of a second golf course and up to 612 additional residential units, was approved for development in 1999 by Hawaii County and is scheduled to begin development soon. In addition to these resorts, an eleven hundred acre area (aka Kaupulehu Resort Expansion Project) abutting the east side of the resort properties has been approved by the county for residential and golf course development. It is anticipated that construction in this area will begin within the next several months.

The resort developments rely upon potable and non-potable water sources situated within the State Agricultural District several miles mauka from the resorts. Water is delivered to the resorts by subterranean gravity flow pipes, which transport the water from existing wells downhill to the resort areas. To reach the resort areas, the pipelines must cross through the State Conservation District which extends mauka from Queen Ka'ahumanu Highway about a mile and a half to the State Agriculture District (see Figure 2). The construction of these pipelines required an environmental assessment and a State Conservation District Use Permit for each project. The permitting effort for these previous projects was conducted between 1989 and 1994 and the pipelines were subsequently constructed to provide potable water and irrigation water to the resort areas, which are generally located along the shoreline.

With the continuing expansion of the master planned resort development makai of the highway, the time has come to expand the capacity of both the potable and non-potable water transmission systems. The existing resort facilities are generally located seaward of the 140-foot elevation contour. For the purposes of gravity-flow water system, the existing resort area is referred to as the "lower" service area. New development at the resorts will occur in the area between the 140-foot elevation and the Queen Ka'ahumanu Highway. This area is referred to as the "upper" service area. The new potable and non-potable infrastructure that is the subject of this assessment is needed to provide water to the upper service area.

For the purpose of this analysis and from a regional perspective, the portion of the Ka'upulehu ahupua'a addressed in this Environmental Assessment extends mauka from the ocean to Mamalahoa Highway and can be roughly divided into thirds. The lower third consists of Urban lands where the resort areas are located, extending from the ocean to Queen Ka'ahumanu Highway. This area includes the "lower" and "upper" service areas described above.

The middle third (the impacted lands) consists of lands classified as Conservation (General Subzone) by the SLUC and extends generally from Queen Ka'ahumanu Highway up to the 800 foot elevation. Land uses in the Conservation lands are limited to infrastructure and utilities. The District is intersected (from mauka to makai) by two separate utility corridors that were previously approved by the State Board of Land and Natural Resources (BLNR) to provide infrastructure links between the urban lands and the non-potable and potable water sources situated in the State Agriculture District. The District is also intersected by a 100-foot roadway corridor that approved by the BLNR but was never built (see Figure 3).

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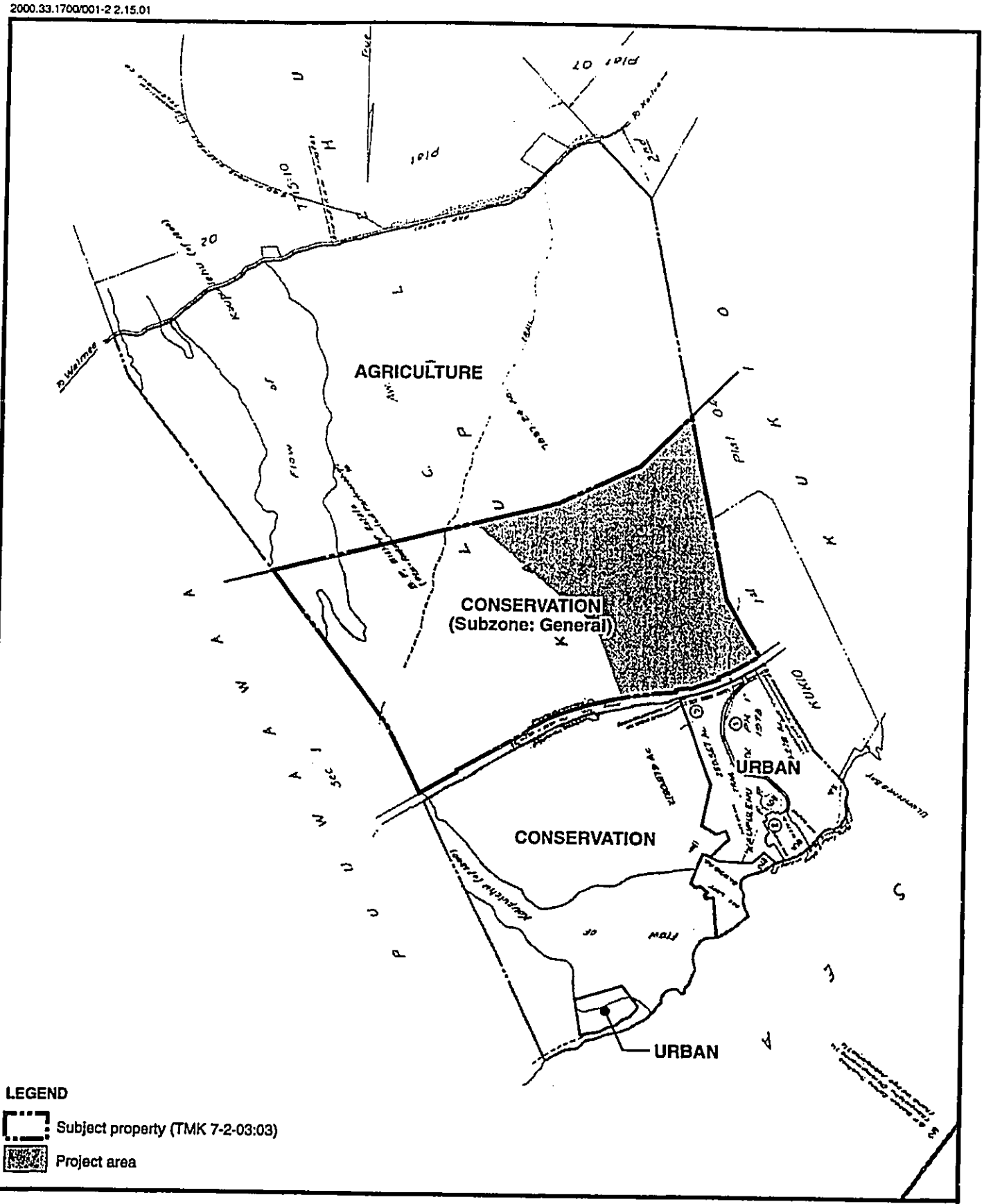

Source: State Land Use District Map, date

NORTH

0 2,500 5,000 10,000

SCALE IN FEET

Figure 2
TAX MAP KEY 7-2-03:03
AND STATE LAND USE DESIGNATIONS
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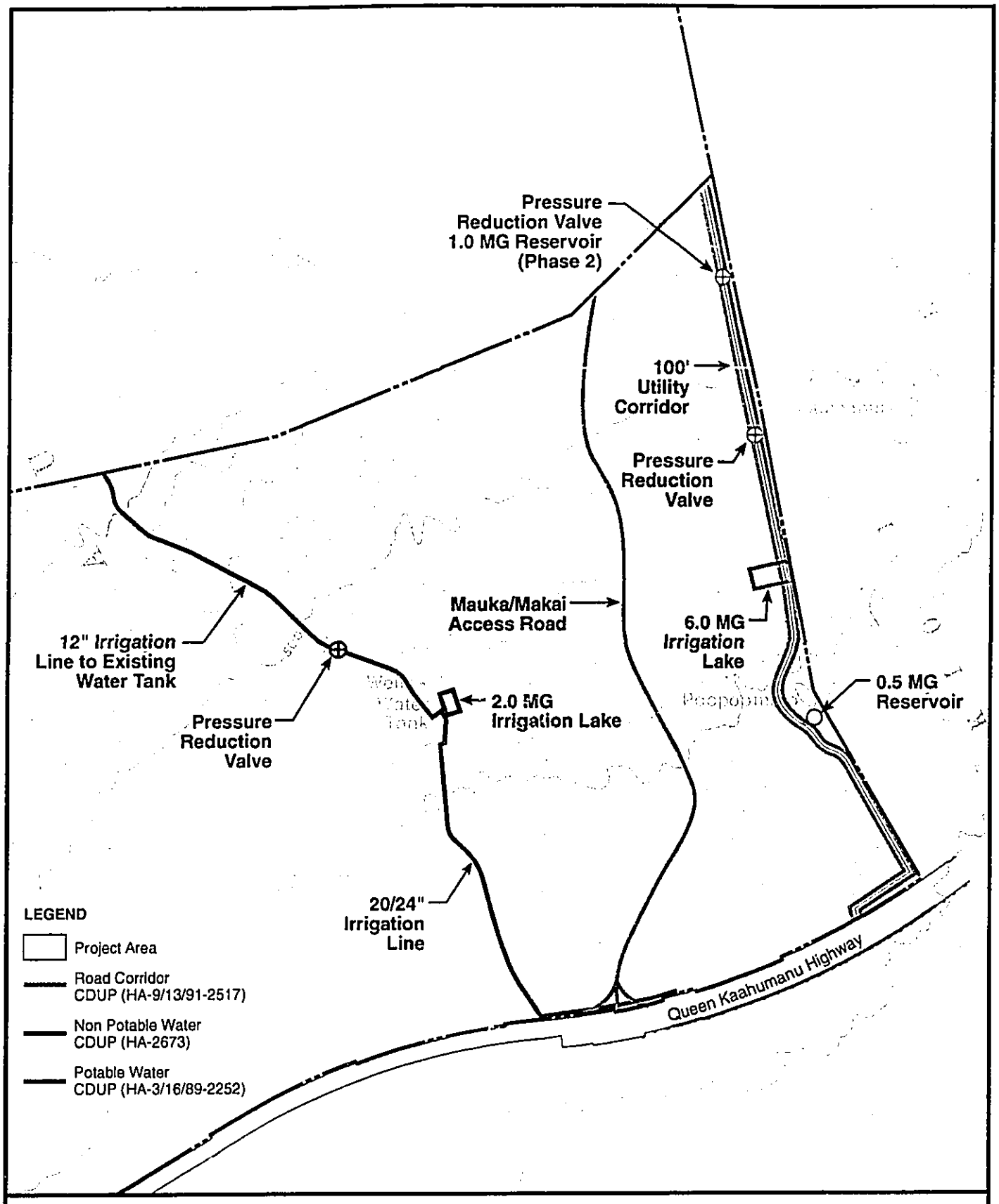

Figure 3
APPROVED CONSERVATION DISTRICT USE PERMITS
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With regard to existing improvments, the district is intersected by a jeep trail, a portion of which is situated within one of the utility corridors, two prehistoric mauka-makai trails, and a 69 kilovolt electrical transmission line suspended from poles and located about 2,400 feet mauka of and parallel to Queen Ka'ahumanu Highway. The line and the tops of the poles are visible from portions of Queen Ka'ahumanu Highway. Other infrastructure in the district includes an existing electrical substation situated just mauka of the electrical transmission lines near the Kukio property boundary, a 0.5 MG potable water tank several hundred feet makai of Po'opo'omino, and an existing 2.0 MG irrigation reservoir situated about 3,200 feet east of the electrical substation.

The upper third consists of lands classified as Agriculture by the State Land Use Commission (SLUC). The Agriculture District extends generally from the 800 foot elevation to Mamalahoa Highway and includes three potable water wells at generally the 1,300 foot elevation and two non-potable irrigation wells at generally the 900 foot elevation, and various appurtenant infrastructure.

Table 1: Summary of Proposed Projects

PROJECT	ELEMENT	DESCRIPTION
One	1	400-foot wide Roadway Corridor
Two	1	2.0 MG Irrigation Reservoir
	2	2.0 MG Irrigation Reservoir
	3	12-inch Irrigation Influent Line
	4	12-inch Irrigation Influent Line
	5	24-inch Irrigation Transmission Line
	6	Relocate Kona Village Water Tanks
Three	1	1.0 MG Potable Water Tank
	2	16-inch Potable Transmission Line
Four	1	Percolation Pit Test Area

1.4. Requested Government Action

Table 1 summarizes the project elements. The requested government action is the issuance of Conservation District Use Permits (CDUP) to allow realignment of a previously approved roadway, construction of two infrastructure projects to expand the resorts' water

delivery system, and an exploratory drilling project to test percolation rates near the highway (see Figure 4). Figure 5 overlays the proposed projects on the developments that were previously approved by the BLNR. Because the previously granted CDUPs have expired, new permits are now required.

The applicant intends to submit two separate CDUP applications, one for the realigned roadway, and the other for infrastructure expansion projects and the exploratory drilling.

1.5. Description and Purpose of the Proposed Action

Following are descriptions of the four proposed projects.

1.5.1. Project One - Realigned Roadway Corridor

Background: In September 1991, the BLNR approved a Final Environmental Assessment for a new grade-separated intersection at Queen Ka'ahumanu Highway to serve the Kaupulehu Resort, a new roadway corridor extending mauka from the highway across the Conservation District to the Agricultural District, and a 6.0 MG irrigation reservoir adjacent to the previously approved utility corridor. On March 9, 1992, the BLNR approved a CDUP (HA-9/13/91-2517) for these projects. However, due to the subsequent downsizing of the Kaupulehu Resort and a general slowdown in the economy, neither the mauka roadway, the grade-separated intersection, nor the irrigation reservoir was ever constructed.

In 1994, Kaupulehu Makai Ventures and the State Department of Transportation determined that the access road for Kaupulehu Resort should intersect Queen Ka'ahumanu Highway near the western property boundary of Ka'upulehu rather than at the site approved by the BLNR. It also determined that acceleration and deceleration lanes could be provided on the highway in lieu of a grade separated interchange. Consequently, the planned Queen Ka'ahumanu Highway intersection was shifted about 3,000 feet west from the previously approved location to the point where the utility corridor's service road intersected the highway (near the Kukio property boundary). Acceleration and deceleration lanes were added to the highway and the resort's main access road, Ka'upulehu Drive, was subsequently constructed to intersect with Queen Ka'ahumanu Highway near the Kukio property boundary. The fully channelized intersection was completed in 1995.

Proposed Project: Project One consists of two elements. The first is the relocation and realignment of the previously approved roadway corridor to tie into the existing Queen Ka'ahumanu Highway intersection (see Figure 5). A two-lane paved roadway is proposed to be constructed within the realigned roadway corridor. The portion of the proposed access road extending through the Conservation District will have an approximate length of about 1.6 miles (8,400 feet). The two-lane access road will have 24 feet of pavement with a 6 foot graded

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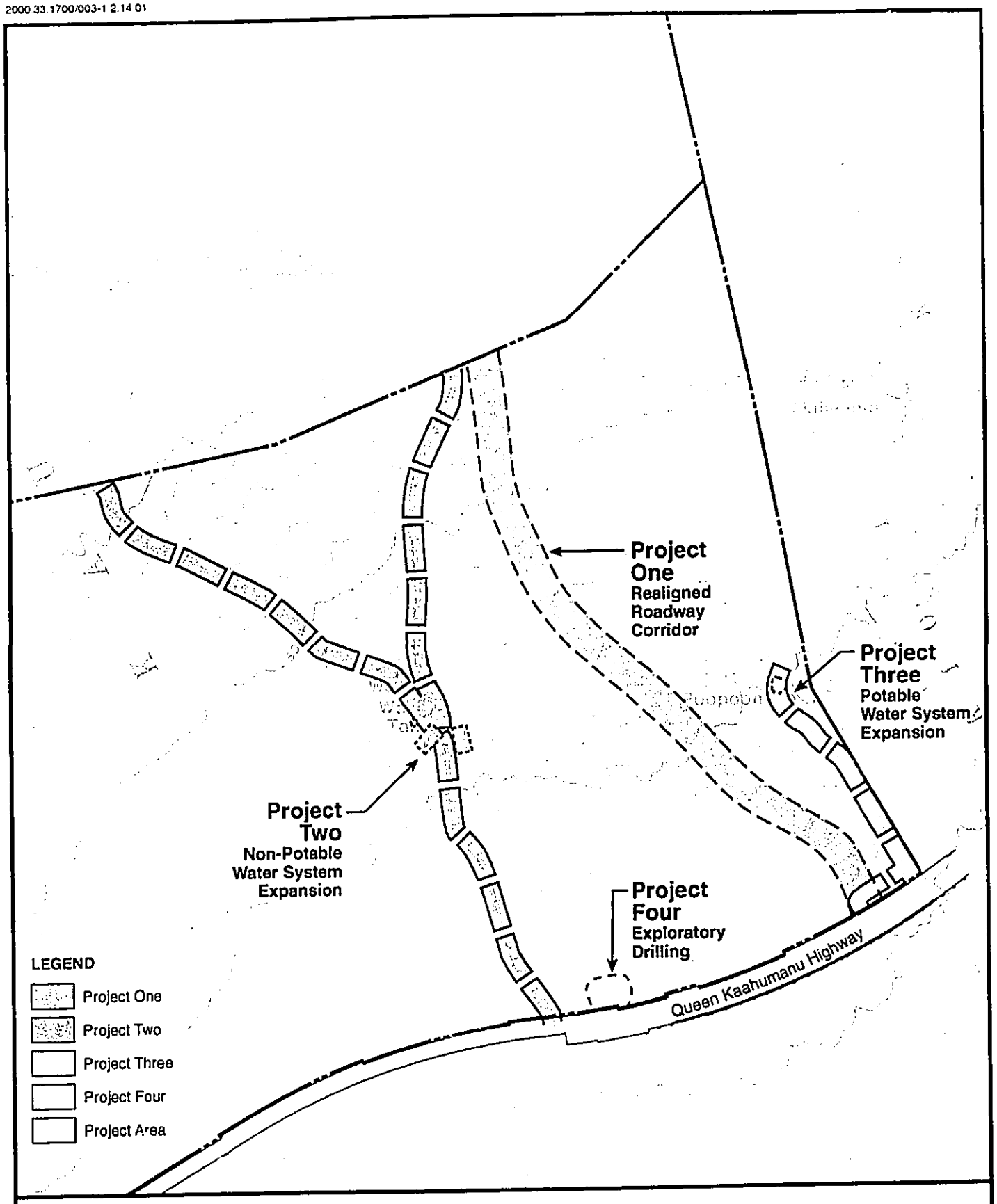

Figure 4
PROPOSED PROJECTS
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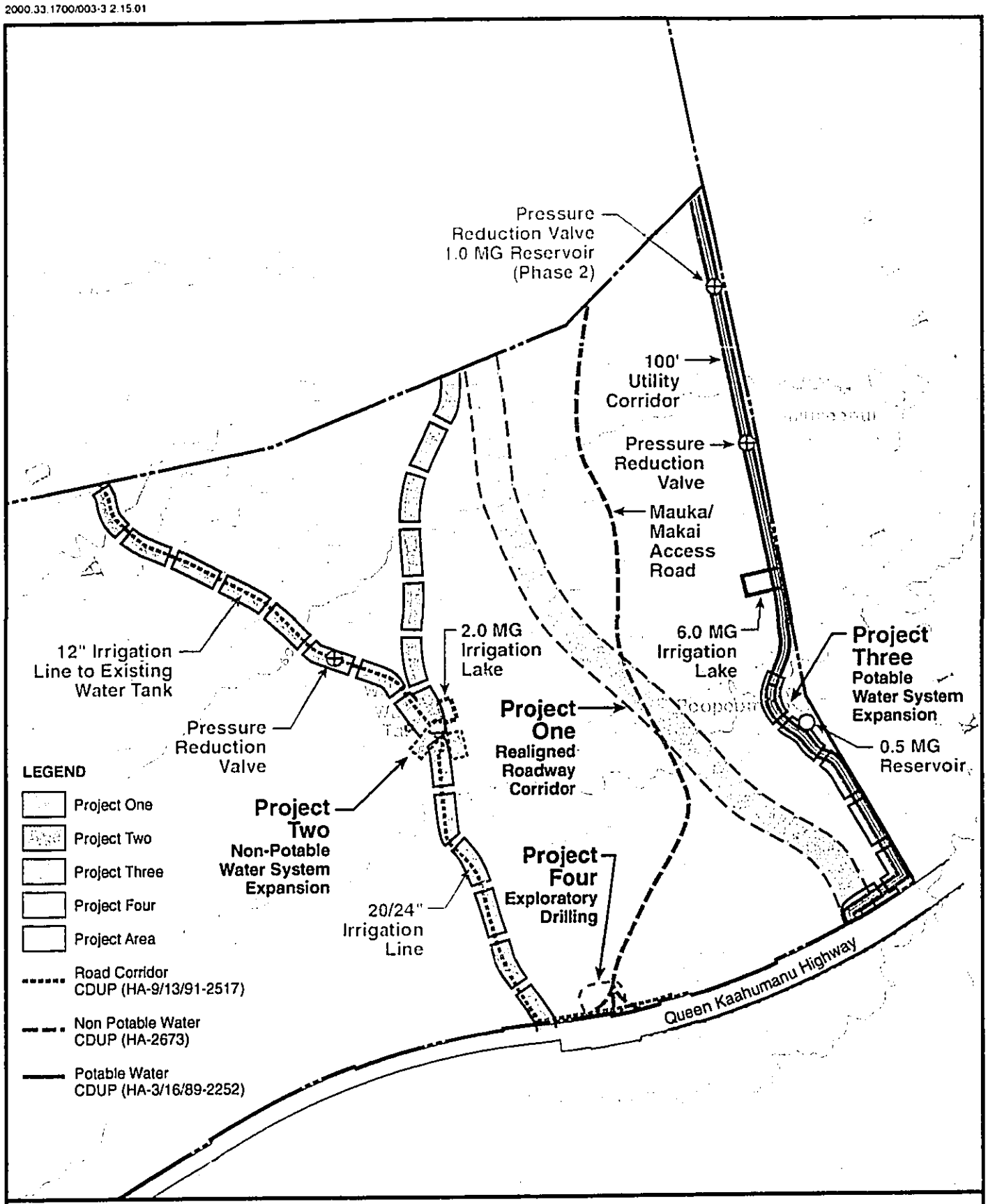

Figure 5
PROPOSED PROJECTS AND APPROVED CONSERVATION DISTRICT USE PERMITS
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shoulder on either side. It will be situated within a 100-foot right-of-way. The original CDUP approved a 24-foot wide paved road within a 100-foot right-of-way. The 400-foot wide roadway corridor now proposed is intended to provide greater flexibility in the final engineering and design of the roadway alignment. The total area of the corridor is approximately 77 acres, but the physical area of the constructed roadway will be only about 7 acres (a two-lane road approximately 36 feet wide x 8,400 feet long within a 100-foot wide right-of-way), which is essentially the same as the corridor approved in 1992.

On April 7, 2000, the County of Hawaii Planning Commission approved a Use Permit for a new 18-hole golf course to be constructed within the Agriculture District makai of Mamalahoa Highway. The proposed access road will link the approved golf course to Queen Ka'ahumanu Highway. This action by the Planning Commission included conditions that the golf course project be constructed within five years and that an access road to the Queen Ka'ahumanu Highway be provided.

Project One will also include a single locational sign to be situated within the 100-foot right-of-way at a point just mauka of the Queen Ka'ahumanu Highway right-of-way. The sign will bear the name of the mauka golf course. It will have a dimension of approximately 4-feet by 8-feet and will be constructed of lava rock and metal. Its total height will not exceed 8 feet.

1.5.2. Project Two - Non-Potable Irrigation System Expansion

Background: In the early 1990s, the resort's proposed non-potable irrigation system was redesigned. The original plan called for a single utility corridor to accommodate both potable and non-potable infrastructure. To that end, on March 9, 1992, the BLNR approved CDUP #HA-9/13/91-2517 for the development of a 6.0 million gallon irrigation reservoir adjacent to a utility corridor bordering the Ka'upulehu-Kukio ahupua'a boundary (the utility corridor is discussed below in Section 1.5.3 and is depicted in Figure 3). However, upon further review, the applicant determined that utilizing the utility corridor for non-potable irrigation infrastructure was too costly because it would require a mile-long transmission line from the non-potable wells which are located east of the corridor. In an effort to reduce the cost of the non-potable irrigation infrastructure, a separate corridor for the non-potable water infrastructure was proposed.

In January 1994, the BLNR approved a Final Environmental Assessment for a non-potable irrigation line, irrigation lake, service road, and highway crossing situated about 4,000 feet east of the potable water utility corridor (see Figure 3). On March 24, 1994, the Board of Land and Natural Resources approved a CDUP (HA-2673) for the project. Subsequent to the BLNR approval, the entire project was constructed. It included a subterranean transmission line (consisting of two segments: a 12-inch and a 16-inch pipe, respectively) extending from existing non-potable wells in the Agricultural District to a point in the Conservation District at an approximate elevation of 475 feet above MSL adjacent to an existing water tank that originally

served the Kona Village Resort. In this area, a 2.0 MG non-potable irrigation lake was built on the west side of the existing jeep trail.

The project also included a subterranean transmission line (consisting of two segments: a 24-inch line and a 20-inch line, respectively) from the irrigation lake to the Hualalai Resort that followed the alignment of an existing jeep trail down to Queen Ka'ahumanu Highway. In addition to the non-potable infrastructure, a 10-foot wide graded service road with stabilized shoulders was constructed extending from the irrigation lake up to the Agricultural District, generally following the alignment of the transmission line. Construction of this system enabled the resort to obtain non-potable water for irrigation at a lower cost than would have been required for the original system.

Proposed Project: Project Two represents an expansion of the non-potable irrigation system to accommodate already approved development at the resort (see Figure 6). Project Two consists of six elements.

The first element is a new 2.0 MG non-potable irrigation lake (Reservoir #1) adjacent to the existing lake at the same approximate elevation. Reservoir #1 is intended to provide additional non-potable irrigation water to the Kaupulehu Resort Expansion Area which has been approved for the construction of up to approximately 1,100 residential units and two golf courses on the property abutting the eastern side of the Hualalai Resort

Project Two's second element is a new 2.0 MG non-potable irrigation lake (Reservoir #2) to be situated immediately makai of the existing lake. Reservoir #2 is intended to provide non-potable irrigation water to the second phase of the Hualalai Resort. Together, the total volume of the two new irrigation lakes plus the existing irrigation lake will be 6.0 MG, which is the same capacity as was originally approved under CDUP #HA-9/13/91-2517.

The two new non-potable irrigation reservoirs (Elements 1 and 2) will be set back approximately 240 feet from the existing 2 million gallon irrigation lake (see Figure 7). The surface area of each reservoir will be approximately 1 acre and will measure approximately 240 feet by 180 feet. The average depth of each reservoir will be about 7 feet. They will be constructed by excavating approximately 17,500 cubic yards of material from the upper end of each site and applying the material at the lower end and sides. The applied material will create a natural-looking lava berm with a maximum height of 10-15 feet. Excess excavated material can be transported to the development sites mauka or makai of the highway and used as fill. The bottom will be lined with high density polyethylene liner. Both sites have been selected to take advantage of the existing topography, thereby minimizing the amount of grading required.

The third element is a 12-inch subterranean non-potable transmission line which will extend approximately 3,500 feet from the Agriculture District boundary down to Reservoir #1.

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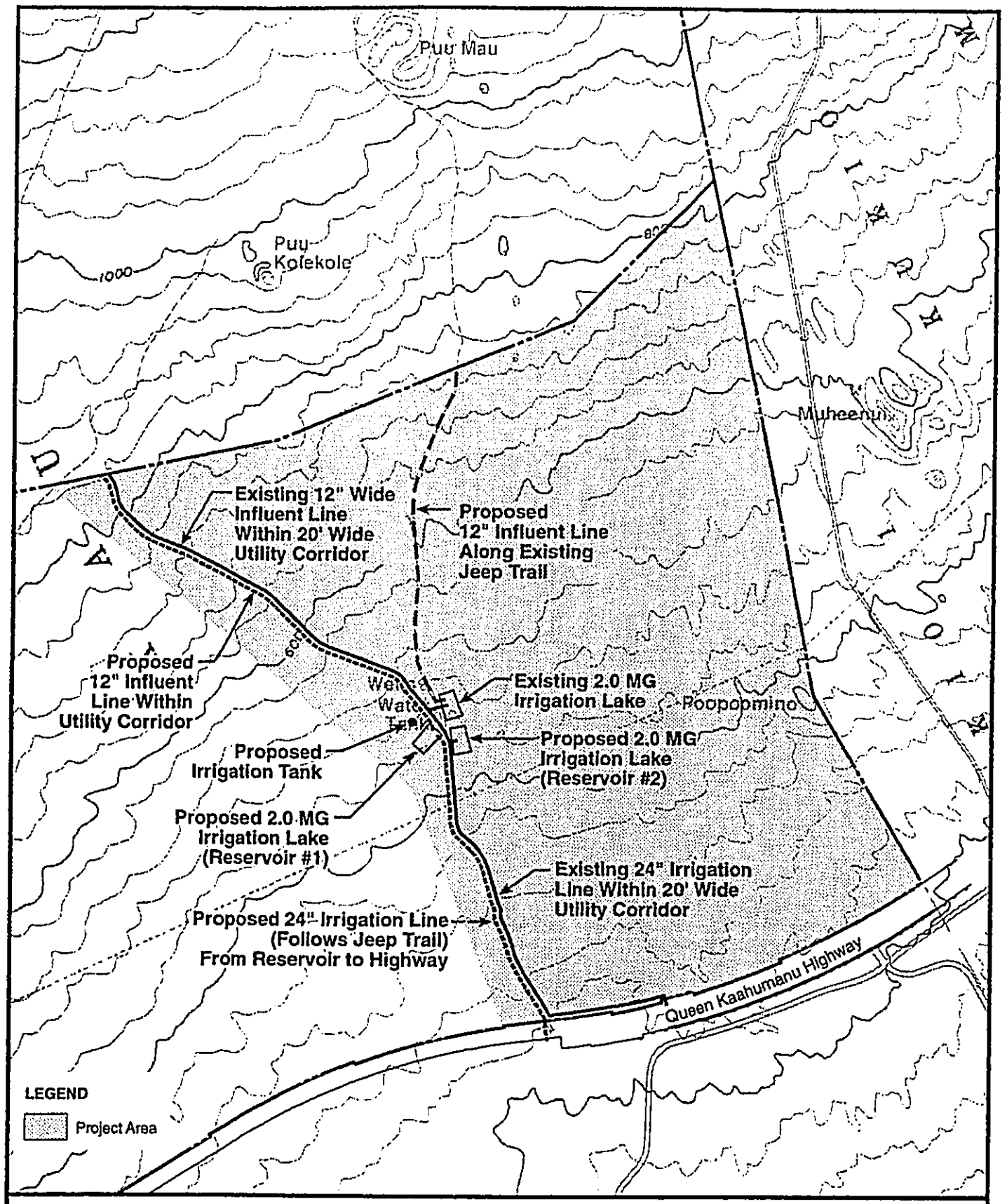

Figure 6
PROJECT TWO:
NON-POTABLE WATER SYSTEM EXPANSION
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
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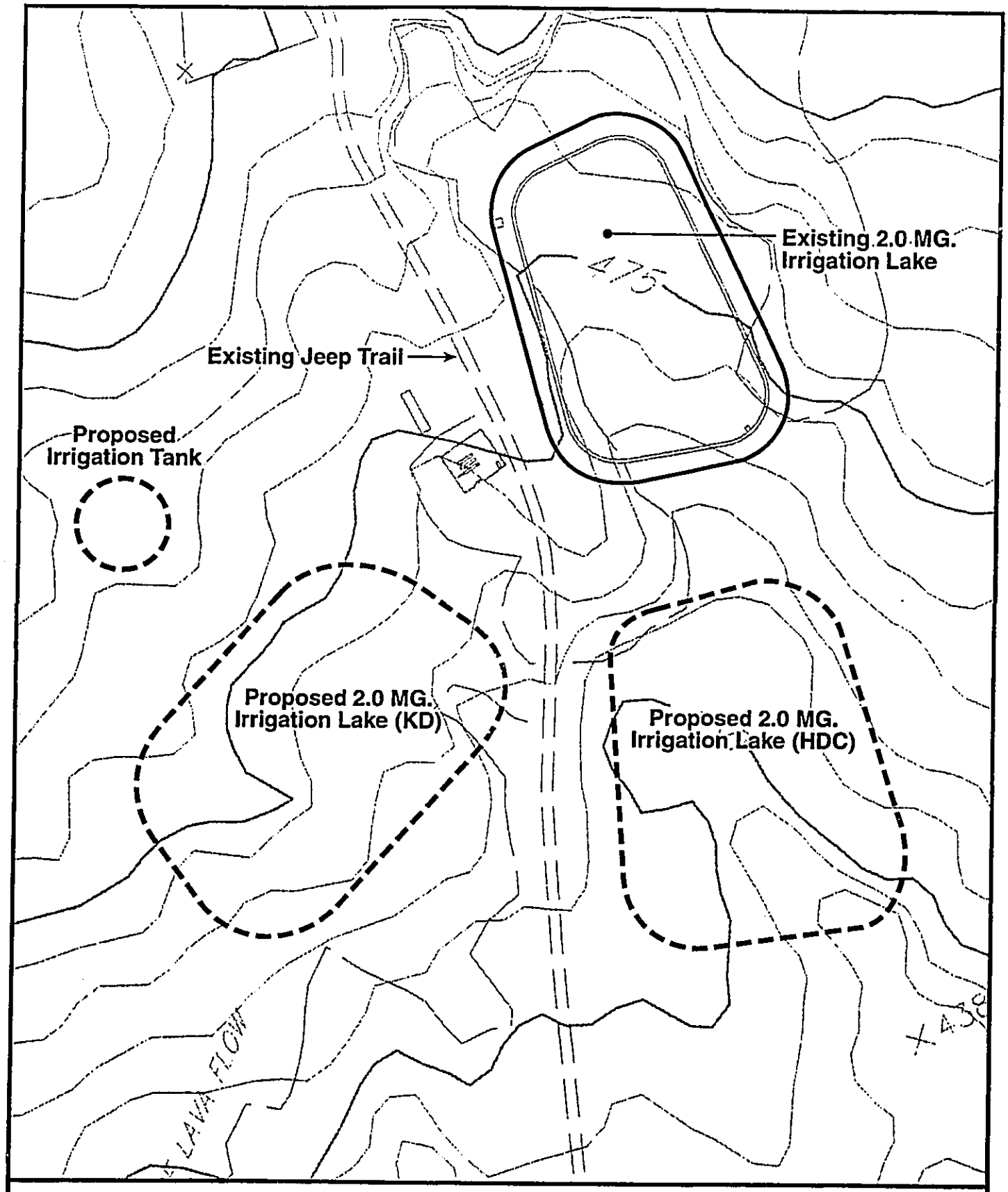

Figure 7
IRRIGATION LAKE PLAN
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
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The line will be situated within the existing non-potable utility corridor established by CDUP HA-2673 discussed above and will connect to existing wells within the Agriculture District. It will be set back between 10 and 20 feet from the edge of the existing service road. This element will also include a PRV. The line will be constructed of ductile iron and will be buried approximately 3.0 feet below the surface. A trench approximately 3.0 feet wide by 5.0 feet deep will be excavated. When construction is completed, the trench will be filled and the pipe line will be covered with the excavated material. Any remaining material will be transported to the resort area to be used as fill material.

The fourth element of Project Two is a 12-inch subterranean non-potable transmission line which will extend approximately 3,500 feet from the Agricultural District down to the proposed irrigation lakes along the alignment of an existing jeep trail. The proposed 12-inch transmission line will provide Reservoir #2 with water from a proposed water treatment plant to be constructed in the Agricultural District. The alignment of the underground transmission line along the existing jeep trail represents the shortest most direct route to the location of the water treatment plant. The new 12-inch influent line serving Reservoir #2 will be set back 10 to 20 feet from the edge of the jeep trail for disturbance limits and will follow the same route. The transmission line will also include a pressure reducing valve at elevation 570'.

The fifth element of Project Two consists of a new subterranean 24-inch non-potable transmission line that follows the alignment of the existing jeep trail from the proposed reservoirs down to an existing connection point at Queen Ka'ahumanu Highway, within the existing irrigation corridor. It will be constructed of ductile iron and will be buried approximately 3.0 feet below the surface. To accomplish this, a trench approximately 4.0 feet wide by 5.0 feet deep will be excavated. When construction is completed, the trench will be filled and the pipe line will be covered with the excavated material. Any remaining material will be transported to the resort area to be used as fill material.

The sixth element of Project Two is the construction of a new non-potable water tank to replace an existing water tank located on the makai side of Queen Ka'ahumanu Highway which serves the Kona Village Resort. The proposed water tank will tie into an existing 4 inch line that extends down to Queen Ka'ahumanu Highway. The water tank will be accessed from the existing access road. The area of the tank will be graded and perimeter fencing will be installed. The new tank will be constructed of glass-lined steel and have a capacity of approximately 232,000 gallons. It will have a diameter of approximately 50-feet and sidewalls approximately 15 feet in height.

1.5.3. Project Three - Potable Water System Expansion

Background: On August 29, 1989, the BLNR approved a CDUP (Permit #HA3/16/89-2252) for a 100-foot wide utility corridor extending mauka from the Queen Ka'ahumanu

Highway along the Ka'upulehu/Kukio property boundary (see Figure 3). The utility corridor was the subject of a Final Environmental Assessment which was approved by the BLNR in March 1989.

The intent was to provide a permanent corridor across the Conservation District within which utilities to support the Kaupulehu Resort could be constructed. This system was intended to transmit water from potable water wells situated in the Agricultural District to the two hotels and two golf courses which were originally planned for development at the resort makai of Queen Ka'ahumanu Highway. The BLNR approved construction of an 18-inch transmission line, two above-ground reservoirs, various pressure reducing valves (PRVs), a 10-foot wide graded service road with stabilized shoulders, overhead electrical lines, an electrical substation, and underground electric, telephone, and cable TV lines. One of the reservoirs was proposed to contain approximately one million gallons of potable water and to be located at an elevation of about 800 feet above mean sea level (msl). Due to the subsequent downsizing of the resort from two hotels containing about 1,500 units to a single hotel containing 243 units, the tank that was eventually constructed at the 857 foot elevation had a capacity of only 0.02 MG.

The second reservoir was to consist of a glass-lined steel tank containing approximately one half million gallons of potable water and was to be constructed at the 400 foot elevation. It was eventually constructed at the 312 foot elevation to serve the resort development situated along the shoreline (the "lower" service area discussed earlier).

Proposed Project: Project Three consists of a new 1.0 million gallons (MG) potable water tank, a PRV, a flow rate station, and a 16-inch transmission line extending from the reservoir down the utility corridor to an existing connection line on the mauka edge of the Queen Ka'ahumanu Highway right-of-way. The proposed water tank (Element 1) will be constructed at an elevation of 414 feet, which places it uphill of the foothill identified as *Po'opo'omino* (see Figure 8). The proposed tank will complement the existing system by providing potable water to the resort's upper service area (the resort development area extending from an approximate elevation of 140 feet to the highway). Element 1 will also include the PRV and flow rate station,

As previously approved, the reservoir will consist of a glass-lined steel water tank about 20 feet tall and about 92 feet in diameter. It will be situated within a one-acre area adjacent to the utility corridor. The tank site will be accessed by a 10 foot wide graded road extending perpendicular from the existing service road within the utility corridor to an 11 foot wide perimeter road around the new tank. Perimeter fencing (6-foot high, chain-link) will surround the water tank.

The subterranean transmission line, Element 2, will be sited within the utility corridor along the eastern side of the existing service road. It will be constructed of ductile iron and will be buried approximately 3.0 feet below the surface. To accomplish this, a trench approximately 4.0

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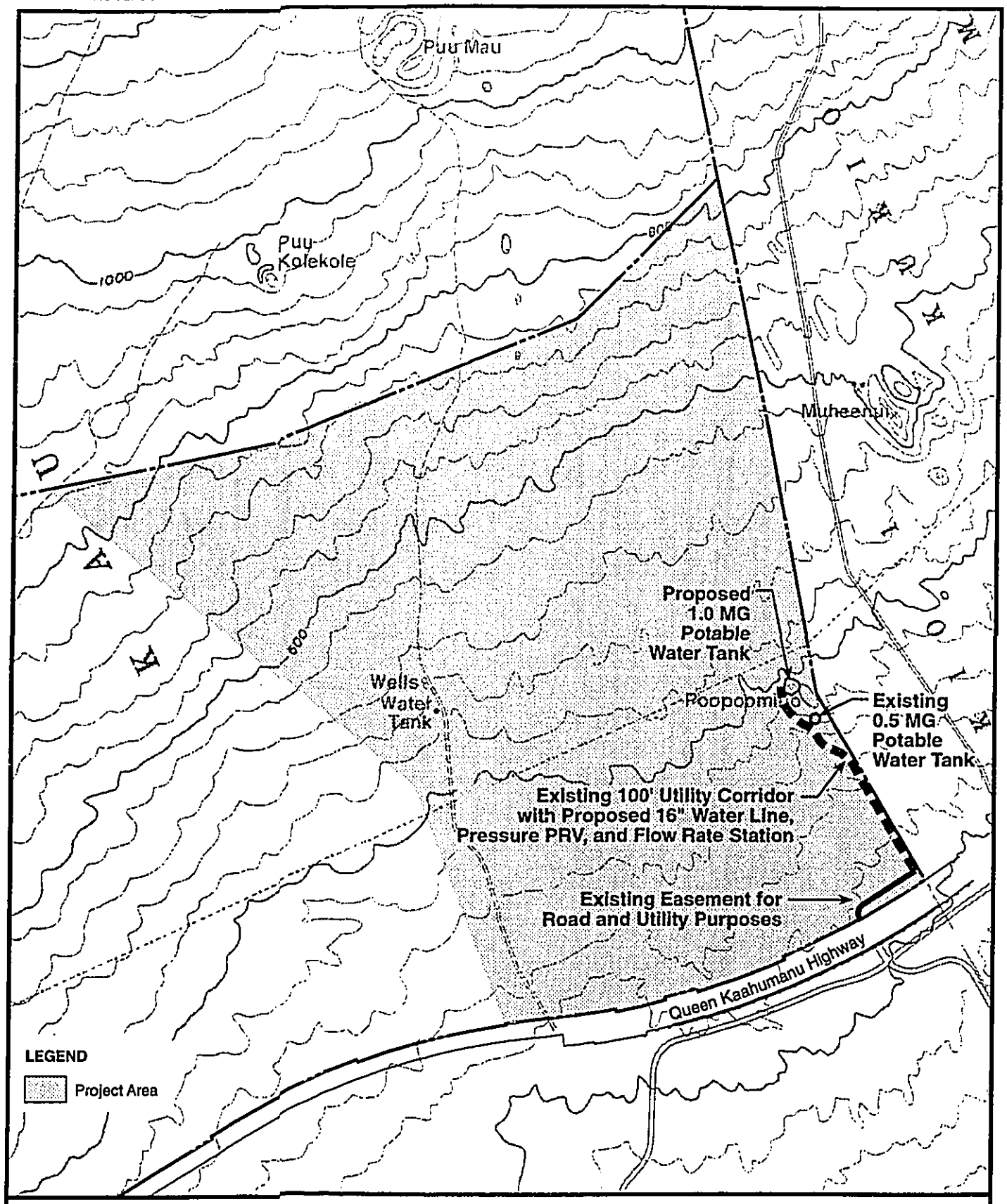

Figure 8
PROJECT THREE:
POTABLE WATER SYSTEM EXPANSION
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
Prepared by Belt Collins Hawaii • February 2001

feet wide by 5.0 feet deep will be excavated. It is estimated that approximately 2,200 cubic yards of material will be excavated from the trench. When construction is completed, the trench will be filled and the pipe line will be covered with the excavated material. Any remaining material will be transported to the resort area to be used as fill material.

1.5.4. Project Four - Exploratory Drilling

Background: In view of the recent approval of a Use Permit by the Hawaii County to allow construction of a new golf course on Agricultural lands in the Ka'upulehu ahupua'a mauka of the existing resorts, it has been determined that a small area (on the order of about four acres) should be established on the mauka side of the Queen Ka'ahumanu Highway right-of-way, adjacent to three existing 96-inch culverts which extend under the highway, to function as a perennial percolation area. The area would be sized to percolate rainfall runoff generated during a 100-year storm event before it enters the culverts, thereby ensuring that developments makai of Queen Ka'ahumanu Highway are not jeopardized during periods of abnormally heavy rainfall.

Proposed Project: Project Four consists of the exploratory drilling of up to three holes, each about 4 inches in diameter and up to 20 feet deep, for the purpose of conducting water percolation tests within a four acre area immediately mauka of the existing twin drainage culverts that extend under Queen Ka'ahumanu Highway (see Figure 9). These tests would provide engineering data that is necessary to calculate the size of the planned percolation pit. Actual construction of the percolation pit is not proposed at this time. Due to the presence of basalt rock formation at or near the ground surface, drilling by rotary coring method will be utilized. This requires pumping water throughout the drilling process to cool the drill bits. It is estimated that about 2,000 gallons of water will be injected into the ground. To provide access for the drill rig and water truck to the boring locations, minor road clearing (removal of boulders and stabilization of the a'a by rolling heavy equipment to form a temporary vehicle path) may be necessary.

The actual percolation tests consist of injecting up to 1,000 gallons of water per test into the bore holes to measure the headfall or injection rate. Several tests may be conducted at each hole.

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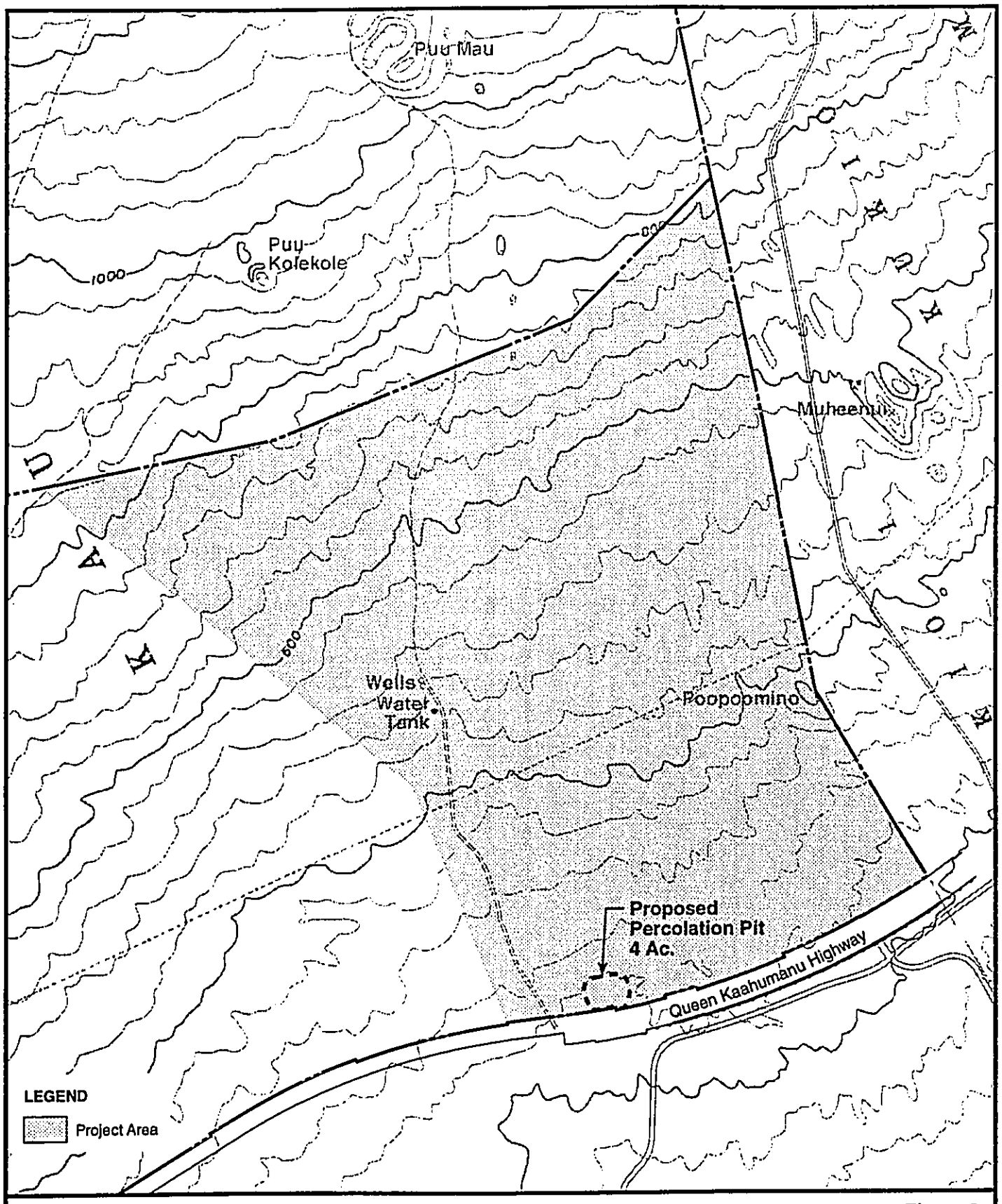

Figure 9
PROJECT FOUR:
EXPLORATORY DRILLING
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
Prepared by Belt Collins Hawaii • February 2001

1.6. Agencies, Organizations, and Individuals Consulted

The following parties were consulted prior to the preparation of the Draft EA.

State of Hawaii

Department of Land and Natural Resources - Land Management Division

Department of Health - Office of Environmental Quality Control

County of Hawaii

Planning Department

Private Organizations/Individuals

Mr. Fred Druer, Kona Village Resort

Mr. Richard Albrecht, Hualalai Development Company

Mr. Alex C. Kinzler, Kaupulehu Developments

Ms. Hannah Springer

Ms. Leinaala Keakealani Lightner

2. GENERAL DESCRIPTION OF THE SOCIAL, ECONOMIC, AND ENVIRONMENTAL SETTING

2.1. Description of the Social and Economic Characteristics of the Proposed Action

The general social and economic characteristics of the Ka'upulehu area are described in the Ka'upulchu Resort Final Environmental Impact Statement (BCA, 1986). Due to the relative lack of development in the Ka'upulehu region, the current socioeconomic conditions of the area remain similar to what they were when the 1986 EIS was published. Since 1986, development in the area includes one 243-unit hotel and approximately 182 residential units, most of which are second homes or units and are occupied only seasonally.

The project site is located in U.S. Census Tract 215.01, which includes the North Kona District of the Island of Hawaii. The 1990 census cites a population of 6,486 and 2,166 households. Within the district of North Kona, population increased 184.5% between 1970 and 1980; from 4,832 to 13,748. Between 1980 and 1990, North Kona's population increased 62.1% to 22,284. Data from the 2000 census is not available at this time.

2.2. Environmental Characteristics

2.2.1. Geology and Topography

The Ka'upulehu ahupua'a is located on the northern slope of Hualalai volcano. The general geology of this area is primarily composed of the pahoehoe and a'a lava flows from Hualalai in 1800 and 1801. The area receives little rainfall, and subsequently there is a lack of soil or groundcover. As a result, the lava has not been eroded by runoff or vegetation.

The topography of the project area is a relatively even slope with the exception of one hill, Pu'u *Po'opo'omino*, approximately 2,600 feet mauka of Queen Ka'ahumanu Highway on the far western edge of the property at an elevation of approximately 400 feet above mean sea level. The existing utility corridor extends around the eastern side of the hill.

2.2.2. Soils and Agricultural Potential

Four land types, as described below, have been identified on the Ka'upulehu mauka lands by the United States Department of Agricultural Soil Conservation Services (SCS) (December, 1973) in a comprehensive soil survey of the Island of Hawaii (see Figure 10). None of the four are agriculturally significant.

(1) A'a Lava Flows (rLV). This lava has practically no soil cover and is generally bare of vegetation. The surfaces of a'a lava flows are masses of clinkery, hard, sharp pieces piled in tumbled heaps that are difficult to traverse on foot. It has been demonstrated that the clinkery a'a surface can be easily moved and crushed by bulldozers into relatively smooth surface cobbles

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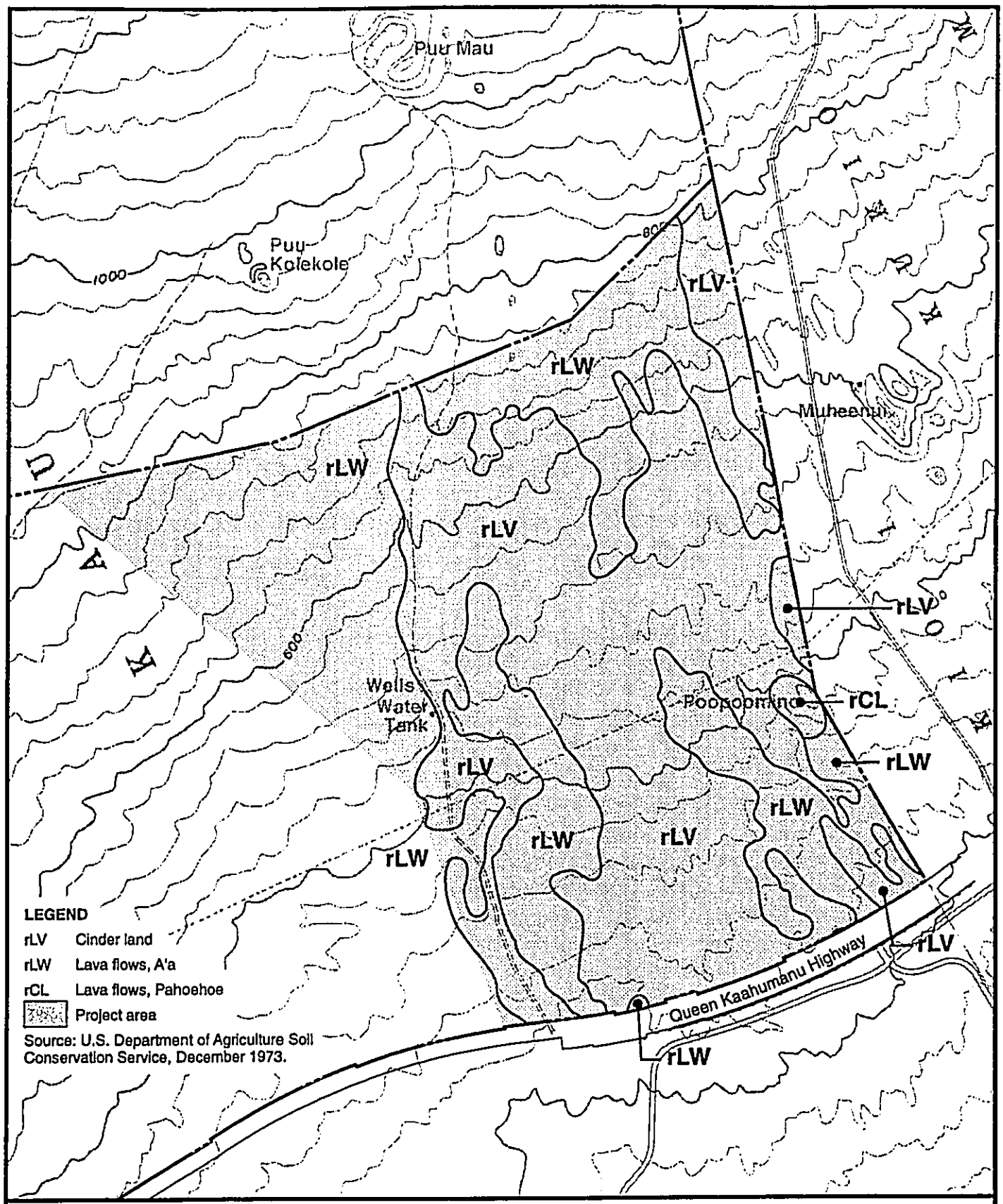

Figure 10
LAND TYPES MAP
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one to four inches in size.

(2) Pahoehoe Lava Flows (rLW). Pahoehoe lava flows, similar to the a'a flows, are a miscellaneous land type with meager soil covering. The surface of the Pahoehoe lava is generally much smoother than the a'a lava. The only soil in this land type is found in cracks and depressions, having been transported there by wind and storm runoff.

(3) Rock Land (rRO). Rock land is another miscellaneous land type that consists of pahoehoe bedrock covered in places with a thin layer of transported soil. The little soil that is present is generally confined to holes and cracks in the bedrock. Lava outcrops are exposed over 50 to 90 percent of the surface.

(4) Cinder Land (rCL). Cinder land is also a miscellaneous land type consisting of bedded cinders, pumice and ash. These materials are black, red, yellow, brown, or variegated. The particles have jagged edges and a glassy appearance and show little or no evidence of soil development. Cinder land commonly supports some grass, but it is not good pasture land because of its loose consistency and poor ability to handle movement. This land is a source of materials for surfacing roads.

As discussed in the Detailed Land Classification, Island of Hawaii, University of Hawaii Land Study Bureau, 1972, the mauka lands of the Ka'upulehu ahupua'a are classified as E287, E319, and E324. The 'E' classification indicates the lack of stability for agricultural purposes. Development of the proposed action is not expected to significantly impact or be impacted by the soils of the project area.

2.2.3. Surface Water and Drainage

Located in the lee of Mauna Kea, the Ka'upulehu lands are an area of low rainfall. The naturally porous and unweathered lava has sparse soil cover, allowing rainfall to percolate rapidly into the ground leaving no evident drainageways. The soil and land types in the area of the proposed action are classified as well-drained due to the naturally porous character of the lava.

It should be noted that the implementation of Project Four (the proposed percolation area) is not considered to be inconsistent with this finding. Although the land types in the area are well drained, development of the agricultural lands during the long term, including the mauka golf course which has not yet been built, may change the character of drainage in the area by adding surface runoff. Given the proximity of the existing culverts under the highway to proposed development within the resort, the proposed percolation area represents a low-cost safety measure that could effectively mitigate flooding during a worst-case storm scenario.

2.2.4. Groundwater and Hydrology

The Ka'upulehu lands, which are part of the Kiholo Aquifer, can be divided into three hydrological sectors. The first falls between Queen Ka'ahumanu Highway and the coast. The second sector extends from Queen Ka'ahumanu Highway upward and inland to an undefined boundary lying in the rift zone between Pu'u Kolekole and Pu'u Nahaha at an elevation between 1,000 and 1,200 feet above sea level. The third sector is restricted to the rift zone where subsurface geological discontinuities occur. The proposed action is located within a portion of the second sector which is characterized by basal groundwater with moderate to weakly brackish quality. The farthest inland location of the second sector may be marginally potable.

Currently, there are two brackish wells located within this second sector to supply irrigation water to the Hualalai golf course (wells #4757-1 and 4757-2), and one non-potable irrigation lake supplying irrigation water to the Hualalai Resort. The two new irrigation lakes to be located next to the existing lake will be sustained by existing and new well sources in the Agriculture District to meet the increased needs of the makai resorts.

2.2.5. Natural Hazards

Potential natural hazards that the project property could be subjected to include earthquakes and volcanic eruptions. Due to the excessively well drained nature of the lava, flooding due to rainwater surface runoff is highly unlikely. Volcanic activity in the area has been studied in great detail. The last volcanic eruption to affect Ka'upulehu lands occurred in 1800-1801 from several vents on the northwest rift zone creating the Ka'upulehu Lava Flow. The United States Geological Survey (USGS) designates the Hualalai volcano as Zone 4 on a scale of 1 to 9 (where 1 represents the greatest hazard associated with rift zones and active vents).

In addition to lava flow hazard zones, hazard zones for tephra falls have also been defined for Hawaii. The Ka'upulehu lands are located in ashfall hazard Zone 2A, which indicates the potential for burial by cinder cones and thinner, more widespread tephra 10cm or more thick from infrequent eruptions of Hualalai. The hazard zones for volcanic gasses are the same as hazard zones for tephra.

The Ka'upulehu lands are outside of hazard zones for ground fracture and subsidence. However, Hualalai volcano is identified by the USGS as being the location of potentially damaging earthquakes. The last large earthquake occurred in 1929 with a magnitude of 6.5 on the Richter scale. Historical data indicates that earthquakes of a level of 6.4 magnitude occur on an average of once every 62 years at Hualalai.

2.2.6. Climate and Meteorology

The Ka'upulehu lands lie in an area between Honokohau and Anaeho'omalu, called Kekaha, meaning dry sun baked land. There is little rainfall below the 1,000 foot elevation point, and an annual average of only 25 to 30 inches at the 2,000 foot elevation point with the summer months being the wettest, and the winter months the driest. All of the proposed projects would be located below the 1000 foot elevation level.

The predominant winds have a distinct daily pattern influenced by land and sea breezes. In the afternoon and early evening, air moves inland on a sea breeze. Late at night and very early in the morning, the air drifts back from the land to the sea. This return drift is usually very gentle.

2.2.7. Air and Noise Quality

The area's air quality is generally good due to the relative lack of human activity or development. Existing air quality is impacted by vehicular traffic on the Queen Ka'ahumanu Highway. In addition, during seasonal conditions when the northeasterly trade winds diminish and are replaced by southerly, or Kona winds, volcanic fumes from the active Kilauea volcano on the southeastern flank of Mauna Loa are blown around the southern portion of the island and up the leeward coast. During these conditions, a heavy volcanic haze known as vog is more readily visible.

The existing noise quality of the subject property is impacted to a small degree by motor vehicle traffic movement along Queen Ka'ahumanu Highway, but more directly, by natural factors including wind moving through the vacant, undeveloped mauka Ka'upulehu lands. It is anticipated that existing noise levels are in the 30 to 50 dBA range, depending on the time of day and levels of traffic on Queen Ka'ahumanu Highway.

The proposed action would be classified as an "indirect source" of air pollution as defined in the federal Clean Air Act of 1977 because its primary association with air pollution would be due to its inherent generation of motor vehicle activity. The impacts to the property area and regional air quality may be caused by increased vehicular activity in and around the property, electrical generation offsite and construction activities. The principal source of short-term air quality impacts will be construction due to vehicular movement, clearing and grading, and general dust generating construction activities. Short-term construction impacts are to be minimized by dust control measures (frequent watering) that will be employed during the construction period. It is expected that at completion of construction, including any landscaping, existing fugitive dust emissions in the project area will decrease.

2.2.8. Visual Attributes

The lands on which the proposed projects are to be constructed range in elevation from about 250 feet at Queen Ka'ahumanu Highway to about the 800 foot elevation level at the western boundary of the Conservation District, and the 1,000 foot elevation level at the farthest eastern boundary point of the Conservation District. The entire area may be generally characterized as vacant mountain slope consisting of historic and prehistoric lava flows, sparsely vegetated with low grasses, shrubs, and few trees. When viewed from the highway, portions of the project area are screened from view by the undulating character of the natural topography and berms of lava along the mauka edge of the highway.

The electrical transmission lines which bisect the district and the upper half of the poles are visible from some vantage points along the highway. The existing electrical substation is also generally visible from the intersection of Queen Ka'ahumanu Highway and Kaupulehu Drive, as is the existing potable water reservoir at the 312 foot elevation. The existing irrigation reservoir is not visible from the highway. The existing access roads which service the utility corridor and the irrigation corridor are visible for several hundred yards mauka of their respective intersections with Queen Ka'ahumanu Highway, but then disappear behind berms of a'a rubble. Because the roads are not paved, their presence does not create a significant visual distraction.

2.2.9. Flora

A botanical field survey of the land areas corresponding to the proposed project was conducted on July 31, 2000 and August 1, 2000 by Char & Associates, and is included in this document as Appendix A. The primary objectives of the survey were to 1) provide a general description of the vegetation on each of the project sites; 2) inventory the flora; 3) search for threatened and endangered species as well as species of concern; and 4) identify areas of potential environmental problems or concerns and appropriate mitigation measures to address them.

To summarize the report, the Conservation District area mauka of Queen Ka'ahumanu Highway is generally characterized by a mosaic of open scrub vegetation on weathered pahoehoe flows interspersed with nonvegetated a'a flows. The predominant plant species is fountain grass (*Pennisterum sectaceum*). Generally, fountain grass coverage below the power line ranges from between 15 percent and 30 percent. Mauka of the power line, fountain grass density increases to 80 percent or more. Other plant species identified in the general project area include *'ilima* (*Sida cordifolia*), *indigo* (*Indigfera suffruticossa*), *kiawe* (*Prosopis pallida*), *lama* (*Diospyros sandwicensis*), silver oak (*Gredvillea robusta*), and *'hi'a lehua* (*Metrosideros polymorpha*). No endangered, threatened, or candidate species were identified on any of the proposed development sites.

2.2.10. Fauna

A two-day ornithological and mammalian survey of the proposed project areas was conducted on September 1 and 2, 2000 by a consulting biologist of Rana Productions Ltd. The survey report is included in this document as Appendix B.

To summarize the report, six mammalian species were observed: domestic dog, small Indian mongoose, cat, donkey, cattle, and feral goat. The most noticeable mammalian species was donkey, which was observed at each of the project sites. No endangered Hawaiian hoary bats were observed. A total of twenty-four individual birds, representing four species were observed: Common Myna (*Acridotheres tristis*), African Silverbill (*Lonchura cantans*), House Finch (*Carpodacus m. mexicanus*), and Yellow-billed Cardinal (*Paroaris capitata*). All of these are alien to the Hawaiian Islands. Two additional species were observed within the existing irrigation reservoir: the endangered endemic Hawaiian Stilt (*Himantopus mexicanus knudseni*) and the indigenous Pacific Golden Plover (*Pluvialis fulva*). However, no endangered, threatened, or candidate avian species were identified at any of the proposed project sites.

2.2.11. Historical and Archaeological Resources

Several archaeological inventory surveys have been conducted within the Conservation District mauka of the Queen Ka'ahumanu Highway during the past 12 years. Following is a summary of their respective findings.

Potable Utility Corridor (Project Three): An archaeological inventory survey of the 100-foot wide utility corridor extending mauka from Queen Ka'ahumanu Highway generally along the Ka'upulehu side of the Kukio property boundary was conducted in February 1989 by Paul H. Rosendahl, Inc. (PHRI) to determine the presence of historic or archaeological resources. The complete report of the surveying archaeologist is included in this EA as Appendix C.

The survey identified two archaeological sites, both trails, which cross the utility corridor. The first trail site (site 1193) is a trail section that runs from the Kukio 1st coastal settlement, inland to Huehue. The trail is known as the Kukio Puhia Pele Trail and is located at an elevation of about 460 feet, which places it mauka of the proposed 1.0 MG potable water tank and transmission line identified as Project Three. The second trail (site 10977) is located at an elevation of about 320 feet and is seaward of *Po'opo'omino*. This trail connects with the Kukio Puhia Pele Trail. It leads to Kahuwai Bay in Ka'upulehu and was part of a major access route. Both trails appear to be part of an overall network of trails linking the coastal settlements of Kahuwai Bay and Kukio with the inland settlements at Huehue. Both trail sites were assessed as significant for information content, cultural value, and interpretive value. Both sites were recommended for "preservation as is." When the access road for the utility corridor was subsequently graded, the segments of each trail which crossed the road was preserved.

Irrigation Corridor (Project Two): An archaeological inventory survey of the 100-foot wide irrigation corridor following the alignment of the existing jeep trail was conducted in September 1993 by Paul H. Rosendhal, Inc. (PHRI) to determine the presence of historic or archaeological resources. The complete report of the surveying archaeologist is included in this EA as appendix D. None were found within the corridor, a 4-acre area around the site of the proposed irrigation lake (now constructed), nor a 100-foot wide corridor extending up to the irrigation wells.

Proposed Irrigation Reservoirs and Percolation Pit (Projects Two and Four): An additional archaeological inventory survey was conducted by Rechtman Consulting between mid July and mid August, 2000 to determine the presence of any historic or archaeological resources in the areas to be impacted by Projects One, Two and Four. The report is included as Appendix E to this Environmental Assessment. No resources were found in project areas Two and Four.

Proposed Realigned Roadway Corridor (Project One): The Rechtman study also included an inventory survey of the entire 400-foot wide roadway corridor. Three sites were identified: Site 10977 (the previously recorded branch of the Kukio Puhia Pele Trail discussed above), Site SIHP 22498 (consisting of two lava blisters interpreted as pre-Contact temporary habitations), and Site SIHP 22499 (a modified lava outcrop interpreted as an agricultural feature). The trail segment crosses the 400-foot corridor about 800 feet mauka of Queen Ka'ahumanu Highway and includes two intact *ahu* (stacked *pahoehoe* slabs) and one collapsed *ahu* were identified alongside the trail. Site 22498 is located along the eastern edge of the roadway corridor about 800 feet mauka from the trail. Site 22499 is located near the Conservation/Agriculture District Boundary (see Figure 11).

2.2.12. Cultural Resources

A Cultural Impact Assessment (CIA) was conducted for the general project area by Rechtman Consulting in December 2000 and is included as Appendix F to this environmental assessment. The CIA was prepared in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai'i, November 19, 1997. In addition, extensive oral history interviews have been conducted for the Kaupulehu Resort Expansion project and have been compiled as part of the Ka'upulehu Integrated Resources Management Plan, a two volume document of several hundred pages which is not included in this environmental assessment but which is available upon request.

Based upon archival research and oral interviews, the consultant has identified two specific cultural properties within the project area. The first is the hill known as *Pu'u Po'opo'omino* which is situated adjacent to the existing utility corridor near the Kukio property boundary. It sits prominently at the *ahupua'a* boundary between Ka'upulehu and Kuki'o. It is

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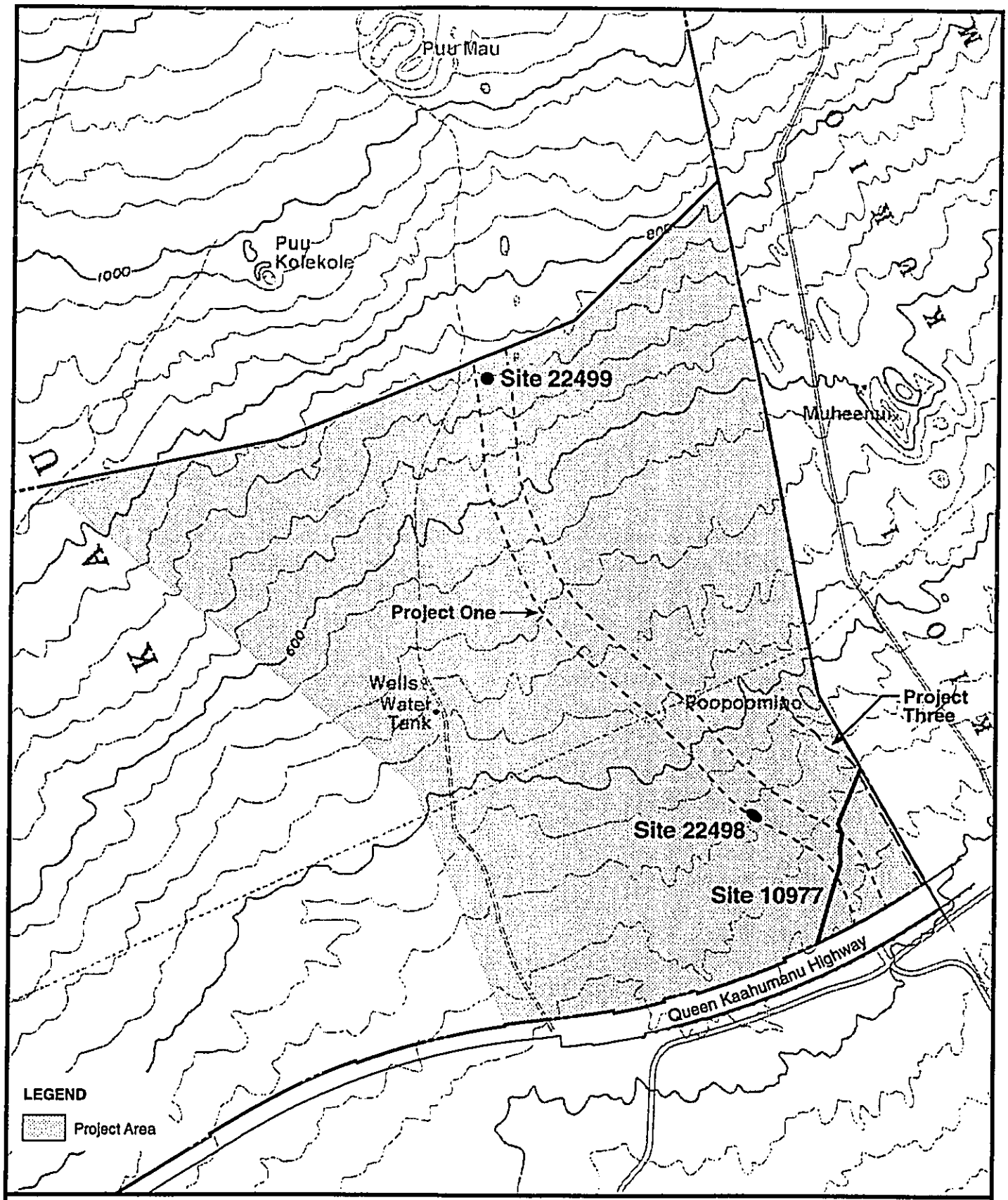

Source: Rechtman Consulting, October 2000

Figure 11
ARCHAEOLOGICAL SITES
Environmental Assessment for Ka'upulehu Infrastructure
Prepared for PIA-Kona Limited Partnership
Prepared by Belt Collins Hawaii • February 2001

identified as a Traditional Cultural Property for its association with legendary events that were and are orally transmitted from one generation to the next, for its association with the legendary *ali'i* of the same name, and for its cultural value.

The second identified Traditional Cultural Property is the *Hu'ehu'e-Ka'upulehu* trail, Site 10977, which has been discussed above. This property is considered to be significant as an important element of the *ahupua'a*, as well as an important feature of the ranching era. It also remains significant to members of the Hawaiian community today.

During the assessment process, one of the interviewees, Ms. Hannah Springer, also identified the general lava flow landscape as personally significant to her. However, the overall lava landscape cannot be categorized as a Traditional Cultural Property because it is an "unstoried boundless natural feature."

2.2.13. Access and Traffic

The lower section of the proposed 16-inch potable water line to be added to the existing utility corridor is presently accessible by an existing jeep trail extending from Queen Ka'ahumanu Highway. The existing wells are accessed by an existing jeep trail from Mamalahoa Highway. The non-potable irrigation lakes and the new non-potable irrigation tank will be accessed by the same existing jeep trail extending from Queen Ka'ahumanu Highway that provides access to the existing irrigation lake and water tank. The two new 12-inch non-potable irrigation lines supplying the two new lakes would be accessed by existing service roads. Both of these service roads are routinely chained and public access is restricted. The percolation pit would be directly accessible from Queen Ka'ahumanu Highway.

The only traffic utilizing the existing service roads are maintenance vehicles associated with the resort.

2.2.14. Wastewater and Solid Waste Disposal

There are no existing wastewater disposal systems or solid waste disposal sites in the vicinity of the proposed project sites, nor are there any associated with the proposed project.

2.2.15. Electrical Power and Communications Systems

The Ka'upulehu ahupua'a is presently traversed by overhead 69kv electrical transmission lines about 3,000 feet inland from the highway at an elevation of about 420 feet above MSL. Electrical power to the proposed infrastructure would be provided by HELCO from these lines. A 10 MVA electrical substation is located about 500 feet mauka of *Po'opo'omino*, approximately 400 feet east of the utility corridor.

Communications (telephone services) to the subject property are provided by Verizon via existing pole lines on the mauka side of Queen Ka'ahumanu Highway. Verizon facilities are capable of serving the planned facilities.

3. IDENTIFICATION AND SUMMARY OF MAJOR IMPACTS AND MITIGATION MEASURES

This section addresses the socioeconomic and environmental consequences of the proposed projects. The process of designing the various components has included meeting with government officials to identify regulatory requirements and an analysis of the subject property to identify existing or potential constraints that may impact the projects. Thus, the projects as they are described in this document represent the applicant's best efforts to avoid significant environmental impacts to every extent practicable.

To determine potential impacts, a study area was defined around the alignment of each of the proposed projects. It should be noted that the size of the study areas should not be confused with the size of the proposed projects, if approved. The study areas were sized to allow for design flexibility and therefore are much larger then the physical area to be actually impacted by the various project elements. The total study area is approximately 116 acres. Table 2 below summarizes the elements of the four proposed projects and compares the study area to the estimated impact area.

Table 2: Comparision of Study Areas and Impact Areas

PROJECT	ELEMENT	DESCRIPTION	STUDY AREA	IMPACT AREA
One	1	Roadway Corridor	77 acres	7 acres
Two	1	2.0 MG Irrigation Reservoir	6 acres	2 acres
	2	2.0 MG Irrigation Reservoir	6 acres	2 acres
	3	12-inch Irriation Influent Line	6 acres	1.2 acres
	4	12-inch Irrigation Influent Line	5.2 acres	1 acre
	5	24-inch Irrigation Transmission Line	1.9 acres	.6 acre
	6	Relocate Kona Village Water Tank	1 acre	1 acre
Three	1	1.0 MG Potable Water Tank	1 acre	1 acre
	2	16-inch Potable Transmission Line	6.4 acres	.25 acre
Four	1	Percolation Pit Test Area	4 acres	.1 acre
TOTAL			**114.5 acres**	**16.15 acres**

3.1. Social and Economic Considerations

The overall social and economic impacts associated with the proposed action are expected to be positive as the proposed infrastructure supports continuing development of the Ka'upulehu Resort Destination Node as stated in the State's West Hawaii Resort plan and the Hawaii County General Plan. Development of the proposed projects will provide short-term construction employment, and long term employment for the operation of the resort facilities.

Development of the Ka'upulehu Resort will contribute to continued population growth and economic development in North Kona. The effects of this general growth are expected to be significant and are described in detail in the Ka'upulehu Resort Final EIS (BCA, 1986) and the Kaupulehu Resort Expansion Area Final EIS (BCH, 1994). Those documents concluded that the socioeconomic effects of the resort project will be positive due to its contributions to regional employment and increased tax revenues.

The infrastructure, in and of itself, will have a indirect impact upon the socioeconomic character of the area in that the residential and golf course components of the Hualalai Resort Phase II and the Kaupulehu Resort Expansion Area will require potable water and non-potable irrigation water to open. Without the water, the resort components will not be suitable for occupancy. However, because the scale of the proposed resort development is considerably less than originally proposed, the resulting socioeconomic impacts of the project, including the development of the infrastructure discussed in this document, are less than what was anticipated in the 1986 and 1994 EISs referenced above.

Construction of the proposed infrastructure will not generate any direct increase in population since the irrigation water and potable water to be provided by the infrastructure will serve areas that have already been approved for development and were the subjects of separate environmental impact statements. The proposed projects will have a positive indirect impact upon the economy of the area in terms of short term construction jobs they generate.

3.2. Environmental Considerations

3.2.1. Geology and Topography

The proposed action will have no impact upon the geology of the Ka'upulehu region.

Impacts upon topography will be generally limited to the grading of the proposed access road, and construction of the two new non-potable irrigation reservoirs, which will require excavation of the reservoir basins as well as construction of berms up to fifteen feet in height. Excavation for the installation of the subterranean lines will not impact topography because the trenches will be filled to match the surrounding grade.

The impact of the access road construction is not anticipated to be significant because it will be generally limited to the grading of an approximately 36-foot strip across the lava. It will be constructed at-grade and will not alter the character of the existing topography.

The impact of the reservoir construction is not viewed as significant due to the size of the berm relative to the surrounding area, its slope, the varying topography of the a'a rubble in the region, and the character of the existing berm surrounding the existing irrigation lake. The non-potable tank site will be graded but no mitigation measures are deemed necessary. The potable water tank site will also be graded. Due to its proximity to *Po'opo'omino*, care will be taken during grading to ensure that the lower slopes of the foothill are not impacted.

Trenches for the transmission lines will be backfilled with excavated material and the surface will be restored to a natural looking character.

The bore holes for the percolation tests will be backfilled with core samples.

3.2.2. Soils and Agriculture Potential

The proposed action will not result in a net loss of any soils or excavated lava rock, nor will it impact any land identified under the State's classification system known as Agricultural Lands of Importance to the State of Hawaii (ALISH). Excess lava rock excavated from the reservoir sites will be transported to the makai resort area and used as fill material.

3.2.3. Surface Water and Drainage

The proposed projects will have no significant impact upon drainage in the area. Because of the highly porous nature of the lava in the proposed project area, development of the proposed infrastructure is not expected to significantly impact the surface and drainage characteristics of the area. The various components of the proposed infrastructure will be designed in accordance with State and County drainage and runoff control standards. The test borings proposed as Project Three will aid in the determination of an appropriate size for a percolation pit to be constructed at some point in the future if substantial development occurs within the State Agriculture District.

3.2.4. Groundwater and Hydrology

The proposed irrigation and potable water infrastructure will not have a negative impact upon the area's groundwater or aquifer because they will be utilizing water provided by wells that have already been approved and developed for the specific purpose of supplying the resort area with potable and non-potable water. The test borings for the percolation pit will have no significant impact upon the area's hydrology because of the extremely small quantities of water

to be utilized during the percolation tests. No mitigation measures are proposed.

3.2.5. Natural Hazards

The proposed projects may be impacted by earthquakes and volcanic activity associated with Hualalai volcano. An earthquake of extreme intensity may result in damage to the reservoirs, storage tank, and/or the transmission pipes. However, because the irrigation lakes are to be situated at least 4,000 feet upslope from the nearest development (Queen Ka'ahumanu Highway), the accidental release of water will have no serious consequence or impact. Utilizing a conservative estimate for the porosity of a'a lava (5 gallons per minute), and identifying the potential drainage basin to be approximately 555,000 square feet (a 150 foot wide corridor extending downslope from the irrigation lakes to the highway) in one minute this narrow drainage basin could absorb approximately 2.775 million gallons of water. However, the potential occurrence of a damaging earthquake will be taken into account in the design of the berms protecting the makai side of the new irrigation lakes. Final design of the berm will be coordinated with all applicable government agencies including the DLNR.

Construction of the proposed access road will be beneficial for the region in terms of providing a new evacuation route to the upland areas in the event of a tsunami which would require evacuation of the coastal resorts.

3.2.6. Climate and Meteorology

Construction and operation of the various projects will have no impact upon climactic conditions in the region.

3.2.7. Air and Noise Quality

Excavation of the proposed irrigation lakes and trenches for the transmission lines, grading the proposed access roadway, as well as construction of the proposed water tanks will result in short-term impacts upon air quality, principally in the form of dust generated by construction vehicles. However, the relative absence of top soil in the area will greatly limit the volume of dust generated and consequently, the potential for a significant impact. Exhaust emissions from construction vehicles will also have a short-term impact on air quality. To mitigate the potential impacts and to ensure that fugitive dust is adequately controlled, the construction sites will be frequently watered by a tanker truck.

Because of the relatively low density of human activity in the area, the ambient noise quality of the Ka'upulehu area is undermined only by vehicular traffic along Queen Ka'ahumanu Highway. Thus, while construction of the proposed project could produce a short-term negative impact on noise quality, in reality, there are no significant human or biological receptors in the

area that could reasonably be disturbed by the noise. Long term operation and periodic maintenance of the irrigation lakes, non-potable water tank, potable water tank and pipe lines will, on the other hand, have no measurable impact. Therefore, no mitigation measures are proposed.

3.2.8. Visual Attributes

Portions of the proposed access road will be visible from segments of Queen Ka'ahumanu Highway were mauka views are not restricted by existing topography. These portions of the access road will appear from those highway segments as a break or gap in the uniform character of the natural topography. However, this impact is not anticipated to be significant.

To mitigate the road's visual impact, it will be paved with asphalt which will blend the natural color of the lava. In addition, landscaping along the roadway shoulders will be in a manner that is consistent with the surrounding environment. A regular maintenance program will be implemented to control the growth of fountain grass along the graded shoulders of the roadway, thereby eliminating the potential for a linear strip of vegetation to establish itself along the shoulders and disrupt the otherwise random appearance of the vegetation. Finally, the roadway is not intended to be lit with street lights. To mitigate the visual impact of the proposed sign on the access road near its intersection with Queen Ka'ahumanu Highway, the sign will be constructed largely of natural lava, giving the appearance of short section of lava stone wall.

No significant visual impacts will result from the construction or operation of the remaining proposed projects. To mitigate the potential view of the proposed potable water tank from Queen Ka'ahumanu Highway, the tank has been sited so as to be generally concealed behind the natural lava hill, *Pu'u Po'opo'omino*. However, the upper half of the tank will be visible from the intersection of Queen Ka'ahumanu Highway and Ka'upulehu Drive. The tank will be painted to blend into the landscape.

Because the existing non-potable Kona Village tank is not visible from the highway, the proposed non-potable replacement tank is not expected to be visible. The water transmission lines will be buried and therefore will not be visible. The fill material used to cover the lines will match the surrounding lava rock. Potential views of the non-potable irrigation reservoirs from the highway will be mitigated by using an a'a berm to form the makai end of the reservoirs in the same manner as the existing reservoir has been constructed. The resulting appearance will be indistinguishable from the character of the surrounding landscape, resulting in no visual impact from the highway.

3.2.9. Flora

Development of the proposed project will result in the loss of some vegetation in the areas to be excavated and/or graded for construction. However, the loss of this vegetation is not considered to be significant because it is commonly found throughout the region and in similar environmental conditions around the state. Mitigation measures to minimize the impact are, therefore, not warranted. Fountain grass or shrub ilima will reestablish itself naturally along the disturbed areas. However, as discussed above, the growth of fountain grass along the access roadway shoulders will be prevented through regular maintenance program to minimize any potential visual impacts that could result from a linear strip of fountain grass in an otherwise randomly vegetated area.

3.2.10. Fauna

No significant bird or mammal habitats have been identified in the study area. Although birds and mammals do frequent the area, the proposed projects are unlikely to impact them. No significant impacts are anticipated. Donkeys observed in the area will not be disturbed. Their continued use of the existing jeep trail will not be cut off or restricted by these projects. Construction of the proposed non-potable irrigation reservoirs is not anticipated to impact the birds attracted to the existing reservoir, including the Hawaiian Stilt and Pacific Golden Plover. Because the two proposed reservoirs are to be designed in the same manner as the existing reservoir, it is likely that the reservoirs will be equally attractive to the stilts and plovers.

3.2.11. Historical and Archaeological Resources

The portion of the trail (Site 10977) crossing the alignment of the proposed access road will be impacted by construction of the roadway. To mitigate the impact, it is recommended that the trail be breached in only one area and that a treatment plan be prepared for the resource. The treatment plan will include restoration and interpretation elements that are consistent with the restoration and interpretation measures that have been implemented for portions of the trail within the Hualalai resort makai of Queen Ka'ahumanu Highway. At the point of the breach, the trail alignment will be preserved through the use of distinct pavement across the roadway.

The portion of the trail (Site 10977) crossing the existing utility corridor will be temporarily impacted during construction of the 24-inch subterranean potable transmission line. As was the case when the trail segment was originally breached by the construction of the existing subterranean transmission line and the existing access road, once construction of the proposed transmission line is completed, the trail surface will be restored to its pre-construction character. Persons desiring to use the trail during the construction period will be provided a temporary route that allows them to cross the construction trench within a safe and reasonable distance from the actual trail alignment. Once construction of the transmission line is completed,

the project will have no further impact upon the historic trail alignment.

Breaches to the trail will be subject to the same preservation strategy that was employed for the makai portion of the trail that runs through the resort development area makai of the highway (Rechtman 1999). That is, both preservation as is and rehabilitation following localized development improvements will be employed. In the area of the access road breach, the feeling of the trail will be maintained by placing a pavement of pahoehoe across the roadway corresponding to the trail right-of-way. Traffic safety signs will be placed on the roadside at the trail crossing and will contain the following cautionary language:

CAUTION PEDESTRIAN CROSSING
Hu'ehu'e–Ka'upulehu Trail

In addition, interpretive signs will be placed along the trail at key locations (potential points of ingress) to provide educational information about the resource. The signs will read as follows:

Hu'ehu'e–Ka'upulehu Trail

State Site 10977
Ka'upulehu Ahupua'a

You are walking along the historic Hu'ehu'e-Ka'upulehu Trail. This was the main ahupua'a upland/coastal transportation route. Used first before European contact by Hawaiians as a footpath and later during historic times by horse and cart, this trail provided coastal inhabitants access to upland agricultural and forest resources, and upland inhabitants access to the resources of the coast. Please take care not to move or rearrange rocks along this historic site.

This resource is protected under State Law, Chapter 6E-11 Hawai'i Revised Statutes

In the area of the pipeline breach, once construction of the pipeline has been completed, the surface of the trail will be restored to match the pre-construction condition of the trail. In addition, the developers of the golf course proposed in the Agriculture District have committed to provide additional interpretive information at the golf course and to work with Ms. Springer and other community members to develop language to be used in the interpretive displays. All interpretive efforts will be submitted to the State Historic Preservation Division of DLNR for review prior to finalization and implementation.

Sites 22498 and 22499 will be preserved in place and will not be impacted by the

construction or operation of the proposed access road.

If subsurface archaeological resources are discovered during the course of grading or excavation, construction will be halted and an archaeologist will be consulted to determine the significance of the discovery, according to procedures established by the Historic Preservation Division of the DLNR.

3.2.12. Cultural Resources

Based upon extensive oral histories conducted with *kama'aina* of the Ka'upulehu area, two significant cultural resources have been identified in the general project area.

The first is the hill known as *Po'opo'omino* which is situated at an elevation of about 400 feet and is circumvented by the utility corridor. The proposed potable water tank will be situated on the uphill side of the hill near its base. No impacts to the hill are anticipated during construction of the water tank and the transmission line.

The second identified cultural site is a branch of the Kukio Puhia Pele trail which extends to Kahuwai Bay (site 10977), and is discussed above.

Given that the proposed potable water tank (portion of Project Three) will be situated low on the southeast margin of the *pu'u*, its placement will not affect the viewplane to this prominent landscape feature from either the mauka or makai trail (site 1193), or from the shoreline. It is therefore determined that the proposed development will have no significant effect on the traditional cultural property of *Pu'u Po'opo'omino*.

As the overall lava flow landscape is not a precisely delimited cultural property, but rather a conceptual resource, it is difficult to assess the exact nature of any potential impacts resulting from construction of the proposed projects. However, as the lava flows hold potential cultural significance, and identified potential significance to at least one *kama'aina* family, it is recommended that recognition of this significance be incorporated into the interpretive effort associated with the Hu'ehu'e-Ka'upulehu trail. An interpretive signs(s) will inform visitors about the significance of the lava flows, other cultural sites, and the culturally significant flora and fauna of the general region.

3.2.13. Access and Traffic

Construction of the proposed access road will provide a direct route from Queen Ka'ahumanu Highway to a golf course that has been approved for construction in the State Agriculture District. Based on an assumption that the peak hour of the day for traffic impacts on the highway is between 3:00 PM and 4:45 PM, it is estimated that the proposed golf course will

generate approximately 22 in-bound peak hour vehicular trips and 28 out-bound peak hour vehicular trips. This represents about 3 percent of the existing peak hour two-directional traffic on the highway.

To mitigate potential vehicular impacts, a dedicated north-bound right turn lane and a south-bound left turn lane will be provided on Queen Ka'ahumanu Highway.

Vehicular access to the existing service road in the utility corridor and the existing jeep trail in the irrigation utility corridor will be restricted (as is now the practice) and limited to construction vehicles during construction. Upon completion of the various projects, vehicular access will be generally restricted to maintenance personnel via the existing intersections of the jeep trails with Queen Ka'ahumanu Highway.

Traffic impacts related to the movement of construction vehicles and workers is considered to be minimal since most vehicular activity will occur on the privately owned service roads and the construction work is not considered to be labor intensive.

3.2.14. Wastewater and Solid Waste Disposal

The proposed facilities will not generate any wastewater. However, the provision of the non-potable irrigation lakes, non-potable tank, and potable irrigation tank, and all new irrigation lines will enable the makai area golf course to operate, as well as increase use of the makai resort facilities. Wastewater generated at the golf course and resort will be treated at a private wastewater treatment plant on the resort property makai of Queen Ka'ahumanu Highway, and outside of the CDUA land. Thus, the construction of the proposed projects will have an indirect impact upon wastewater disposal at the resort.

The proposed projects will have no direct impact upon solid waste collection or disposal in the Ka'upulehu area. However, as is the case with wastewater, construction of the irrigation systems will indirectly impact the solid waste generated by use of the resort and golf courses. It is expected that the golf courses will generate limited amounts of solid waste for collection and disposal.

3.2.15. Electrical Power and Communications Systems

The proposed project will not require electrical transmission or communications facilities to cross the Conservation District.

3.2.16. Public Schools; Health Care Facilities; Police and Fire Protection Services

The proposed action will not affect the existing or future operation of schools or health

care facilities. Fire protection services will be positively affected by the construction of the irrigation system which will ensure adequate flow of water for fire protection. The development of the new non-potable irrigation lake will help to increase water availability to Hualalai Resort, thus increasing the fire protection capabilities of the area. Construction of the proposed action will, however, have a short-term impact on traffic flow along Queen Ka'ahumanu Highway in the form of a limited number of additional vehicles utilized by construction workers traveling to and from the construction site. Construction of the proposed access road will have a beneficial impact for emergency vehicles by providing direct access between Mamalahoa Highway and Queen Ka'ahumanu Highway within the *ahupua'a* of Ka'upulehu.

3.2.17. Recreational Resources

Without the proposed infrastructure, construction of Hualalai Resort's second golf course will not be possible. The course is intended to serve as an important recreational facility for the resort. Thus, construction of the infrastructure will have a positive impact on the provision of a new recreation resource in the region.

4. ALTERNATIVES CONSIDERED

Known feasible alternatives to the proposed project elements are limited to those that would allow the objectives of the proposed project area to be met while minimizing potential adverse environmental impacts. As noted before, the proposed project has been designed to provide an effective, efficient and environmentally acceptable means of providing potable and non-potable water services to the resort facilities makai of Queen Ka'ahumanu Highway. As described in the preceding section of this Environmental Assessment, the proposed project is expected to have minimal and/or positive impacts upon the physical, natural, social and economic environments of the project area. In compliance with applicable regulations, other possible alternatives to the proposed project have been investigated and rejected for a variety of reasons.

4.1. Project One: Access Road

4.1.1. No Action

Demand for the proposed access road was anticipated and the project approved approximately 10 years ago. However, as discussed earlier a downturn in the economy delayed its construction and the CDU permit subsequently expired. This present proposal to build the access road fulfills the original intent of the project.

In the past year, the County of Hawaii approved a Use Permit for a golf course in the State Agriculture District. A condition of that approval is the requirement to provide access to the golf course from Queen Ka'ahumanu Highway. The proposed road is intended to fulfill that requirement. The No Action alternative would result in the applicant's inability to fulfill the condition.

4.1.2. Location

The location of the proposed access road is dictated by four restrictive conditions. First, the existing intersection of Ka'upulehu Drive and Queen Ka'ahumanu Highway establishes the mauka access road's intersection with the highway. Since the DOT will not permit a second intersection in the vicinity of the first at Ka'upuiehu, there is no feasible alternative to the existing intersection.

The second consideration is the slope of the land. The proposed alignment has been engineered to comply with government design standards for a two-lane road in an agricultural area, including grade and maximum allowable horizontal curvature.

The third consideration is the geological character of the land. The proposed alignment avoids a series of lava tubes that have been identified in the mauka area.

The fourth consideration is cost. The proposed alignment represents the most direct connection between the highway and the Agriculture District, given the above three considerations. Alternative alignments were considered but none were able to meet all the stated considerations.

4.1.3. Design

The proposed design of the roadway complies with all appropriate state and county roadway standards, while minimizing its visual impact. Other more elaborate designs were considered, such as additional lanes and different paving materials, but these were rejected because they were not consistent with the applicant's objective to construct an access road with minimal impact to the physical environment.

4.2. Project Two: Irrigation Infrastructure

4.2.1. No Action

The non-potable irrigation lakes are required to provide adequate irrigation to the Ka'upulehu resort area. Not constructing the lakes debilitates the operation of the resort, as well as the growth of the resort area, which would be contrary to the goals and objectives of the Hawaii County General Plan. For these reasons, this alternative was rejected.

4.2.2. Location

The proposed location of the non-potable irrigation reservoirs are dependent upon two considerations: the location of the existing reservoir and distribution line, and the elevation needed to achieve optimal operation of the gravity flow system.

Constructing the reservoirs near the existing reservoir and distribution line would allow the new reservoirs to connect to the existing utility corridor. Removing the proposed reservoirs to a site farther from the existing facility increases cost as well as environmental impacts associated with the project because the added length of the required transmission line and the need for another service road to access the reservoirs would increase the size of the area to be impacted.

Relocating the reservoirs to a higher elevation would likely require additional pressure reduction valves which would add cost to the project as well as require additional ground disturbance. Relocation of the reservoirs to a lower elevation would result in inadequate water pressure for irrigation in the upper service area.

Locating the 12-inch influent line (Project Two-Element 3) for Reservoir #1outside of the existing non-potable utility corridor would impact a currently undisturbed area and would

increase the cost of the project.

The applicant has also considered an alternative location for the 12-inch influent line (Project Two-Element 4), which is intended to serve Reservoir #2. This alternative route would follow the proposed alignment of Project One, the access road. However, the alternative would result in a more circuitous, and consequently costly, route which would result in greater ground disturbance than the preferred alternative. For this reason, the alternate alignment was rejected.

The site of the proposed replacement water tank was selected because of its proximity to existing infrastructure. Constructing the Kona Village replacement tank (Element 6) outside of the existing non-potable utility corridor would impact a currently undisturbed area and would increase the cost of the project because it would require an additional transmission line to connect to the existing 4-inch line.

4.2.3. Design

A potential design alternative for the Project Two-Elements 1 and 2 is to utilize a water tank instead of an irrigation reservoir to store the well water. To store 4 million gallons of water, two tanks approximately 130 feet in diameter and about 20 feet high would be required. This alternative was rejected, however, because the cost of constructing the irrigation reservoirs will be considerably less than constructing enclosed tanks.

Reducing the size of the transmission line would also constrain the operation of the system because it would not deliver the volume of water required on a daily basis to irrigate the proposed golf course. Reducing the size of the influent line to the reservoirs would constrain the ability to refill the reservoirs nightly with a volume of water sufficient to meet the next day's needs.

4.3. Project Three: Potable Water Tank and Line Alternatives

4.3.1. No action

The potable water tank and transmission line are required to provide adequate potable water to meet the needs of the Hualalai Resort's Phase II. Not constructing the tank debilitates the operation of the resort and its recreation activities. Reduced operation inhibits the growth of the resort in general. For this reason, this alternative was rejected.

4.3.2. Location

The proposed location of the potable water tank is dependent upon the location of the existing supply wells and the elevation needed to ensure adequate pressure to the gravity flow system. As discussed above, the resort area makai of the highway is generally divided into two

service areas. The existing potable water system serves the so-called "lower" service system which extends from an elevation of about 140 feet to the shoreline. The new system is needed to provide adequate water pressure to the "upper" service area which extends from the 140 foot elevation up to the highway.

The proposed water tank location utilizes the old access road, utility corridor, and existing jeep trail to keep the cost and environmental impacts of constructing a new service road to a minimum. This location was also deemed best as it sites the tank behind a natural hill, *Pu'u Po'opo'omino*, and therefore minimizing visual impacts as it is out of site from Queen Ka'ahumanu Highway.

If the proposed tank were located at an elevation lower than 414 feet, the resulting water pressure would be inadequate per the County's Department of Water Service (DPS) standards. Placing the tank at a lower elevation would also impact views from the highway and could potentially impact *Po'opo'omino*, if it were built closer to the foothill.

Placing the tank at a higher elevation would require additional pressure reducing valves to ensure that the water pressure in the upper service area was in line with county standards.

For these reasons, relocating the water tank and line to alternate elevations was rejected.

4.3.3. Design

The proposed water tank will have a capacity of one million gallons. Construction of a single tank, rather than several small tanks, will reduce visual impacts as well as overall construction costs. Reducing the size of the transmission line would constrain the operation of the potable system because it would not deliver the volume of water required on a daily basis by the resort.

4.4. Project Four: Test Borings

Because the proposed percolation pit is intended to mitigate regional storm water flow during a worst-case scenario by providing a short-term retention basin for storm water that is flowing toward the existing drainage culverts under the highway, its location is tied to the location of the culverts. Therefore, the only alternative is no action. A No Action alternative would involve no test borings to determine the percolation rate which is needed to calculate the size of the proposed percolation pit. While a percolation pit could still be constructed, its effectiveness could only be estimated without the necessary data. If the plan for a percolation pit were abandoned, storm runoff resulting from a worst-case event might overtop the highway (although no such event has occurred to date in the area), which would pose an immediate hazard to motorists as well as a potential flood hazard to proposed resort development near the makai edge

of the 150-foot setback area established on the makai side of the highway right-of-way. For these reasons, the No Action alternative has been rejected.

4.5. Summary

The above alternatives have been rejected in part because they do not meet the objectives of the proposed project: to provide an effective, efficient and environmentally acceptable means of transporting potable and non-potable water from upland wells to the planned and existing Ka'upulehu resort facilities; to minimize environmental impacts from the proposed project; and to be economically feasible.

5. DETERMINATION

Based on the information available and the design of the physical components of the proposed projects, it has been determined that development of the non-potable irrigation reservoirs, the non-potable and potable irrigation tanks, the various transmission lines and access road as described herein, and the test borings proposed for the future percolation pit would result in positive socioeconomic benefits and would not have significant negative impacts upon the environment. Furthermore, the preparation of this EA is in full compliance with the environmental disclosure process, as defined in Chapter 343, Hawaii Revised Statutes, and Chapter 200, Department of Health Environmental Impact Statement Rules. Therefore, a finding of no significant impact (FONSI) is anticipated and no environmental impact statement will be required for the proposed action.

6. FINDINGS AND REASONS SUPPORTING DETERMINATION

In considering the significance of potential environmental effects, the applicant has considered the sum of effects on the quality of the environment and evaluated the overall cumulative effects of the proposed action. The applicant has considered every aspect of the proposed action and the expected consequences, both primary and secondary and the cumulative as well as the short and long term effects of the proposed action. As a result of these considerations, the applicant has determined that :

a. The proposed action does not involve an irrevocable commitment to loss of destruction of any significant natural or cultural resources. No significant biological resources have been identified in any of the proposed development sites. One of two significant cultural properties identified in the proximity of the utility corridor will be impacted by construction of the subterranean potable transmission line and the access roadway. However, this impact can be mitigated by restoring the pre-construction character of the trail after construction of the subterranean line and by paving the trail crossing on the access road with pahoehoe and providing appropriate signage.

b. The proposed action increases the range of beneficial uses of the environment as it provides infrastructure needed to ensure the economic viability of the resort area. The new access road will be beneficial as a mauka-makai evacuation route and will also benefit emergency vehicles desiring direct access between Mamalahoa Highway and Queen Ka'ahumanu Highway.

c. Approval of the requested CDUP(s) and the implementation of the proposed action would result in the realization of the County's long term environmental and land use policies, goals, and guidelines as expressed in the Hawaii County General Plan. The proposed action as a whole contributes to economic and recreational activities in the Ka'upulehu area. In addition, the projects neither undermine the scenic views and inherent beauty of the region, or the quality of the natural environment.

d. The proposed action does not adversely affect the economic or social welfare of the community or State. The proposed action would evoke a positive affect on the economic and social welfare of the community as it provides both short term and indirect long term employment within the Ka'upulehu lands by ensuring the continued economic viability of the resort.

e. The proposed action does not involve substantial secondary impacts such as population changes or effects upon public facilities such as schools, health care, police, and fire department impacts. The proposed infrastructure is necessary to continue development of the resort area in a manner consistent with land use approvals that have already been

granted by the County of Hawaii.

f. The proposed action does not increase the demand for public services or facilities that are not already contemplated. The facilities will all be privately funded.

g. The proposed action does not substantially affect public health. The proposed potable water infrastructure will benefit public health by ensuring that guests and residents of the resort areas will be provided with potable drinking water.

h. The proposed action does not involve substantial degradation of environmental quality. No significant environmental resources have been identified in the project area.

i. The proposed action does not substantially affect rare, threatened, or endangered species or habitats. None have been identified within the project area.

j. The proposed action does not detrimentally affect air or water quality or ambient noise levels. The general lack of top soil minimizes the amount of dust that will be generated by construction activities. Short term impacts on air quality resulting from grading activities can be adequately mitigated with a dust control program. Due to the lack of residential development near any of the proposed project elements, noise impacts resulting from construction activities are non-significant.

k. The proposed action does not substantially affect an environmentally sensitive area such as flood plain, tsunami zone, erosion prone area, geologically hazardous land, estuary or coastal waters. No environmentally sensitive areas have been identified within the area to be impacted by the project.

l. The proposed action does not substantially affect scenic vistas and view planes identified in County or State plans or studies. Views of Hualalai mountain and *Po'opo'omino* from Queen Ka'ahumanu Highway will not be obstructed or impacted by any elements of the proposed projects. Because the projects are all located mauka of the highway, views to the shoreline are not impacted. Visual impacts resulting from the construction of the roadway and proposed water tanks can be mitigated through proper design and the use of colors that blend with the surrounding environment.

m. The proposed action does not require substantial energy consumption as all the water-related infrastructure operates as a gravity flow system. The proposed access road will not include any form of lighting.

n. The proposed action does not involve a larger commitment for further actions. The infrastructure projects were all anticipated with the previously granted land use

approvals for the resort areas. The proposed access roadway represents the realignment of a previously approved and permitted roadway.

The proposed project has been designed to be compatible with the locality and surrounding area and is appropriate to the physical conditions characterizing the area. The mitigation measures proposed will ensure that the existing environmental character of the area will be preserved. The applicant will be responsible for, and comply with, all applicable statutes, ordinances and rules of the federal, state, and county governments.

7. PUBLIC AND AGENCY REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENT

A notification of the availability of the Draft EA was published on May 8, 2001 in the Bulletin of the Office of Environmental Quality Control. During the 30-day review and comment period, the Department of Land and Natural Resources, accepting agency for the EA, received five comment letters. Those letters are included in this section, together with responses prepared by the applicant's agent, Belt Collins Hawaii Ltd.

SIERRA CLUB
HAWAI'I CHAPTER
P.O. Box 2577, Honolulu, HI 96803
tel: 808.538.6616 fax: 808.537.9019

May 21, 2001

Roger Harris
PIA - Kona Limited Partnership
P.O. Box 803
Kamuela, HI 96743

Lee Sichter
Belt Collins
680 Ala Moana #100
Honolulu, HI 96813

Sirs:

It is entirely unclear from the description in the Environmental Notice what purpose the water system improvements along Queen Ka'ahumanu Highway serve. Who will receive this water and what growth along the coastline will this project facilitate?

The environmental assessment—or, more likely, an Environmental Impact Statement—needs to fully disclose the secondary growth inducing impacts of this project. The consultants and Department of Land and Natural Resources should be mindful of the Supreme Court's decision in the Kahana Sunset case.

Sincerely,

Jeff Mikulina
Director, Sierra Club, Hawai'i Chapter

cc. Office of Environmental Quality Control
Department of Land and Natural Resources, Eric Hill

BELT COLLINS

July 2, 2001
2000-33-2700 / 01P-186

Mr. Jeff Mikulina, Director
Sierra Club - Hawai'i Chapter
P.O. Box 2577
Honolulu, Hawaii 96803

Dear Mr. Mikulina:

Draft Environmental Assessment
Kaupulehu Infrastructure

We are writing on behalf of the applicant, PIA-Kona Limited Partnership, to respond to your letter of May 21, 2001 which provided comments on the above document.

As discussed in the Draft Environmental Assessment (EA), the proposed water system improvements represent an expansion of the existing system which provides service to the Hualalai Resort, the Kona Village Resort, and the Kaupulehu Resort. Specifically, the potable water will be provided to the Hualalai Resort Project District, which was approved by the Hawaii County Council last year and constitutes Phase II of the resort. The non-potable water will be shared by the Hualalai Project District and the Kaupulehu Resort Expansion Area.

The secondary growth inducing impacts of the project are discussed in Section 3.1 of the Draft EA.

Thank you for your advice concerning the importance of being mindful of Hawaii State Supreme Court decisions.

Very truly yours,

BELT COLLINS HAWAII LTD.

Lee Sichter

LS:lf

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BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/SDWB

June 12, 2001

To: Dean Y. Uchida, Administrator
Land Division
Department of Land and Natural Resources
Attention: Eric Hill

From: FOR Thomas E. Arizumi, P.E., Chief
Environmental Management Division
Department of Health

Subject: CONSERVATION DISTRICT USE APPLICATION HA-3029
WATER SYSTEM IMPROVEMENTS, ROADWAY AND TEST BORES
KAUPULEHU, NORTH KONA, HAWAII

The subject application and draft environmental assessment was transmitted directly to the Department of Health, Clean Water Branch, which has prepared comments under a separate correspondence. The Kaupulehu Infrastructure Draft Environmental Assessment was subsequently referred to the Department of Health, Safe Drinking Water Branch, which has the following comments to offer:

Safe Drinking Water

1. It would appear that the proposed project involves Public Water System No. 163, Kaupulehu. Hawaii Administrative Rules, Title 11, Chapter 20, Rules Relating to Potable Water Systems, section 11-20-30 requires that a substantially modified distribution systems for public water systems be approved by the Director.

2. The draft environmental assessment indicates that the proposed development has a dual water system. The potable and nonpotable water systems must be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply. In addition, all nonpotable spigots

and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption of nonpotable water.

Underground Injection Control (UIC)

1. If Project Four phase plans to use drainage injection wells (drywells), it will be necessary to obtain a UIC permit to authorize the construction and operation of these wells.

2. Injection wells cannot be sited within 1/4 mile of any drinking water source.

If you have any questions, please call William Wong, Chief, Safe Drinking Water Branch, at 586-4258.

SY:la

BENJAMIN J. CAYETANO
GOVERNOR

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

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/CWB

05062PKP.01

June 12, 2001

TO: Dean Y. Uchida
Administrator
Land Division
Department of Land and Natural Resources

ATTENTION: Eric Hill

FROM: Thomas E. Arizumi, P.E., Chief
Environmental Management Division
Department of Health

SUBJECT: **Conservation District Use Application HA-3029**
Water System Improvements, Roadway and Test Bores
Kaupulehu, North Kona, Hawaii

The Department of Health, Clean Water Branch (CWB) has reviewed the subject submittal and has the following comments:

1. The Army Corps of Engineers should be contacted to identify whether a Federal permit (including a Department of Army permit) is required for this project. If it is determined that a Federal permit is required for the subject project, then a Section 401 Water Quality Certification would also be required from CWB.

2. If the project involves any of the following discharges into State waters classified as Class A or Class 2, a National Pollutant Discharge Elimination System (NPDES) general permit is required for each activity:

   a. Storm water runoff associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than five (5) acres of total land area. (Note: If construction begins or continues after March 10, 2003, NPDES general permit coverage would also be required for construction activities, including clearing, grading, and excavation, that result in the disturbance of one (1) acre or more).

b. Hydrotesting water.

c. Construction dewatering effluent.

3. If the discharges mentioned in Item 2 above enter State waters classified as Class 1 or Class AA, an NPDES individual permit would be required. One individual permit could cover any or all types of discharges. From the maps provided in the submittal, it appears that discharges would enter either Class 1 inland waters or Class AA marine waters.

The CWB requires that Notices of Intent (NOI) for NPDES general permits be submitted thirty days before the discharge is to occur. NPDES individual permit applications should be submitted 180 days before the discharge is to occur. NOI and NPDES individual permit applications can be picked up at the CWB office or downloaded from our website at *http://www.state.hi.us/doh/eh/cwb/forms/index.html*.

Should you have any questions, please contact Kris Poentis of the Engineering Section, CWB, at (808) 586-4309.

KP:cr

BELT COLLINS

July 2, 2001
2000-33-2700 / 01P-187

Mr. Thomas E. Arizumi, P.E., Chief
Environmental Management Division
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Arizumi:

Draft Environmental Assessment
Kaupulehu Infrastructure

We are writing on behalf of the applicant, PIA-Kona Limited Partnership, to respond to your letters of June 12, 2001 which provided comments on the above document. Following are responses to the comments of the Safe Drinking Water Branch.

Safe Drinking Water

1. Acknowledged. The applicant will comply as requested.

2. Acknowledged. The applicant will comply as requested.

Underground Injection Control System

1. Acknowledged. The applicant will comply if drywells are utilized.

2. Acknowledged.

Following are responses to the comments of the Clean Water Branch.

1. No federal permit is required for the proposed projects.

2. The proposed projects will result in no discharge to State waters.

3. As discussed in the Draft Environmental Assessment and identified on the maps contained therein, the proposed projects are situated at least a mile inland from the coast, on the upland side of Queen Kaahumumanu Highway, in an area characterized by a'a and pahoehoe lava flows. There will be no discharge into Class 1 inland waters or Class AA marine waters.

Very truly yours,

BELT COLLINS HAWAII LTD.

Lee Sichter

LS:lf

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NA ALA HELE
Hawai'i Trail & Access System

June 4, 2001

MEMORANDUM

TO: Dean Uchida, Land Division Administrator

FROM: Rodney T. Oshiro, Na Ala Hele

SUBJECT: CDUA HA-3029
Water System Improvements, Roadways and Test Bores
Kaupulehu, North Kona, Hawaii
TMK 7-2-03:3 (por)

Na Ala Hele has a vital interest in the Huehue-Kaupulehu Trail and would like to invite PIA-Kona Limited Partnership to the monthly meetings of the Na Ala Hele Advisory Council to discuss any proposed breach, detour, or alteration of the trail. The council should be made aware of any adverse impact to the trail as a result of the proposed development.

Division of Forestry & Wildlife • Dept. of Land & Natural Resources • P.O. Box 4849 • Hilo, Hawaii 96720-0849

BELT COLLINS

July 2, 2001
2000-33-2700 / 01P-188

Mr. Rodney Oshiro
Na Ala Hele
Division of Forestry & Wildlife
Department of Land and Natural Resources
State of Hawaii
P.O. Box 4849
Hilo, Hawaii 96720-0849

Dear Mr. Oshiro:

Draft Environmental Assessment
Kaupulehu Infrastructure

We are writing on behalf of the applicant, PIA-Kona Limited Partnership, to respond to your memo of June 4, 2001 which provided comments on the above document. Mr. Roger Harris, representing the applicant, will be contacting you to schedule a presentation of the project at an upcoming meeting of the Na Ala Hele Advisory Council.

Very truly yours,

BELT COLLINS HAWAII LTD.

Lee Sichter

LS:lf

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BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

GENEVIEVE SALMONSON
DIRECTOR

June 7, 2001

Mr. Roger Harris
PIA - Kona Limited Partnership
P.O. Box 803
Kamuela, Hawai'i 96743

Mr. Harry Yada, Administrator
Land Division
Department of Land and Natural Resources
1151 Punchbowl Street, Room 220
Honolulu, Hawai'i 96813

Mr. Lee Sichter
Belt Collins Hawai'i
680 Ala Moana Boulevard, Suite 100
Honolulu, Hawai'i 96813

Dear Messrs. Harris, Yada and Sichter:

We have reviewed the draft environmental assessment entitled: "Ka'upulehu Infrastructure" and dated February 2001, for various improvments in the conservation district of north Kona at Tax Map Keys 7:2-3- parcel 3. We believe that the document is very well-written and we offer the following comments for your response and consideration.

1. Identification of consulted agencies, individuals and organizations. Pursuant to section 11-200-9(c) and 11-200-10, Hawai'i Administrative Rules, please list the individuals, agencies and organizations consulted prior to the issuance of the draft environmental assessment and anticipated finding of no significant impact.

2. Visual impacts: Please include photographs of the project site, especially as they relate to views of Pu'u Po'opo'omino and the proposed potable water tank.

3. Cumulative impacts: The Kuki'o project in the next TMK parcel will also be doing drilling and placing water tanks. Please assess the cumulative impacts of these two projects.

If there are any questions, please call Leslie Segundo at 586-4185. Thank you for the opportunity to comment.

Sincerely,

GENEVIEVE SALMONSON
Director

BELT COLLINS

July 2, 2001
2000-33-2700 / 01P-189

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
Department of Health
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Draft Environmental Assessment
Kaupulehu Infrastructure

We are writing on behalf of the applicant, PIA-Kona Limited Partnership, to respond to your letter of June 7, 2001 which provided comments on the above document.

1. The following individuals, agencies, and organizations were consulted prior to the issuance of the Draft Environmental Assessment: State Department of Land and Natural Resources, State Office of Environmental Quality Control, Hawaii County Planning Department, Mr. Fred Duerr (Kona Village Resort), Mr. Richard Albrecht (Hualalai Development Company), Mr. Alex Kinzler (Kaupulehu Developments), Ms. Hannah Springer, and Ms. Leinala Keakealani Lightner. A new subsection, section 1.6, will be added to the EA and will contain the above information.

2. Attached are ten (10) photographs of the project site which are pertinent to the proposed project.

3. Enclosed is a map provided by Akinaka & Associates, Ltd., the civil engineers for the Kukio project. The map shows the location of existing infrastructure in the area and the site of the proposed Kukio project elements. All of the Kukio elements lie within the State Urban District.

With regard to cumulative impacts, it appears that only the proposed Kaupulehu Potable Water Tank (Project Three-Element 1) may have a visual relationship to the Kukio project elements. The proposed Kukio water tank and water treatment plant appear to be located on the makai side of Poopoomino adjacent to the existing Kaupulehu Potable Water Tank. Because the proposed Kaupulehu water tank will be located behind Poopoomino, it will be physically separated from the Kukio project elements by the hill.

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From a visual perspective, the Kukio project elements, together with the existing Kaupulehu Water Tank and Element 1 of Project Three, may be visible from certain vantage points along Queen Kaahumanu Highway with an unobstructed view of the hill.

No cumulative impact on water resources is anticipated because both the Kaupulehu and Kukio water tank projects are intended to provide new storage capacity for existing wells. In addition, it appears that the Kukio project will be treating non-potable water prior to storage. Thus, it should have no impact upon the potable water resource at Kaupulehu.

Very truly yours,

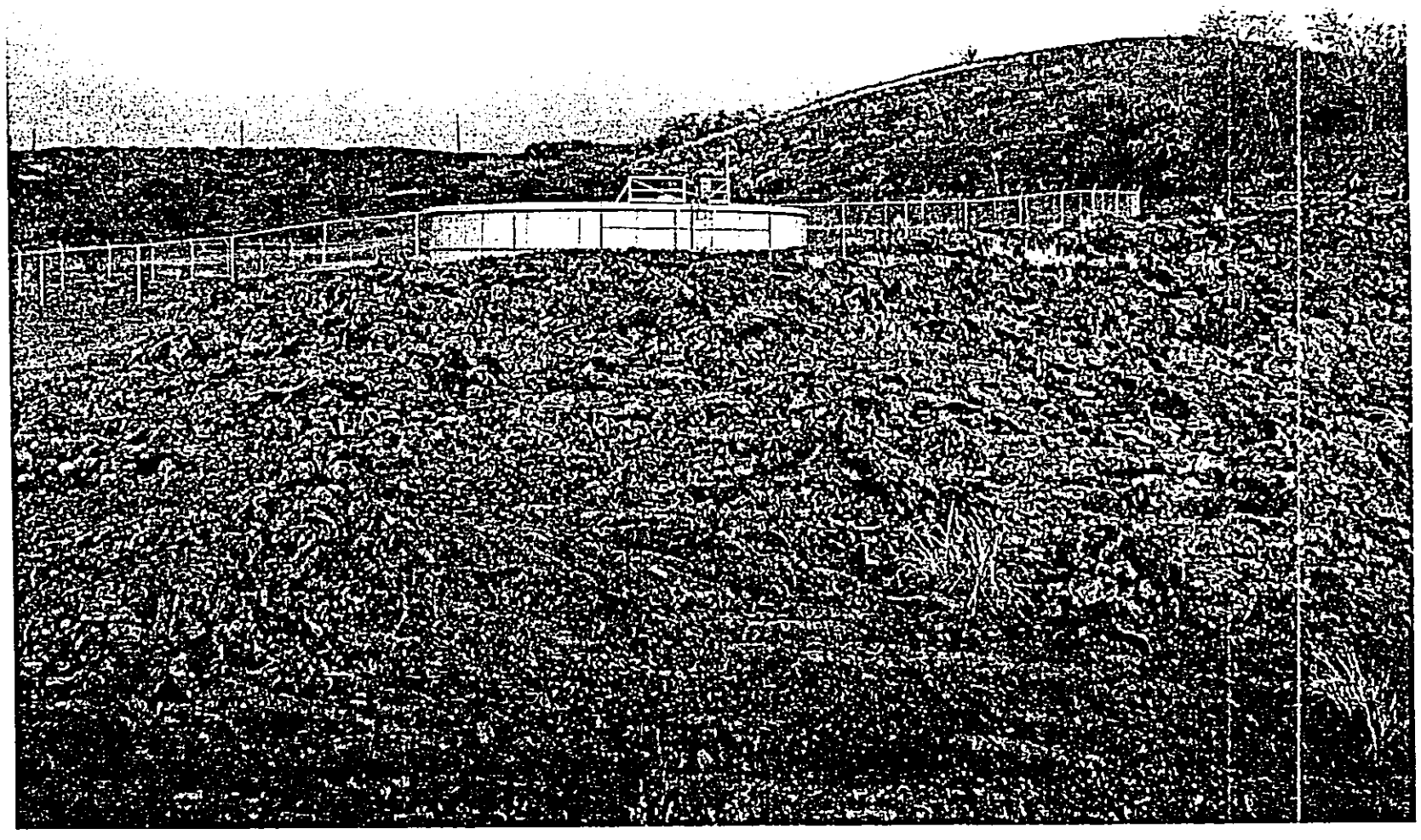
BELT COLLINS HAWAII LTD.

Lee Sichter

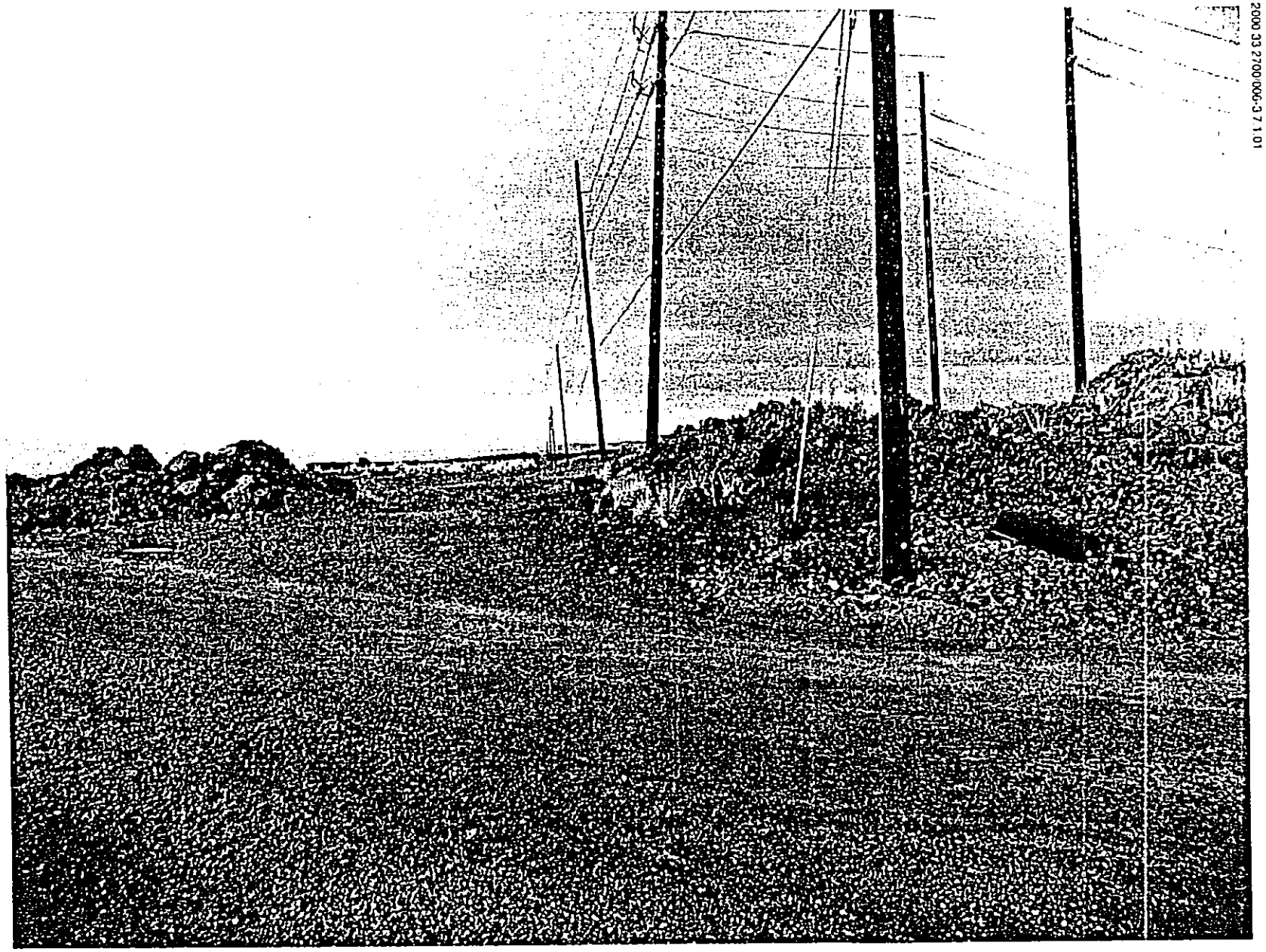
LS:lf

Enclosures

1. View of the existing utility corridor leading to the potable water tank.



2. Close-up of the existing potable water tank.

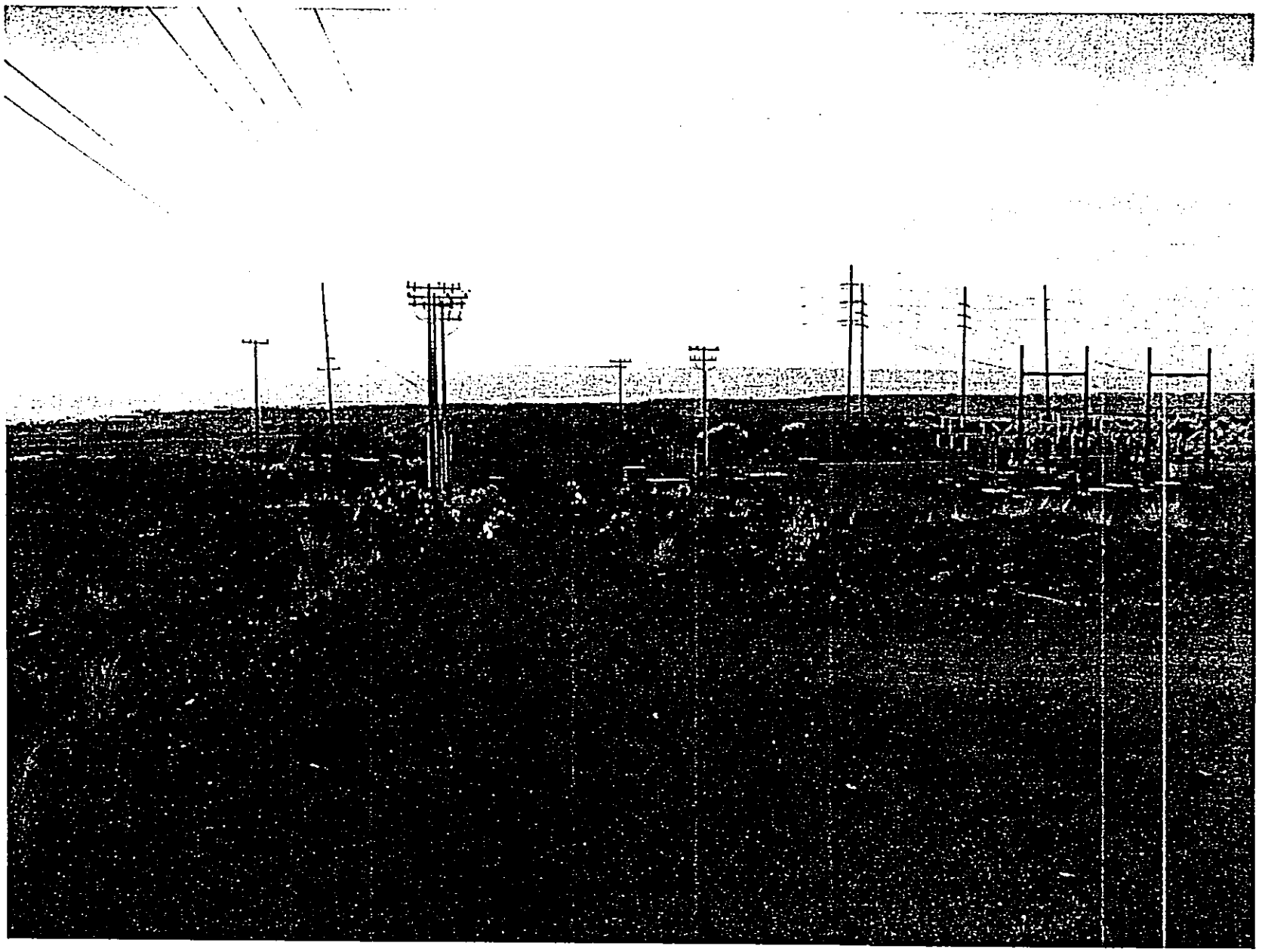


3. View of the existing HELCO utility poles looking east from the potable utility corridor.

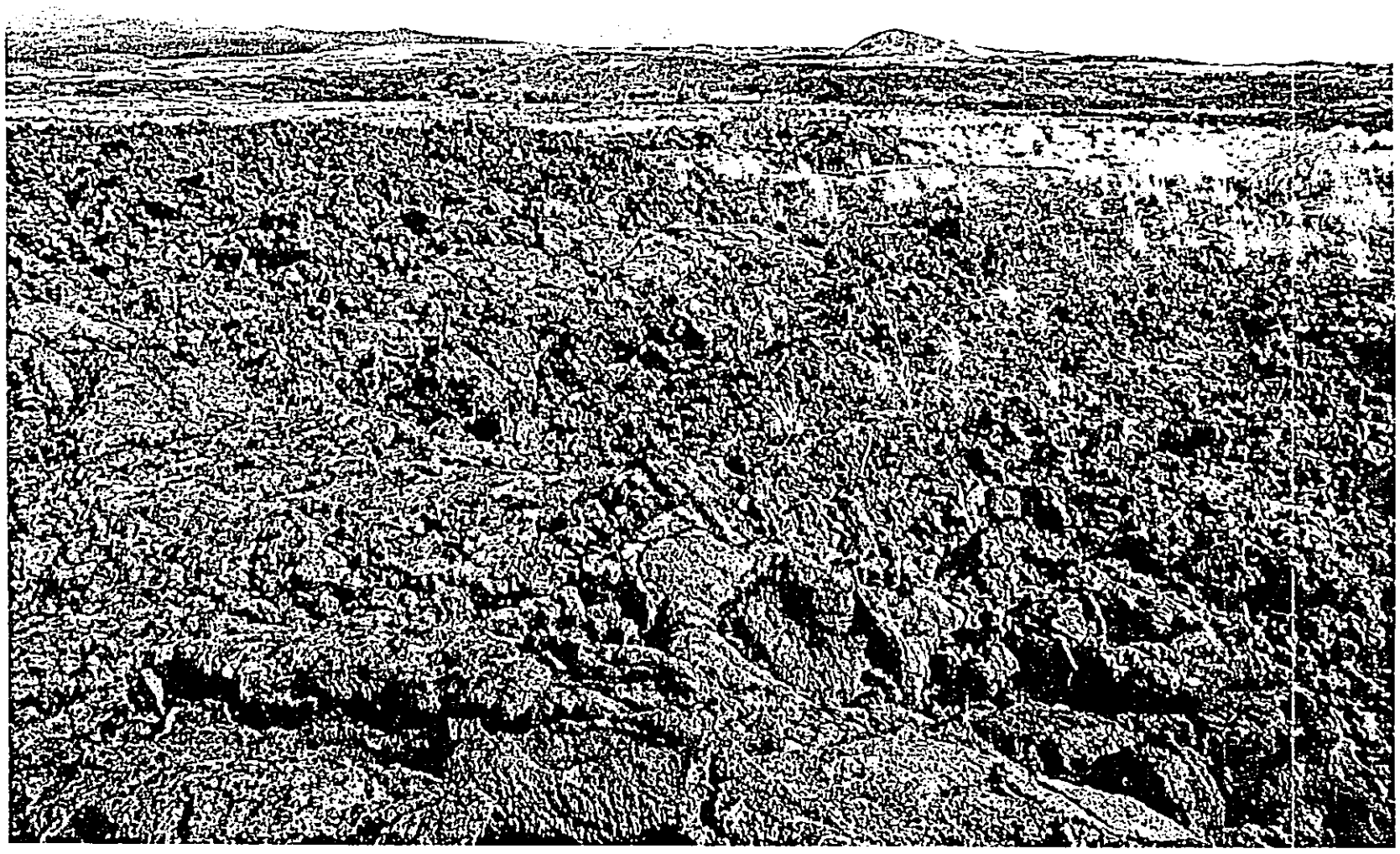
4. View of existing non-potable utility corridor looking mauka from Queen Kaahumanu Highway.

5. View of existing non-potable irrigation reservoir and existing Kona Village water tank.

6. Close-up of the non-potable irrigation reservoir.



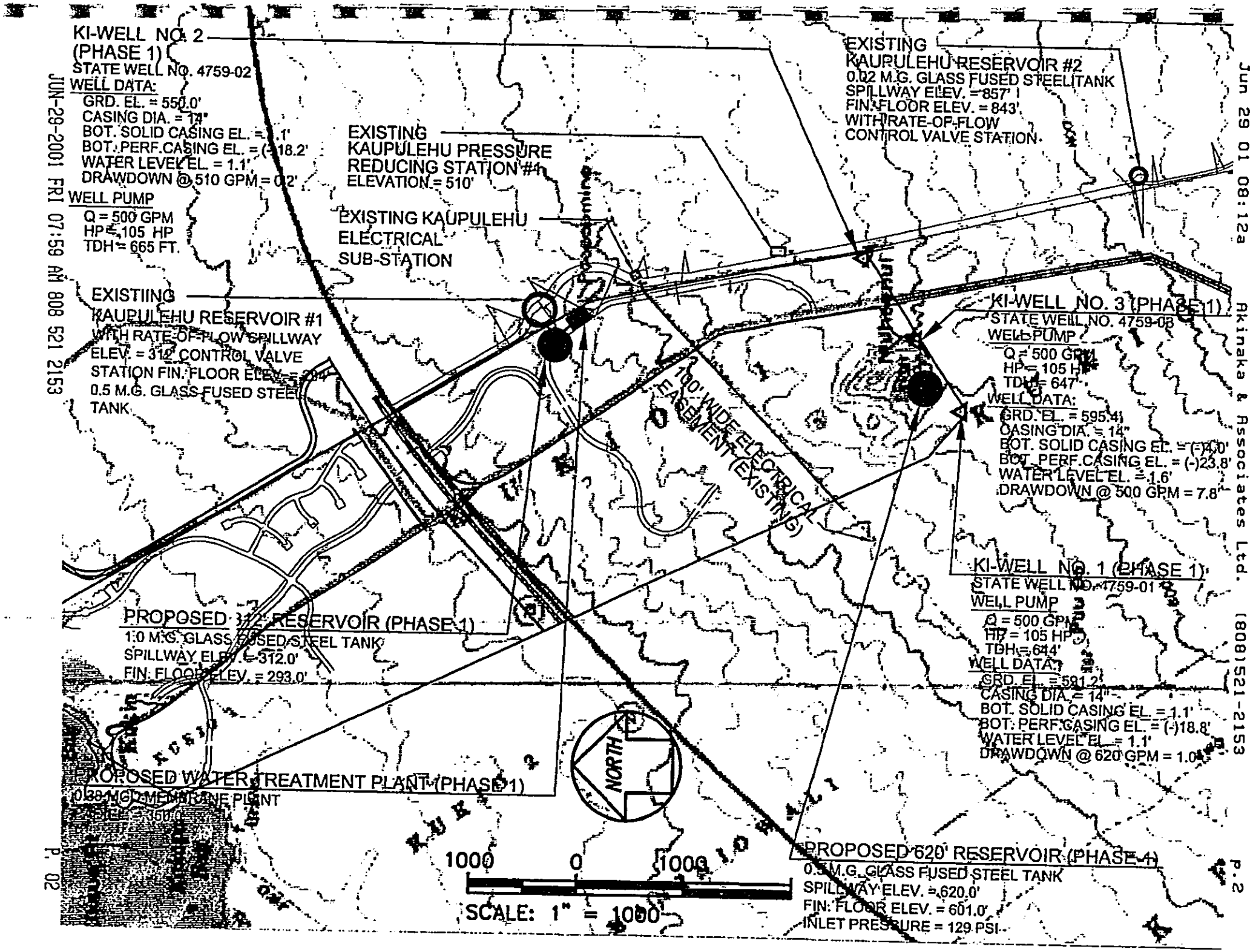
7. View of the existing electrical substation looking makai.



8. View of Poopoomino with existing potable reservoir just visible at lower right edge of the hill. Photo is looking mauka from Queen Kaahumanu Highway along Arch. Site 10977 (The Trail), which is faintly visible from the clumps of California grass extending in a diagonal from the center of the photo toward the upper right corner.

9. View looking mauka from the point where the trail intersects the proposed roadway corridor.

10. View from the trail looking mauka (east) toward the site of the existing non-potable reservoir and water tank, which are not visible due to the topography.


KI-WELL NO. 2 (PHASE 1)
STATE WELL NO. 4759-02
WELL DATA:
GRD. EL. = 550.0'
CASING DIA. = 14"
BOT. SOLID CASING EL. = 1.1'
BOT. PERF.CASING EL. = (-)18.2'
WATER LEVEL EL. = 1.1'
DRAWDOWN @ 510 GPM = 0.2'
WELL PUMP
Q = 500 GPM
HP = 105 HP
TDH = 665 FT.
EXISTING KAUPULEHU PRESSURE REDUCING STATION #1
ELEVATION = 510'
EXISTING KAUPULEHU ELECTRICAL SUB-STATION
EXISTING KAUPULEHU RESERVOIR #2
0.02 M.G. GLASS FUSED STEEL TANK
SPILLWAY ELEV. = 857'
FIN. FLOOR ELEV. = 843'
WITH RATE-OF-FLOW CONTROL VALVE STATION
EXISTING KAUPULEHU RESERVOIR #1
WITH RATE-OF-FLOW SPILLWAY ELEV. = 312' CONTROL VALVE STATION FIN. FLOOR ELEV. = 294'
0.5 M.G. GLASS FUSED STEEL TANK
100' WIDE ELECTRICAL EASEMENT (EXISTING)
KI-WELL NO. 3 (PHASE 1)
STATE WELL NO. 4759-03
WELL PUMP
Q = 500 GPM
HP = 105 HP
TDH = 647'
WELL DATA:
GRD. EL. = 595.4'
CASING DIA. = 14"
BOT. SOLID CASING EL. = (-)4.0'
BOT. PERF.CASING EL. = (-)23.8'
WATER LEVEL EL. = 1.6'
DRAWDOWN @ 500 GPM = 7.8'
KI-WELL NO. 1 (PHASE 1)
STATE WELL NO. 4759-01
WELL PUMP
Q = 500 GPM
HP = 105 HP
TDH = 644'
WELL DATA:
GRD. EL. = 581.2'
CASING DIA. = 14"
BOT. SOLID CASING EL. = 1.1'
BOT. PERF.CASING EL. = (-)18.8'
WATER LEVEL EL. = 1.1'
DRAWDOWN @ 620 GPM = 1.0'
PROPOSED 312' RESERVOIR (PHASE 1)
1.0 M.G. GLASS FUSED STEEL TANK
SPILLWAY ELEV. = 312.0'
FIN. FLOOR ELEV. = 293.0'
PROPOSED WATER TREATMENT PLANT (PHASE 1)
0.38 MGD MEMBRANE PLANT
PROPOSED 620' RESERVOIR (PHASE 1)
0.5 M.G. GLASS FUSED STEEL TANK
SPILLWAY ELEV. = 620.0'
FIN. FLOOR ELEV. = 601.0'
INLET PRESSURE = 129 PSI
NORTH
1000 0 1000
SCALE: 1" = 1000'

Appendix A

BOTANICAL SURVEY
KA'UPULEHU MAUKA LANDS
NORTH KONA DISTRICT, HAWAI'I

by

Winona P. Char
CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: BELT COLLINS HAWAII

August 2000

BOTANICAL SURVEY
KA'UPULEHU MAUKA LANDS
NORTH KONA DISTRICT, HAWAI'I

INTRODUCTION

Several projects are planned for the lands mauka of Queen Ka'ahumanu Highway, above the Ka'upulehu resort area. These projects are located within the State Conservation District.

The first project consists of a 100-foot wide, approximately 9,800-foot long utility corridor and a site for a proposed 0.5 MG potable water tank adjacent to the utility corridor. The second project is a 400-foot wide, approximately 8,400-foot long roadway corridor. The third project is a 20-foot wide, roughly 7,700-foot long irrigation/utility corridor; two irrigation reservoirs will be located adjacent to the irrigation/utility corridor. The fourth project is a percolation pit, approximately 4 acres in size, abutting the mauka side of the Queen Ka'ahumanu right-of-way.

These corridors and other sites cross over sparsely vegetated pahoehoe and 'a'a lava flows. Field studies to assess the botanical resources on the proposed projects were conducted on 31 July and 01 August 2000. Four botanists, working in teams of two each, were used to gather the data contained in this report. The primary objectives of the survey were to:

1) provide a general description of the vegetation on each of the sites;
2) inventory the flora;
3) search for threatened and endangered species as well as

species of concern; and

4) identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator and field botanists with other botanical studies conducted in the general area. Topographic maps with the projects identified were examined to determine terrain characteristics, access, boundaries, and reference points. The reservoir sites, percolation pit, and water tank site as well as the 400-foot wide corridor were flagged and staked by the survey engineers prior to our field studies. The other two corridors follow existing corridors and jeep roads.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, past and present disturbances, drainage, exposure, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium, and for comparison with the recent taxonomic literature.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions of the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the annual, weedy plants.

DESCRIPTION OF THE VEGETATION

There have been botanical surveys conducted for the two existing corridors. The 100-foot-wide corridor along the Ka'upulehu/Kuki'o boundary was surveyed by Char in December 1988, and the 20-foot wide irrigation corridor was surveyed in September 1993. Open scrub dominated by fountain grass (Pennisetum setaceum) occupied the areas with weathered pahoehoe lava flows, while 'a'a flows were largely barren. No threatened and endangered species or species of concern were found.

The four study areas support similar vegetation and are described below.

100-Foot Wide Utility Corridor and 0.5 MG Water Tank

The approximately 9,800-foot long corridor covers a total of 22.5 acres. This is an existing utility corridor that was originally granted a Conservation District Use Permit in the late 1980's.

From the Queen Ka'ahumanu Highway to just below the proposed 0.5 MG water tank, the corridor passes through weathered pahoehoe lava for the most part. In this area, fountain grass cover varies from 15 to as much as 40% cover. Other species are few and very scattered in distribution. These include kiawe (Prosopis pallida), 'ilima (Sida fallax), 'uhaloa (Waltheria indica), 'a'ali'i (Dodonaea viscosa), and indigo (Indigofera suffruticosa). Along the existing corridor, a few plants of golden crown-beard (Verbesina encelioides) and woolly mullein (Verbascum thapsus) are found.

The proposed water tank site (±1-acre) will be located at the base of Po'opo'omina, a small cinder cone, and near existing

structures. The cinder cone supports a grove of kiawe trees, 15 to 30 feet tall, at its base. Plant cover on the cinder substrate is about 90%, consisting primarily of fountain grass with scattered plants of 'ilima and 'uhaloa.

Above the proposed water tank site, the corridor passes over several 'a'a flows. These 'a'a flows are primarily barren. Plants tend to be found along the margins of the flow where it interfaces the pahoehoe flows, and also on small islands of pahoehoe scattered through the 'a'a flow.

Fountain grass on the pahoehoe flows above the proposed water tank is somewhat denser, about 60% cover. A few scattered lama trees (Diospyros sandwicensis) and shrubs of naio (Myoporum sandwicense) occur on this section. Near the upper end of the corridor is a small water tank. A small area which receives overflow from the tank supports a "lusher" growth of vegetation which includes tree tobacco (Nicotiana glauca), Chenopodium carinatum, 'alena (Boerhavia repens), garden spurge (Chamaesyce hirta), threadstem carpetweed (Molluga cerviana), hairy horseweed (Conyza bonariensis), fountain grass, and a sapling of silk oak (Grevillea robusta).

400-Foot Wide Roadway Corridor

The approximately 8,400-foot long corridor covers about 77.13 acres. It crosses over open scrub dominated by fountain grass on pahoehoe flows and several large fingers of barren 'a'a lava.

On the lower half of the corridor below the powerline (about 450 feet elevation), plant cover on the pahoehoe flows varies from 15 to 30% cover with the fountain grass 2 to 3 feet high. A few scattered low kiawe trees, 7 to 9 feet tall, are found here.

Other plants observed in the scrub vegetation include 'uhaloa, lovegrass (Eragrostis amabilis), comb hyptis (Hyptis pectinata), 'a'ali'i, noni (Morinda citrifolia), Portulaca pilosa, and threadstem carpetweed.

Along the upper half of the corridor above the powerline, fountain grass becomes denser, 80 to 90% cover, and the grass somewhat taller 3 to 3.5 feet high. Lama trees are also found along the corridor. Several large collapsed lava tube caves occur along the southern portion of the corridor. Some contain plants of the native peperomia or 'ala'ala wai nui (Peperomia blanda var. floribunda) and a native member of the mint family, the spurflower (Plectranthus parviflorus). Two fern species, the hairy swordfern (Nephrolepis multiflora) and the wood-fern (Christella parasitica), are also associated with these lava tube areas.

A small herd of about 11 goats were observed along the corridor. Donkey droppings and browsing damage are also common along this corridor as well as the other corridors.

20-Foot Wide Irrigation/Utility Corridor and Irrigation Reservoirs

The irrigation/utility corridor is roughly 7,700 feet long and covers 35.3 acres. There is an existing jeep road extending the length of the corridor. Along the bulldozed shoulders of the jeep road there are scattered plants of tree tobacco, golden crown-beard, fountain grass, and 'ilima. One dead plant of small crownflower (Calotropis procera) is found along the road.

Like the other corridors, this corridor passes through a mosaic of open scrub vegetation on pahoehoe flows and barren 'a'a flows. Again, the fountain grass cover is more open on the area below

the powerline and scattered, low trees of kiawe occur here. Above the powerline, the fountain grass cover becomes denser and trees of lama are occasionally observed. The two new irrigation reservoirs (total area approximately 12 acres) are found above the powerline on weathered pahoehoe lava. Two donkeys were observed here.

The corridor terminates at the irrigation well sites. The well site is fenced. A few weedy species occur within the fenced area, protected from the goats and donkeys. These include spiny amaranth (Amaranthus spinosus), sowthistle (Sonchus oleraceus), sourbush (Pluchea carolinensis), garden spurge, coat buttons (Tridax procumbens), threadstem carpetweed, yellow wood sorrel (Oxalis corniculata), purple cudweed (Gamochaeta purpurea), and maile hohono (Ageratum conyzoides).

Percolation Pit

The percolation pit consists of approximately 4 acres located on the mauka side of the Queen Ka'ahumanu right-of-way.

The percolation pit is sited on a large, barren 'a'a flow. Along the edges of the flow there are a few patches of weathered pahoehoe lava with fountain grass scrub, about 15% plant cover. Where the pit borders the right-of-way, there are a few kiawe trees and shrubs of sourbush and koa haole or ekoa (Leucaena leucocephala).

DISCUSSION AND RECOMMENDATIONS

The areas with weathered pahoehoe flows support an open scrub vegetation dominated by fountain grass. A few scattered kiawe trees, small shrubs, and herbaceous species occur along the lower half of the corridors. Along the upper half of the corridors, scattered native trees and shrubs such as lama, naio, and 'a'ali'i

are found. Browsing damage from donkeys and goats is severe in some areas.

The 'a'a flows are largely barren. Plants tend to occur along the margins of the flows where they lie adjacent to the scrub-covered pahoehoe flows.

None of the plants found during these field studies is a threatened or endangered species or a species of concern (U.S. Fish and Wildlife Service 1999). All of the plants can be found in similar habitats throughout the West Hawai'i region.

The earlier survey of the 100-foot wide utility corridor (Char 1988) recorded a few native species not observed during this study. These plants were the 'iwa'iwa fern (Doryopteris decipiens), pili grass (Heteropogon contortus), kakonakona grass (Panicum torridum), nehe (Lipochaeta lavarum), pua kala or native poppy (Argemone glauca), 'ohi'a lehua (Metrosideros polymorpha), and 'akia (Wikstroemia pulcherrima). Some of these plants, such as the kakonakona and pua kala, are annual species which come up during the rainy season. None of the plants mentioned above is a threatened and endangered species or a species of concern.

Given these findings, the proposed projects are not expected to have a significant negative impact on the botanical resources. However, it is recommended that the roadway alignment within the 400-foot wide corridor be sited to avoid the lama trees wherever possible.

LITERATURE CITED

Char, W.P. (Char & Associates). 1988. Botanical Survey, Ka'upulehu Resort CDUA, Water Line and Maintenance Roadway, Ka'upulehu, North Kona, Hawai'i. Prepared for Belt Collins & Associates. December 1988.

Char, W.P. (Char & Associates). 1993. Botanical Assessment Survey, Ka'upulehu Resort Irrigation Corridor, Ka'upulehu, North Kona District, Island of Hawai'i. Prepared for Belt Collins & Associates. September 1993.

Evenhuis, N.L. and S.E. Miller, editors. 1995-1998. Records of the Hawaii Biological Survey. Bishop Museum Occasional Papers Nos. 41-56.

Evenhuis, N.L. and L.G. Eldredge, editors. 1999. Records of the Hawaii Biological Survey. Bishop Museum Occasional Papers Nos. 58-59.

Lamoureux, C.H. 1988. Checklist of Hawaiian pteridophytes, "Kupukupu O Hawai'i Ne'i". Lyon Arboretum, University of Hawai'i, Manoa.

U.S. Fish and Wildlife Service. 1999. U.S. Fish and Wildlife Service species list, plants. March 23, 1999. Pacific Islands Ecoregion Office, Honolulu, HI.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI. Bishop Museum Special Publication 83.

PLANT SPECIES LIST -- Ka'upulehu Mauka Lands

The following checklist is an inventory of all the plants observed during the field studies. The plant names are arranged alphabetically by families within each of three groups: Ferns, Dicots, and Monocots. The taxonomy and nomenclature of the Ferns follow Lamoureux (1988), while the flowering plants, Dicots and Monocots, are in accordance with Wagner et al. (1990). The few recent name changes for the flowering plants follow those reported in the Hawaii Biological Survey series (Evenhuis and Miller 1995-1998; Evenhuis and Eldredge 1999).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   E = endemic = native only to the Hawaiian Islands.
   I = indigenous = native to the Hawaiian Islands and also elsewhere.
   I? = questionably indigenous = data not clear if dispersal to the islands by natural or human-related mechanisms, but weight of evidence suggests probably natural.
   P = Polynesian introduction = plants introduced by the Polynesians to Hawai'i, and now naturalized.
   P? = questionably a Polynesian introduction, or possibly introduced early after Western contact (1778).
   X = introduced or alien = all those plants brought by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778.
4. Presence (+) or absence (-) of a particular species within each of four sites:
   1 = 100-foot wide utility corridor and 0.5 MG water tank

2 = 400-foot wide roadway corridor
3 = 20-foot wide irrigation/utility corridor and irrigation reservoirs
4 = Percolation pit

Scientific name	Common name	Status	Vegetation type 1	2	3	4
FERNS						
NEPHROLEPIDACEAE (Swordfern family)						
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy swordfern, 'okupukupu	X	+	+	–	–
THELYPTERIDACEAE (Wood-fern family)						
Christella parasitica (L.) Levl.	wood-fern	X	–	+	–	–
FLOWERING PLANTS						
DICOTS						
AMARANTHACEAE (Amaranth family)						
Alternanthera pungens Kunth	khaki weed	X	–	–	+	–
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	–	–	+	–
ASCLEPIADACEAE (Milkweed family)						
Calotropis procera (Aiton) W.T. Aiton	small crown flower	X	–	–	+	–
ASTERACEAE (Daisy family)						
Ageratum conyzoides L.	maile hohono	X	+	–	+	–
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	+	+	+	–
Gamochaeta purpurea (L.) Cabr.	purple cudweed	X	–	–	+	–
Pluchea carolinensis (Jacq.) G. Don	sourbush, pluchea	X	+	+	+	+
Sonchus oleraceus L.	sowthistle, pualele	X	–	–	+	–
Tridax procumbens L.	coat buttons	X	–	–	+	–
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	X	+	–	+	–
CHENOPODIACEAE (Goosefoot family)						
Chenopodium carinatum R. Br.		X	+	+	–	–

Scientific name	Common name	Status	Vegetation type 1	2	3	4
EBENACEAE (Ebony family)						
Diospyros sandwicensis (A. DC) Fosb.	lama	E	+	+	+	–
EUPHORBIACEAE (Spurge family)						
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X	+	+	+	–
FABACEAE (Pea family)						
Indigofera suffruticosa Mill.	indigo, 'iniko	X	+	+	+	+
Leucaena leucocephala (Lam.) de Wit	koa haole, ekoa	X	–	–	–	+
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	+	+	+	+
LAMIACEAE (Mint family)						
Hyptis pectinata (L.) Poit.	comb hyptis	X	–	+	–	–
Plecthranthus parviflorus Willd.	'ala'ala wai nui, spurflower	I	–	+	–	–
MALVACEAE (Mallow family)						
Sida fallax Walp.	'ilima	I	+	+	+	+
MOLLUGINACEAE (Carpetweed family)						
Molluga cerviana (L.) Ser.	threadstem carpetweed	X	+	+	+	–
MYOPORACEAE (Naio family)						
Myoporum sandwicense A. Gray	naio, false sandalwood	I	+	–	–	–
NYCTAGINACEAE (Four-o'clock family)						
Boerhavia repens L.	alena	I	+	–	–	–
OXALIDACEAE (Wood sorrel family)						
Oxalis corniculata L.	yellow wood sorrel, 'ihi 'ai	P?	–	–	+	–
PIPERACEAE (Pepper family)						
Peperomia blanda var. floribunda (Miq.) H. Huber	'ala'ala wai nui	I	–	+	–	–

Scientific name	Common name	Status	Vegetation type 1	2	3	4
PORTULACAEAE (Purslane family)						
Portulaca oleracea L.	common purslane, pigweed, 'ihi	X	–	+	–	–
Portulaca pilosa L.		X	+	+	–	–
PROTEACEAE (Protea family)						
Grevillea robusta A. Cunn. ex R. Br.	silk oak, silver oak, 'oka kilika	X	+	+	–	–
RUBIACEAE (Coffee family)						
Morinda citrifolia L.	noni	P	–	+	–	–
SAPINDACEAE (Soapberry family)						
Dodonaea viscosa Jacq.	'a'ali'i, 'a'ali'i ku makani	I	+	+	–	–
SCROPHULARIACEAE (Figwort family)						
Verbascum thapsus L.	woolly mullein, common mullein	X	+	–	–	+
SOLANACEAE (Nightshade family)						
Nicotiana glauca R.C. Graham	tree tobacco	X	+	–	+	–
STERCULIACEAE (Cacao family)						
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	+	+	+
MONOCOTS						
POACEAE (Grass family)						
Eragrostis amabilis (L.) Wight & Arnott	lovegrass	X	+	+	+	–
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X	+	+	+	+

Appendix B

A Survey of Avian and Mammalian Species, Various Sites at Ka-ʻu-pulehu, North Kona District, Island of Hawaiʻi, Hawaiʻi.

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Introduction:

This report summarizes the findings of a 2 day ornithological and mammalian survey of seven proposed development sites at Ka-'u-pulehu in the North Kona District on the Island of Hawai'i. The property abuts the existing Ka-'ahu-manu Highway, directly across the road from the entrance to the Hualalai development complex (Figure 1). Fieldwork was conducted on September 1st and 2nd, 2000.

The primary purpose of the survey was to determine if there were any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of the seven proposed development sites. In addition, we were asked to assess the probability of any usage of the sites by listed species given the habitat currently available.

Avian phylogenetic order used in this report follows *Birds Of The World: A Checklist 5th Edition* (Clements 2000); scientific nomenclature follows the American Ornithologist's Union *Check-list of North American Birds 7th Edition* (AOU 1998) and the 42nd supplement to *Check-list of North American Birds* (AOU 2000). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.* 1990). Place names follow *Place names of Hawaii* (Pukui *et al.* 1974).

General Site Description:

The terrain on which the seven sites are located, gently slopes from east to west; from a maximum elevation of approximately 800 feet to slightly less than 200 feet above mean sea level (Figure 1). The terrain is composed of a mix of pahoehoe and a'a lava flows. The majority of the area is made up of a Mauna Loa flow dating from the Holocene and Pleistocene ages which is estimated to be between 3,000 and 5,000 years old. On the eastern edge of the general project area this flow is partially covered by a newer Mauna Loa flow estimated to be between 1,500 and 3,000 years old. Centered in the just north of the southeastern boundary of the area is an outcropping flow formed between 5,000 and 10,000 years ago (Wolfe and Morris 1996).

The seven sites surveyed encompass approximately 146 acres. The individual sites and the development proposed on them, are described below and graphically illustrated in Figure 1.

1. A 9800± foot long utility corridor, 100 feet wide, extending along the boundary between the Ka-'u-pulehu and Ku-ki'-o 2 ahupua'as, encompassing approximately 22.5 acres. This site is divided into two parts:

2000.33.2700/001-1 kB/7/00

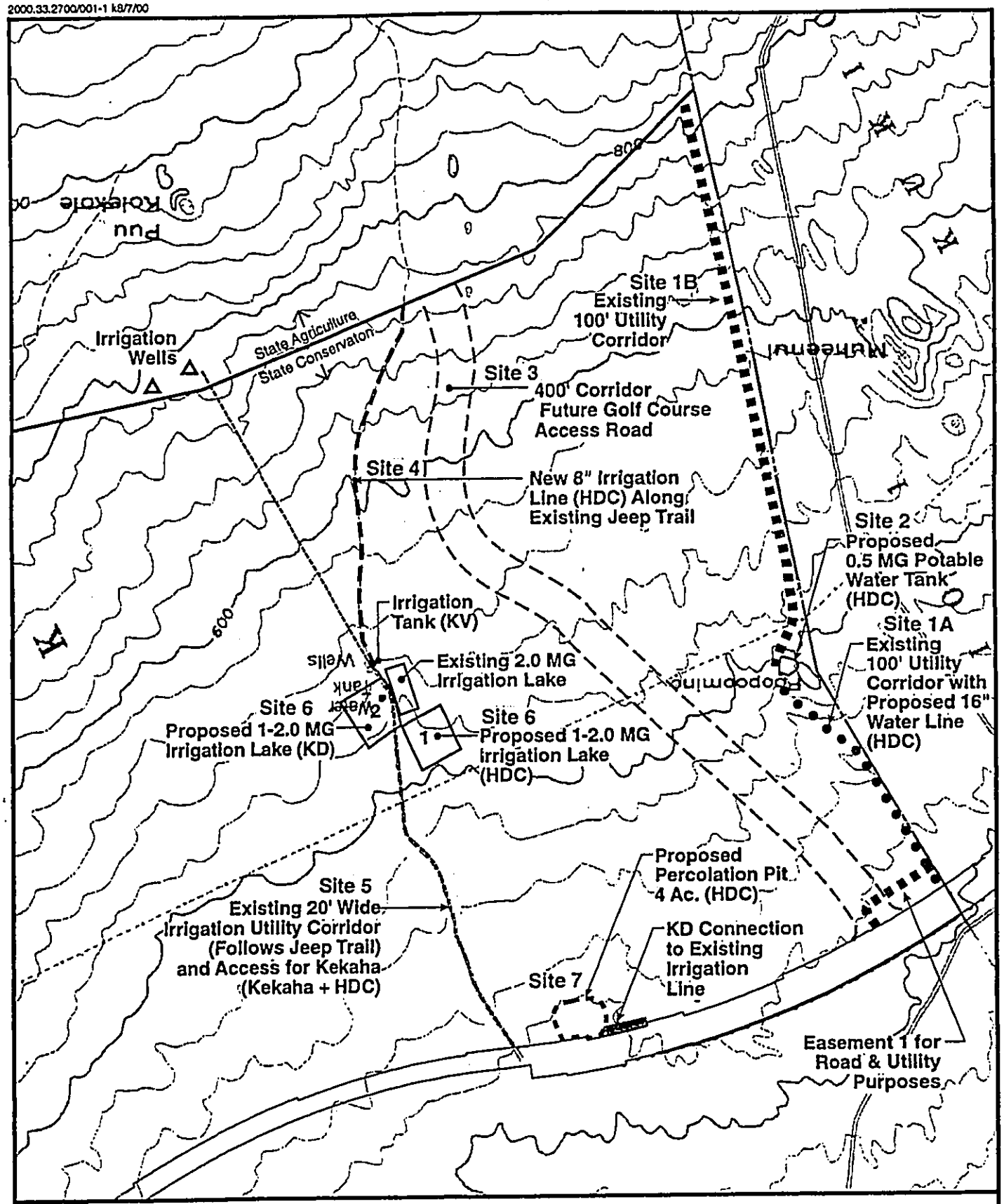

Figure 1.

Various Development Sites Ka-'u-pulehu North Kona

1A). The portion between Queen Ka-'ahu-manu Highway and the proposed potable water tank described as Site 2.

1B). From Site 2 to the eastern terminus of the proposed utility corridor.

2. An approximately one acre site adjacent to the above utility corridor proposed for the construction of a 0.5 million gallon potable water tank.

3. A 8400± foot long roadway corridor, 400 feet wide, extending up-slope from the Queen Ka-'ahu-manu Highway and Ka-'u-pulehu Drive intersection totaling approximately 77 acres.

4. A new 8inch irrigation line 3700± feet long, located along an existing jeep trail.

5. A 7700± foot long by 20 feet wide irrigation/utility corridor east of the above roadway corridor, total area approximately 33 acres. There is a an existing jeep road extending the length of this corridor.

6. A six acres site adjacent to the irrigation corridor, on which it is proposed that two new irrigation reservoirs will be constructed.

7. A proposed percolation pit abutting the up-slope side of the Queen Ka-'ahu-manu Highway covering approximately four acres.

The vegetation within the general proposed development area is best characterized as a Fountain Grass Grassland subtype of the Lowland Dry Grassland community. This habitat is dominated by fountain grass (*Pennisetum setaceum*) an alien (introduced to Hawai'i by man) African grass and buffelgrass (*Cenchrus ciliaris*), yet another alien species (Gagne and Cuddihy 1990, *in* Wagner *et al.* 1990).

The ground cover varies from none, along Queen Ka-'ahu-manu Highway to as much as 90% at the higher elevations. There are several stands of kiawe (*Prosopis pallida*) located within site 1 (see above), as well as a few 'ohi'a (*Metrosideros polymorpha*) trees at the higher elevations along Site 1B (Figure 1). Other than these there are few trees within the general project area.

Mammalian Survey Methods:

All observations of mammalian species were of an incidental nature. With the exception of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), all other terrestrial mammals found on the Island of Hawai'i are alien species. Most are ubiquitous; no trapping program was proposed or undertaken to quantify the usage by alien mammalian species of the study sites. A running tally was kept of all vertebrate species observed and heard while within

the development sites. The survey of mammals was limited to visual and auditory detection, coupled with observation of scat, tracks and other animal sign. Visual scans were made for Hawaiian hoary bats, or *'ope'ape'a* as they are locally known, during crepuscular periods on two evenings and two mornings

Avian Survey Methods:

Linear transects were placed along sites 1, 3, 4 and 5 (Figure 1). A total of 31 count stations were placed approximately 300 meters apart along the transects, a hip-chain was used to measure the distance between stations. Six-minute unlimited distance counts were made at each station (Reynolds *et al.* 1980). Count stations were counted once; additionally, a tally was made of birds detected during the census time on site. Sites 2, 6 and 7 were inspected, and vertebrate species encountered, tallied (Figure 1). Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated during the early morning hours between 0600 hrs. and 1100 hrs., the peak of daily bird activity. An additional two hours were spent on two evenings in an attempt to detect nocturnally flying seabirds and owls overflying the general development area. Time not spent counting was used to search the sites and the surrounding area for species, and habitats not detected during count sessions.

Results:

Six mammalian species; domestic dog (*Canis f. familiaris*), small Indian mongoose (*Herpestes a. auropunctatus*), cat (*Felis catus*), donkey (*Equus a. asinus*), cattle (*Bos taurus*), and feral goat (*Capra h. hircus*) were detected during the course of this study.

The most noticeable mammalian species within the general project area was donkey. All seven sites had abundant donkey sign. Live animals were seen along site 1, 3, 4 and 5, and within site 6 (Figure 1). Skeletal remains of goat and donkey were encountered along site 3. Scat of dog, mongoose, cat and feral goat was found throughout the area surveyed, that of cattle was encountered along site 1B. No rodents were detected during the course of this survey; however, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) as well as European house mice (*Mus domesticus*), utilize resources found within the sites surveyed. Without conducting a trapping program, it is difficult to assess the presence or population densities of these often hard-to-see mammals. All of these introduced mammalian species are deleterious to avian populations. Hawaii's sole endemic terrestrial mammalian species, the endangered Hawaiian hoary bat, or *'ope'ape'a*, was not detected during the course of this survey.

We recorded a total of 24 individual birds, representing four species; Common Myna (*Acridotheres tristis*), African Silverbill (*Lonchura cantans*), House Finch (*Carpodacus m. mexicanus*) and Yellow-billed Cardinal (*Paroaris capitata*), during station counts. All of

these are alien to the Hawaiian Islands (Table 1). An additional two species; Hawaiian Stilt (*Himantopus mexicanus knudseni*) and Pacific Golden-Plover (*Pluvialis fulva*) were recorded as incidental observations within the existing irrigation reservoir located adjacent to Site 6. The Hawaiian Stilt is an endangered endemic (native and unique to Hawai'i) sub-species of the mainland Black-necked Stilt. The Pacific Golden-Plover is an indigenous (native to Hawai'i, but also found elsewhere) migratory species.

KEY TO TABLE 1

ST	Status
A	Alien Species
RA	Relative Abundance = # of birds / # stations

TABLE 1

Avian Species Detected During Station Counts at Ka-'u-pulehu Development Sites

Common Name	*Scientific Name*	*ST*	*RA*
STARLINGS - Sturnidae			
Common Myna.	*Acridotheres tristis.*	A	0.355
WAXBILLS & ALLIES - Estrilididae			
African Silverbill	*Lonchura cantans*	A	0.355
FRINGILLIDS - Fringillidae			
House Finch.	*Carpodacus m. mexicanus.*	A	0.032
EMBERIZIDS - Emberizadae			
Yellow-billed Cardinal.	*Paroaria capitata.*	A	0.032

No avian species listed as endangered, threatened, proposed or as a candidate species by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended (ESA), or by the State of Hawai'i under it's endangered species program (Federal Register 1999, DLNR 1986) were detected within any of the six development sites surveyed. (see previous paragraph regarding Hawaiian Stilts seen adjacent to Site 6).

The findings of both the avian and mammalian studies were consistent with the habitat currently present on the project sites, and previous faunal surveys of similar habitat located in the North Kona and South Kohala Districts.

Previous Surveys:

There have only been four comprehensive bat surveys conducted on the Island of Hawai'i (Jacobs 1994, Cooper et al. 1995, Cooper and David 1995, David 1996b). Only one of these surveys addressed lands close to the project sites. David Jacobs conducted an Island wide survey between 1990-1993 which attempted to ascertain the distribution and abundance of Hawaiian hoary bats by sampling along paved principal roadways around the Island of Hawai'i (Jacobs 1994). I am unaware of any electronic bat surveys having been conducted within 5 miles of the proposed development sites. Several brief electronic bat surveys have been conducted on lands close to the Kona International Airport, the town of Kailua, Kona and around the Waikoloa Area (David 1995, 1996a, 1999a, 1999b, 1999c, 1999d, 2000a, 2000b). Bats were not detected on any of these surveys, though bats have been regularly reported from the area. The bulk of the remaining published literature relies heavily on anecdotal and incidental information on bat distribution and abundance on the Island (Baldwin 1950, Bryan 1955, Tomich 1986).

The first systematic surveys of the avifauna of Hawai'i were undertaken in 1976. Starting in that year and continuing until 1983 the U.S. Fish & Wildlife Service (USFWS) conducted a state wide survey of the avifauna of Hawai'i (Scott *et al.* 1986). During the course of the Hawaii Forest Bird Surveys program (HFBS) the project area was not surveyed; it was already so denuded of native forest that it was not thought that any native forest birds could still survive in the habitat present. The author has conducted numerous avian surveys within the North Kona District in habitat similar to that found within the proposed developments sites (David 1995, 1996a, 1999a, 1999b, 1999c, 1999d, 2000a, 2000b). Additionally the project sites are located within the National Audubon Societies, North Kona Christmas Bird Count Circle, which has been counted annually since 1988 (David 1989, 19990, 1991, 1992, 1993, National Audubon Society 2000).

Discussion:

A one time survey can not provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact over a number of years. The development sites and most of the North Kona and South Kohala Districts have been experiencing drought conditions for the past 3-5 years. The average rainfall for the general project area is approximated 10 inches a year. Over the past 5 years, precipitation has been down approximately 22%. And over the past two years, by more than 52% (NCDC 2000).

The habitat currently available to terrestrial vertebrate species within the project sites is extremely dry. The low diversity and densities encountered is in no small part due to the lack of utilizable resources currently available on site for either bird or mammal species.

Given the conditions present the findings of the mammalian survey are consistent with other surveys conducted within the lowland areas of North Kona and South Kohala within the recent past (David 1995, 1996a, 1996b, 1999a, 1999b, 1999c, 1999d, 2000a, 2000b). It is likely that Hawaiian hoary bats overfly the project site upon occasion, as they have been seen in numerous lowland areas in North Kona, usually between the months of March and November (Jacobs 1994, R. David unpublished field notes 1975-1999).

Not surprisingly the diversity and density of avian species detected during this survey was lower than one would ordinarily expect from the location of the study sites. Common Mynas and African Silverbills represented 92% of the birds counted during this survey. At 26 of the 31 count stations (84%) we did not record a single bird during count periods. Seventy one percent of the birds detected were recorded from only one (3%) of the stations counted. The average number of birds detected at each station was less than one (0.77%) individual.

The ongoing drought has greatly impacted many of the lowland alien avian species normally present in this area. Results of recent faunal surveys conducted by the author in the lowland grassland areas of the North Kona and South Kohala Districts have shown greatly reduced avian diversity and density over the last few years (David 1996a, 1996b, 1999a, 1999b, 1999c), as compared to earlier surveys and publications covering the same general area (David 1989, 1990, 1991a, 1992, 1993, 1994, 1995). The habitat currently found on the development sites and within the fountain grass dominated lowland areas in North Kona and South Kohala does not provide the resources necessary for the sustenance or nesting of native avian species. In a wetter year it is to be expected that additional resident alien avian species utilize the existing habitat within the proposed development sites.

It is possible that small numbers of the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or Ua'u over-fly the project site between the months of May and October (Banko 1980, Harrison 1990). This species was formerly common on the Island of Hawai'i (Wilson & Evans 1890-1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as the mid to high elevations of Mount Hualalai. Within recent historic times this species has been reduced to relictual breeding colonies located at high elevations on Mauna Loa and possibly Mount Hualalai (Banko 1980, Harrison 1990, Cooper & David 1995, Cooper *et al.* 1995, R. David Unpublished Field Notes 1986-1995, 1999).

The primary cause of mortality in Dark-rumped Petrels is thought to be predation by alien mammalian species at the nesting colonies (Day and Cooper 1997, Cooper and Day 1994). Collision with utility structures is considered to be the second most significant cause of mortality of this seabird species in Hawai'i. Nocturnally flying seabirds,

especially fledging birds, can become disoriented by exterior lighting on their way to sea in the summer and fall. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley and Podolsky 1993, Ainley *et al.* 1994, Cooper and Day 1994, 1998, Day and Cooper 1997, Podolsky et al. 1998). There is no suitable nesting habitat within any of the proposed development sites for this species.

From an terrestrial vertebrate perspective, the development of any, or all of the seven proposed sites will not significantly impact any federally or State of Hawai'i endangered, threatened, proposed or rare avian or mammalian species.

Recommendations:

To reduce the potential for interactions between nocturnally flying Dark-rumped Petrels and external lights and other man-made structures, it is recommended that any external lighting planned within the proposed development sites be shielded as described in Reed *et al.* (1985). This mitigation would serve the dual purpose of minimizing the threat of disorientation and downing of Dark-rumped Petrels, while at the same time complying with the County of Hawaii's current planning policy which recommends the shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting to the astronomical observatories located on Mauna Kea.

Literature Cited:

Ainley, D. and R. Podolsky. 1993. Kauai Seabird Study Task2 - Ecological Study. Unpl. Final Report, prepared for the Electric Power Research Institute, Palo Alto, California, by PRBO Stinson Beach, CA. 35 pp.

Ainley, D., R. Podolsky, L. Deforest, N. Nurand G. Spencer. 1994.Factors affecting the Status and Population Trends of the Newell's Shearwater on Kauai: A model for Threatened Petrels on Urbanized Tropical Oceanic Islands. Conservation. Biology.

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

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

Baldwin, P. H. 1950. Occurrence and behavior of the Hawaiian bat. J. Mammal. 31 (4): 455-456.

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

Bryan, E. H., Jr. 1955. The Hawaiian bat. 'Elepaio Vol. 15: 63-64.

Clements, J.F. 2000. Birds Of The World: A Checklist, 5th Edition. Ibis Publishing Co., Vista, California. 867 pp.

Cooper, B. A. and R. E. David 1995. Radar and Visual Surveys of Seabirds in the HELCO SSP Unit 71, Puna, Hawaii, During July 1995. Prepared for R. M. Towill Corporation & Hawaii Electric Light Co. 19 pp.

Cooper, B. A. and R. H. Day. 1994. Interactions of Dark-rumped Petrels and Newell's Shearwaters with utility structures on Kauai, Hawaii: Results of 1993 Studies. Final Report. 170 pp.

_____. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. Colonial Waterbirds 21 (1): 11-19

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

David, R. E. 1989. North Kona Christmas Count - 1988 -. 'Elepaio Vol.49, No. 9. (55-56)

_____ 1990. North Kona Christmas Count 1989. 'Elepaio Vol. 50, No. 5. (Pg. 41-42).

_____ 1991 North Kona Christmas Count 1990. 'Elepaio Vol. 51, No. 6. (Pg. 37).

_____ 1992 North Kona Christmas Count 1991. 'Elepaio Vol. 52, No. 3. (Pg. 20-21).

_____ 1993 North Kona Christmas Count 1992. 'Elepaio Vol.53, No. 7. (Pg. 47-48).

_____ 1994 The Birds of Ka-loko - Honokohau National Historical Park, Hawaii: A Fieldcard. National Park Service UH/CPSU.

_____ 1995 Faunal Survey for the Kaloko Town Center, Environmental Impact Statement, District of North Kona, Island of Hawai'i, Hawai'i. Prepared for 23pp. Prepared for: Kimura International.

_____ 1996a. Ornithological and Mammalian Surveys of the Waikaloa Maneuver Area, Waimea, Island of Hawai'i, Hawaii. Prepared for: Wil Chee Planning and the Army Corps of Engineers, Pacific Ocean Division . 32 pp.

_____ 1996b. Ornithological and Mammalian Surveys of the Proposed Improvement and Realignment Corridors of the Saddle Road (State of Hawaii Route 200), Island of Hawai'i, Hawaii. Prepared for: Rust E&I & The Federal Highways Administration, Central Federal Lands Highway Division. 99pp.

_____ 1999 a. Faunal Survey of Terrestrial Vertebrate Species within the Proposed Kaloko-Honokohau Business Park Site, Ka-loko, North Kona District, Hawai'i. Prepared for: *William L. Moore Planning & Lanihau Partners, L.P.*

_____ 1999 b. Faunal Survey of Terrestrial Vertebrate Species, Kona International Airport Master Plan Update. Keahole, North Kona, Hawai'i. Prepared for Edward K. Noda & Associates & Department of Transportation Airports Division (HDOT-AIR).

_____ 1999 c. Faunal Survey of Terrestrial Vertebrate Species, within the Proposed University of Hawai'i Center at West Hawai'i Site, North Kona, Hawai'i. Hawai'i Community College Long Range Development Plan. Prepared for: Wil Chee Planning.

_____ 1999 d. A Survey of Terrestrial Vertebrate Species Associated with the Wai-koloa Maneuver Area, Phase II: Wai-koloa Village and Surrounding Areas, Island of Hawai'i, Hawai'i. Prepared for: Edward K. Noda & Associates & the U.S. Army Corps of Engineers, Pacific Ocean Division (POD).

_____ 2000a. Faunal Survey of Avian and Mammalian Species Kaloko Industrial Park, Phases III & IV, Kaloko, North Kona, Hawai'i. Prepared for Wilson Okamoto & Associates and TSA International, Ltd.

_____ 2000b. Faunal Survey of Avian and Mammalian Species Associated with the Wai-koloa Maneuver Area, Phase III: Former Nansay Hawaii, Ouli and Puako, South Kohala, Hawai'i. Project Nos. H09H1004301 and H09H1004302. Prepared for: Donaldson Enterprises Inc. & the U.S. Army Corps of Engineers, Pacific Ocean Division (POD).

Day, R., and B. Cooper 1997. Patterns of Movement of Dark-rumped Petrels and Newell's Shearwaters on Kauai. The Condor 97: 1011 1027.

DLNR 1986. Indigenous wildlife, endangered and threatened Wildlife and plants, and introduced wild birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule dated 28, August 1986.

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

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

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

Jacobs, D.S. 1994. Distribution and Abundance of the Endangered Hawaiian Hoary Bat, *Lasiurus cinereus semotus*, on the Island of Hawai'i. Pacific Science, Vol. 48, no. 2: 193-200.

Krusic, E.A. , M. Yamasaki, C.D. Neefus, and P.J. Pekins 1996. Bat habitat use in the White Mountain National Forest. J. Wildl. Manage. 60(3):625-631.

National Audubon Society 2000. North Kona Christmas Count 1993-1999. Online database.

NCDC 2000. National Climatic Data Center: Monthly Surface Data, Waikoloa Beach Station 1985-1999. Asheville, NC.

Podolsky, R., D. Ainley, G. Spencer, L. Deforest and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kauai. Colonial Waterbirds 21 (1): 20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini 1976. Place Names of Hawaii. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. Auk 102: 377-383.

Reynolds, R.T., J.M. Scott and R.A. Nussbaum. 1980. A variable circular plot method for estimating bird numbers. Condor. 82:309-313

Scott, J. M., S. Mountainspring, F. L. Ramsey and C. B. Kepler. 1986. Forest Bird Communities of the Hawaiian Islands: Their Dynamics, Ecology, and Conservation. Studies in Avian Biology No. 9. Lawrence, Kansas: Allen Press Inc. 431 pp.

Tomich, P.Q. 1986. Mammals in Hawaii. Bishop Museum Press. Honolulu, Hawaii. 375 pp.

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

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

Wolfe, E. W., and J. Morris 1996 Geological Map of the Island of Hawaii. U.S. Department of the Interior, U.S. Geological Survey.

Appendix C

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Report 511-012389

ARCHAEOLOGICAL INVENTORY SURVEY
KAUPULEHU RESORT UTILITY CORRIDOR PROJECT AREA

Land of Kaupulehu, District of North Kona
Island of Hawaii

February 1989

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Report 511-012389

ARCHAEOLOGICAL INVENTORY SURVEY
KAUPULEHU RESORT UTILITY CORRIDOR PROJECT AREA

Land of Kaupulehu, District of North Kona
Island of Hawaii
(TMK:7-2-03:03)

by

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SUMMARY

At the request of Ms. Anne Mapes of Belt Collins & Associates (BCA), for BCA client, Kaupulehu Developments, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the Kaupulehu Resort Utility Corridor project area, situated in the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:7-2-03:03). The overall objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Assessment (EA) to be prepared in conjunction with a Conservation District Use permit and other development permit applications to be made to the appropriate state and county agencies. The Use permit is required in conjunction with the client's proposal to develop water transmission facilities within a 100 ft-wide corridor along the southern boundary of the Land of Kaupulehu.

Field work was conducted on December 27, 1988. During field work, two sites, both trails, were identified within the proposed corridor. The trails appear to be both historic and prehistoric, and they are assessed as significant for information content, cultural value, and interpretive value. On the basis of the field work, and based on discussions with Dr. Ross Cordy of DLNR-HSS, the sites are recommended for "preservation as is."

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INTRODUCTION

BACKGROUND

At the request of Ms. Anne Mapes of Belt Collins & Associates (BCA), for BCA client, Kaupulehu Developments, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the Kaupulehu Resort Utility Corridor project area, situated in the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:7-2-03:03). The project area consists of an underground waterline, two water tanks, overhead electric lines, and a maintenance road. The overall objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Assessment (EA) to be prepared in conjunction with a Conservation District Use permit and other development permit applications to be made to the appropriate state and county agencies. The Use permit is required in conjunction with the client's proposal to develop transmission facilities within a 100 ft-wide corridor along the southern boundary of Kaupulehu.

Field work was conducted on December 27, 1988, by PHRI Supervisory Archaeologist Margaret L.K. Rosendahl and PHRI Field Archaeologists Robert Noah and David Statler. Approximately 24 man-hours of labor were expended in conducting the field work. Upon completing the field work, findings and preliminary conclusions--including tentative evaluations and recommendations--were discussed with Dr. Ross Cordy of the Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS). The findings and tentative evaluations and recommendations will be formally reviewed by the DLNR-HSS and by the Hawaii County Planning Department (HCPD) upon submission of this final report.

SCOPE OF WORK

The basic purpose of the survey was to identify--to discover and locate on available maps--all sites and features of potential archaeological significance present in the project area. Formerly called a reconnaissance survey and more recently referred to as an inventory survey, the proposed survey comprises the initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey--data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent mitigation--data recovery research excavations, construction monitoring,

interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The basic objectives of the present survey were four-fold: (a) to identify (find and locate) all sites and site complexes present within the specified project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent data collection and/or mitigation work that might be necessary or appropriate.

The inventory survey was carried out in accordance with draft DLNR guidelines which are currently used by the HCPD and DLNR-HSS as guidelines for review and evaluation of archaeological inventory-level survey reports submitted in conjunction with various development permit applications.

PROJECT AREA DESCRIPTION

The present project area is situated in the Land of Kaupulehu, which was awarded to Lot Kamehameha (Land Commission Award [LCA] 7715) during the Great Mahele (Figure 1). Kaupulehu is situated on the lower southwestern slope of Hualalai Volcano. This area has a dry, hot climate and consists of extensive lava fields, many of which have little to no soil accumulation. Average annual rainfall in the area is 10-20 inches, with a slightly lower average along the coastal zone (Armstrong 1983:57); temperatures in the area range from 70-76 degrees F (DLNR 1970:81).

The project area consists of a 100-ft wide corridor, situated immediately north of the boundary between the Lands of Kaupulehu and Kukio 1st, extending approximately 5,800 feet between Queen Kaahumanu Highway and an undeveloped parcel. The corridor rises in elevation, from 220 ft AMSL (above mean sea level) at its seaward end, to 820 feet AMSL at its inland extent (Figure 2).

The terrain of the project area is generally very uneven and consists of prehistoric pahoehoe and aa flows derived from Hualalai Volcano (Macdonald et al. 1983:353). The aa flows dominate the inland portion of the area. Vegetation in the project area consists mostly of a ground cover of fountain grass (Pennisetum setaceum [Forsk.] Chiov.). In the inland portion of the area, in addition to the grass, are scattered lama (Diospyros sp.). Growing around the base of the large cinder cone, Poopoomino, at approximately the 320 ft elevation, is a stand of kiawe (Prosopis pallida [Humb. and Bonpl. ex Willd.] HBK.). Generally, vegetation in the project area is less dispersed at lower elevations.

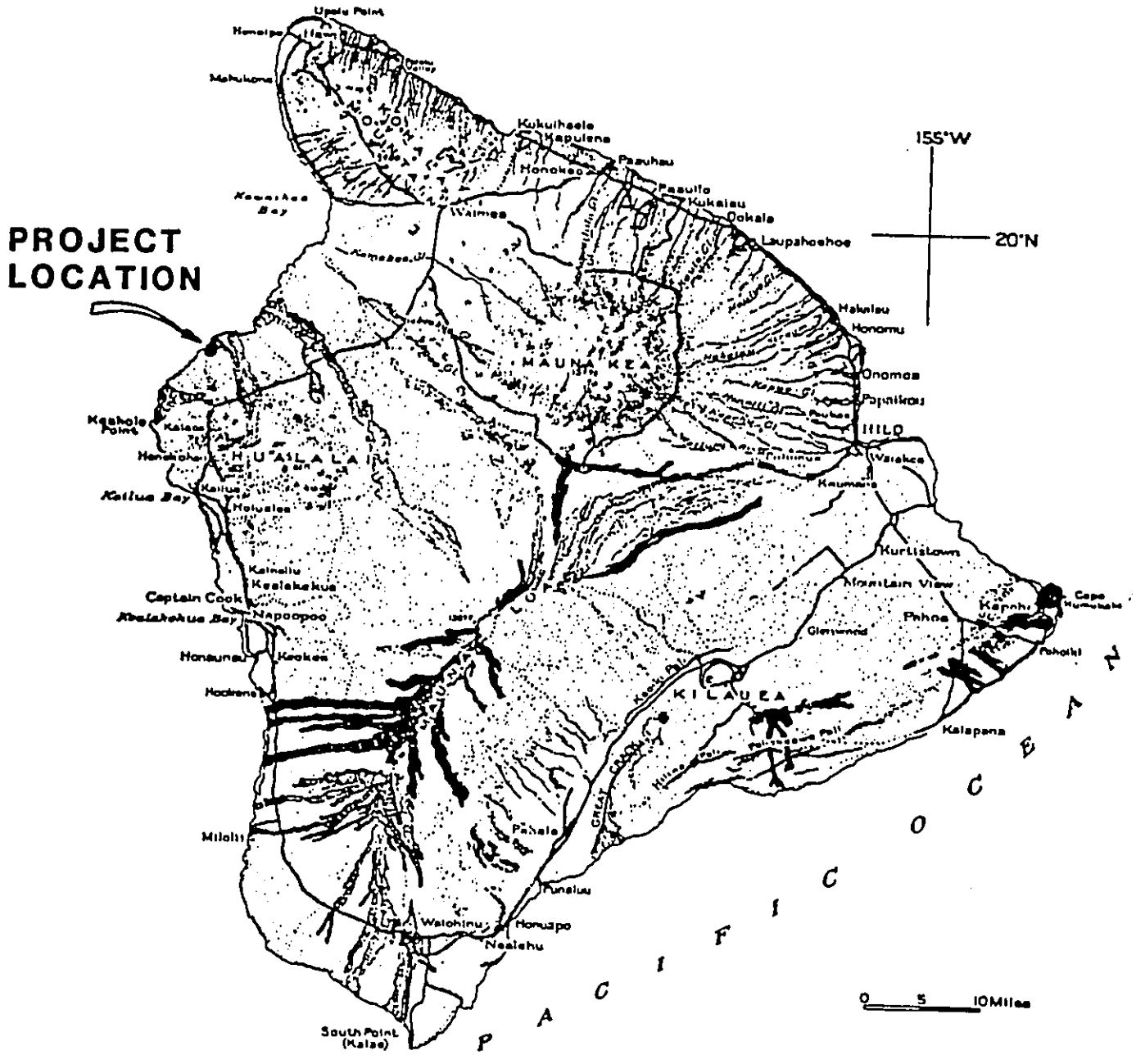

Figure 1. PROJECT LOCATION MAP

ARCHAEOLOGICAL INVENTORY SURVEY
KAUPULEHU RESORT UTILITY CORRIDOR PROJECT AREA
Land of Kaupulehu, District of North Kona
Island of Hawaii (TMK:7-2-03:03)

Report No. 88-511 February 1989

(Map taken from Macdonald and Abbott 1970:288.)

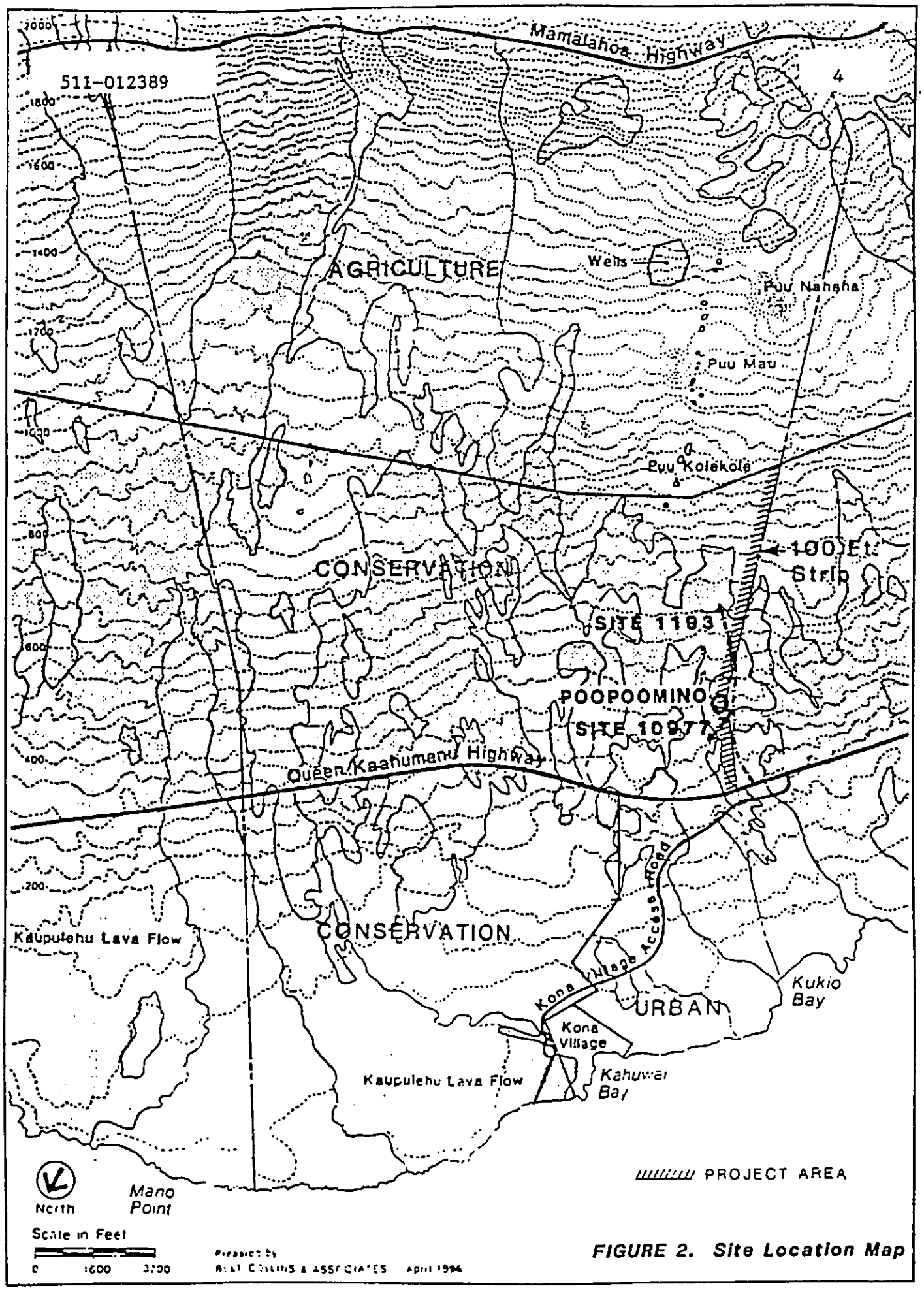

FIGURE 2. Site Location Map

PREVIOUS ARCHAEOLOGICAL WORK

There have been numerous previous studies within the general vicinity of the present project area, most of which focused on the coastal section of Kaupulehu. A detailed review of many of these studies is presented in Walker and Rosendahl (1988:6-8). The following is an abbreviated version of the Walker and Rosendahl review:

> The most recent archaeological work [prior to Walker and Rosendahl] conducted in the Kaupulehu Makai Resort project area was a reconnaissance survey of the makai (seaward) parcel of Kaupulehu. This survey was conducted in September 1984 by the Department of Anthropology, B.P. Bishop Museum, for Barnwell Industries, Inc. (Carter 1985). Within Carter's report is Marion Kelly's "Notes on the History of Kaupulehu" (Kelly 1985; Appendix C). Kelly's report includes discussions of (a) cultivation in Kekaha, (b) the meaning of the place name Kaupulehu, (c) the konohiki of Kaupulehu, (d) petroglyphs at Kaupulehu, (e) Lono in Kona, (f) Kane at Kaupulehu, and (g) leases and development.
>
> Archaeological field work within the Land of Kaupulehu prior to Carter's survey includes six surveys conducted between 1930 and 1981. In 1930, John E. Reinecke, while carrying out a survey of sites along the western coast of Hawaii Island for B.P. Bishop Museum, recorded several sites along the shoreline of Kaupulehu (Reinecke Ms.). Reinecke's sites were later included in an inventory of Hawaii Island sites prepared by B.P. Bishop Museum for the Hawaii County Planning Department (Emory 1970). In early 1963, Lloyd J. Soehren of the Department of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of Kaupulehu and Makalawena for B.P. Bishop Estate (Soehren 1963). Between June-October 1970, the Parks Division of the State Department of Land and Natural Resources conducted a surface survey of the Kailua-Kawaihae road corridor for the State Department of Transportation (Ching 1971). Between 1971-1975 the State of Hawaii, during the Statewide Inventory of Historic Places, inspected the coastal portion of Kaupulehu. In April 1981, Eric Komori of the Department of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of two parcels of land in the coastal portion of Kaupulehu for Cambridge Pacific, Inc. (Walker and Rosendahl 1988:6-8).

The Walker and Rosendahl 1988 study is the most recent and comprehensive work conducted in the vicinity of the project area. The study consisted of an inventory survey of a parcel in the coastal portion of the Lands of Kaupulehu and Kukio 1st. During the survey, 53 sites (201 component features), both historic and prehistoric, were identified. The The survey indicated that early occupation in Kaupulehu most likely took place primarily along the coast.

Other archaeological projects conducted in the general vicinity of the project area include salvage of the Ke-ahole to Anaehoomalu section of the Kailua-Kawaihae Road (Queen Kaahumanu Highway) (Rosendahl 1973), survey and testing along the coast of the Lands of Kukio 1st and 2nd and Maniniowali (Cordy 1978, 1981), and reconnaissance surveys in Kukio 1st (Renger 1970; Rosendahl 1985; Walker and Rosendahl 1985).

FIELD WORK PROCEDURES

Field investigations were conducted December 27, 1988, by PHRI Supervisory Archaeologist Margaret L.K. Rosendahl and PHRI Field Archaeologists Robert Noah and David Statler. Twenty-four man-hours of labor were expended in conducting the field work. Prior to the work, the property boundaries were surveyed and marked with flagging tape by professional surveyors.

The inspection of the corridor started at the inland extent of the corridor and proceeded seaward. The corridor was inspected by means of pedestrian sweeps; distance between sweeping crew members was approximately 10 m. Surface visibility during the sweeps was generally fair.

Identified sites were assigned PHRI temporary site numbers (prefixed by T-) and were plotted on a blueline topographic map of the project area prepared by Belt Collins & Associates (1"=80'). Later, T-sites were correlated with previously designated SIHP (State Inventory of Historic Places) sites, and the SIHP numbers (1193 and 10977) were assigned to the sites. Descriptive data and feature dimensions for the sites were recorded on standard PHRI site survey record forms. The sites were photographed using 35 mm black and white film (PHRI Roll No. 511-1). Subsequent to recording, sites were marked with bright pink flagging tape and were tagged with an aluminum tag denoting the temporary site number, the PHRI project number (88-511), the letters "PHRI," and the date.

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*State Inventory of Historic Places (SIHP) site designation system: all four-digit site numbers prefixed by 50-10-19- (50 = State of Hawaii, 10 = Island of Hawaii, 19 = USGS 7.5' series quad map ["Kiholo, Hawaii"]).

FINDINGS

Two sites, both trails, were identified within the proposed corridor (Figure 2). See Table 1 for a summary of the sites and for CRM (Cultural Resource Management) value mode assessments. During the field work, one temporary site number (T-1) was assigned to both trails. Subsequently, a review of maps from surveys of adjacent properties (Walker and Rosendahl 1988; Walker and Rosendahl 1985) identified the trails as sections of a major inland-seaward trail system that had been previously assigned separate site numbers.

SITE 1193 - TRAIL

Site 1193 is a trail section that runs from the Kukio 1st coastal settlement, inland to Huehue (Figure 3). The trail measures about 0.7 m wide. Across pahoehoe, the trail is well-worn, and across aa, the trail consists of rounded aa pebbles. The only modifications to the trail are a number of filled-in cracks. Several bottle glass fragments, two horseshoes, and a soda bottle were noted along the trail. The glass fragments were aqua, green, and purple. The soda bottle was complete and consisted of light green glass; the bottle had side seams and had the number "268" on its base.

Site 1193 was originally designated D21-7* by Renger (1970:37), and subsequently was assigned its present number by Ching (1971:202-203). Ching identifies this feature as the Kukio Puhia Pele Trail. It originates in Kukio and proceeds inland and crosses the Kukio 1st-Kaupulehu boundary at approximately the 460-ft elevation contour (where the present project area corridor is located). The extent of this trail within Kukio 1st is recorded in Walker and Rosendahl (1985:Figure 3).

SITE 10977 - TRAIL

This trail section is 0.7 m wide and is well-worn across pahoehoe and aa. The section is located seaward of Poopoomino and is oriented to the north (toward Kahuwai Bay). The trail crosses a pahoehoe lava field and continues north over an aa flow. At approximately the 320 ft elevation (on Kukio 1st property immediately south of Poopoomino, a large prominent cinder cone) the trail connects with the Kukio Puhia Pele Trail (Site 1193) (Walker and Rosendahl 1985:Figure 3). Site 10977 leads to Kahuwai

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*B.P. Bishop Museum site designation system: all site numbers prefixed by 50-Ha-D21 (50 = State of Hawaii, Ha = Island of Hawaii, D = North Kona District, 21 = Land of Kukio).

Table 1.

SUMMARY OF IDENTIFIED SITES AND FEATURES
KAUPULEHU RESORT UTILITY CORRIDOR PROJECT AREA

Site Number	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess. R	I	C
1193	Trail	Transportation	M	M	H
10977	Trail	Transportation	M	M	H

#Cultural Resource Management
Value Mode Assessment--Nature: R = scientific research,
I = interpretive, C = cultural;
--Degree: H = high, M = moderate, L = low.

Bay in Kaupulehu and was part of a major access route (Walker and Rosendahl 1988:90). During the survey and testing of the Kaupulehu Makai Resort Project Area, this trail was designated as Site 10977, its present site number (Walker and Rosendahl 1988:Figure 2). In the Kukio 1st survey (Walker and Rosendahl 1985), an inland portion of this trail which intersects with the Kukio Puhia Pele Trail was assigned temporary number T-141 (Walker and Rosendahl 1985:Figure 3).

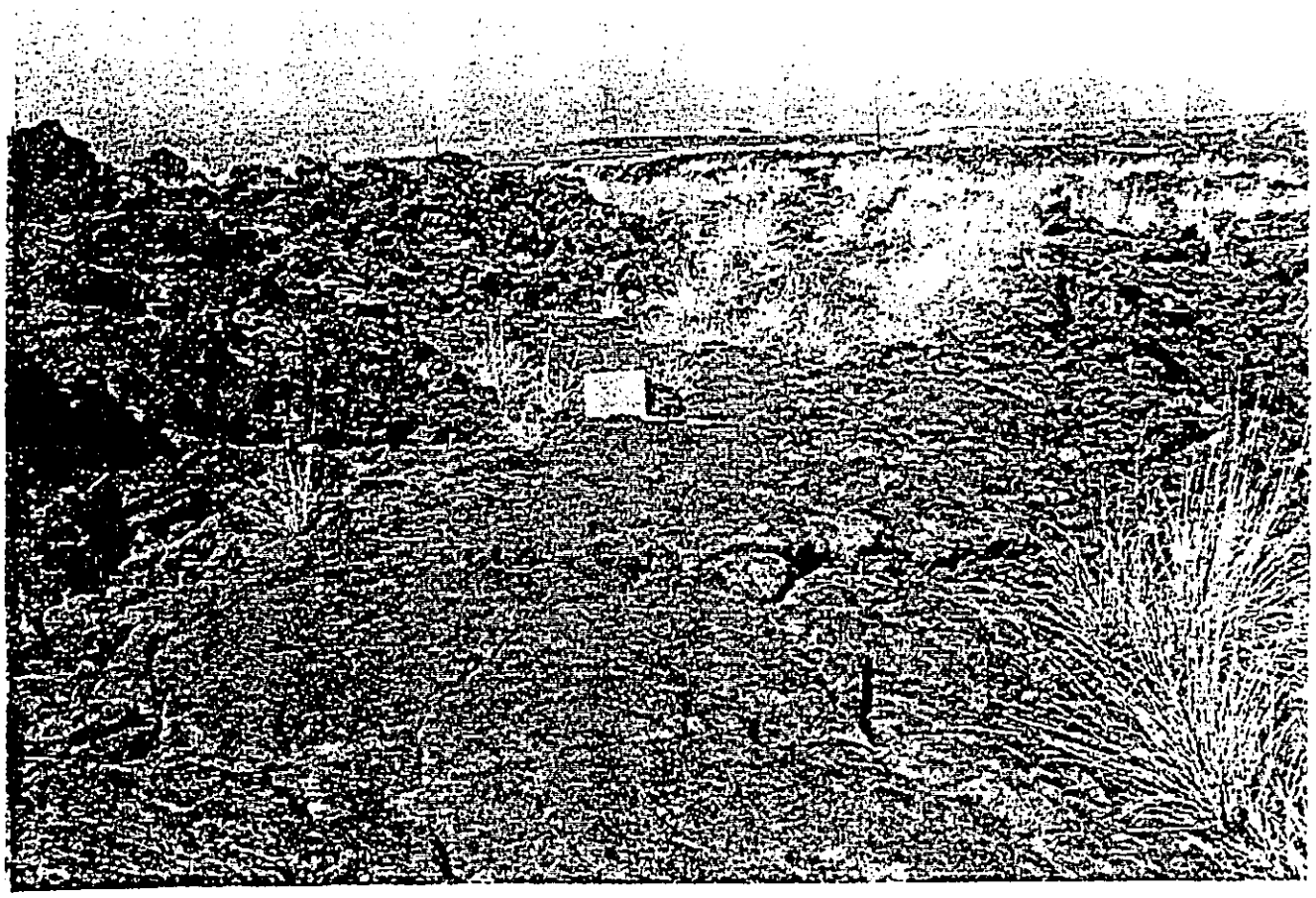

Figure 3. Site 1193, View to North. (PHRI Neg.1044-3)

CONCLUSION

DISCUSSION

The two trail sections identified during the present survey appear to be part of an overall network of trails linking the coastal settlements of Kahuwai Bay and Kukio with the inland settlements at Huehue. According to Ms. Hannah Kihalani Springer, who conducted oral history interviews with former residents of Kekaha, and with visitors to Kekaha (Springer 1985:Appendix B), this trail route was very popular in the 1920s, after which over the next 30 years use of the trail diminished (pers. comm.). Kekahi Kamaaina, who was interviewed by Hannah Springer, provided this description of the trails:

> The trails linking Ka'upulehu Beach with the uplands of Pu'uwa'awa'a and Kalaoa are very old and, where vegetation permits, are prominent features of the lava-lands. The trail to Kalaoa from Ka'upulehu intersects with the trail from Kuki'o upslope, at Po'opo'omino. It then follows a course up and over Pu'uokai, across the southwestern flank of Nahaha, across the eastern flank of Puhiapele, and from there on to Kalaoa through Hu'ehu'e and the Homesteads, at Kaulana, Pu'ukala, Haleohi'u, Hamanamana, and Kalaoa. (Springer 1985:Appendix B-95).

A search through maps at the State Survey Division by Carol Silva located a map (Reg. Map 1278) drawn by Emerson which "plots two trails leading from opposite ends of Uluweuweu Bay, upland past Poopoomino, indicating that the area may have been fairly well-traveled" (Silva 1985:Appendix A:85).

The ethnographic and documentary evidence, along with the presence of historic artifacts along the present trail sections, indicates the sections were used historically. Prehistoric use is inferred from the adjacent coastal sites that dated to an overall date range of AD 1688-1780 (Walker and Rosendahl 1988:191).

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site significance assessments are based on the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS) uses these criteria for evaluating site significance. Sites determined to be potentially significant for information content fall under Criterion D (Category A and X, Table 2), which defines significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types are evaluated under Criterion C (Category B), which defines significant resources as those which "embody

the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction" (36 CFR Sec. 60.4).

Sites with potential cultural significance (Category C) are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is

Table 2.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS
AND RECOMMENDED GENERAL TREATMENTS
KAUPULEHU RESORT WATER DEVELOPMENT SURVEY

Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
1193	+	-	+	+	*	-	-	+
10977	+	-	+	+	*	-	-	+

General Significance Categories:

A=Important for information content, further data collection necessary (PHRI=research value);
X=Important for information content, no further data collection necessary (PHRI=research value, SHPO=not significant);
B=Excellent example of site type at local, region, island, State, or National level (PHRI=interpretive value); and
C=Culturally significant (PHRI=cultural value).

Recommended General Treatments:

FDC=Further data collection necessary (intensive survey and testing, and possible subsequent data recovery/mitigation excavations);
NFW=No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential (possible inclusion into landscaping suggested for consideration);
PID=Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
PAI=Preservation "as is," with no further work (and possible inclusion into landscaping), or minimal further data collection necessary.

*If site is to be affected by construction in the future, prior to construction the site should undergo further data collection.

a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Prior to evaluating the sites, the present survey findings were reviewed with Dr. Ross Cordy of DLNR-HSS. Dr. Cordy suggested minimizing any impact to the trails. In light of Dr. Cordy's suggestion and the present overall data, based on the above federal and state criteria, Site 1193 and Site 10977 are assessed as significant for information content, cultural value, and interpretive value, and the sites are recommended for "preservation as is." It is further recommended that if the water line crosses the trail in an aa area, then the water line should be buried. If the line crosses a pahoehoe area, then it should be situated as to minimize any obstruction to pedestrian traffic--possibly construct a causeway over this portion of the water line.

Another consideration is the visual impact to the area. This concern was expressed by Hannah Kihalani Springer, who as mentioned earlier, is very familiar with the area and the trails. Ms. Springer suggested the land owners incorporate these trails along with the other trails in the area as part of the recreational amenities of the resort. These trails are also within the Hawaii State Na Ala Hele's proposed demonstration area which spans from Kaupulehu to Maniniowali.

In order to facilitate future client management decisions regarding site treatments, sites are further evaluated in terms of three value modes which are derived from the previously mentioned state and federal evaluation criteria. The archaeological sites are evaluated in terms of potential scientific research, interpretive, and/or cultural values. Research value refers to the potential of archaeological resources to produce information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values. Based on the above value modes, Site 1193 and Site 10977 are assessed as having high significance in terms of cultural value and moderate significance in terms of scientific and interpretive values (See Table 1).

The evaluations and recommendations presented within this final report have been based on a surface inventory survey of the project area. There is always the possibility that potentially significant, unidentified surface structural remains, subsurface cultural features, or deposits will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

REFERENCES CITED

Advisory Council on Historic Preservation (ACHP)

1985 Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review. Washington, D.C.: Advisory Council on Historic Preservation. (Draft Report, August)

Armstrong, R.W. (ed.)

1983 Atlas of Hawaii. Honolulu: University of Hawaii Press.

Carter, L.

1985 An Archaeological Reconnaissance of the Makai Parcel of Ka'upulehu Ahupua'a, North Kona, Hawai'i Island. Ms.020585. Dept. Anthro., B.P. Bishop Museum.

Ching, F.K.W.

1971 The Archaeology of South Kohala and North Kona: From the ahupua'a of Lalamilo to the ahupua'a of Hamanamana. Surface Survey Kailua-Kawaihae Road Corridor (Section III). Hawaii State Archaeological Journal 71-1. Dept. Land and Natural Resources, Division of State Parks.

(Code of Federal Regulations)

36 CFR Part 60 National Register of Historic Places. Washington, D.C.: Dept. Interior, National Park Service.

Cordy, R.H.

1978 A Study of Prehistoric Social Change: The Development of Complex Societies in the Hawaiian Islands. Ph.D. dissertation (Anthropology), University of Hawaii.

1981 A Study of Prehistoric Social Change: The Development of Complex Societies in the Hawaiian Islands. New York: Academic Press. (Virtually identical to author's 1978 Ph.D. dissertation [Anthropology, University of Hawaii], with addition of an epilogue.)

DLNR (Dept. of Land and Natural Resources)

1970 An Inventory of Basic Water Reources Data: Island of Hawaii. Division of Water and Land Development. Hawaii Department of Land and Natural Resources Report R34. Honolulu.

Emory, K.P.

1970 Inventory of Archaeological and Historical Sites in the Districts of Kona and Ka'u and in Anaehoomalu, South Kohala, Island of Hawaii. Departmental Report Series 70-12. Dept. Anthro., B.P. Bishop Museum.

Kelly, M.

1985 Appendix C: Notes on the History of Kaupulehu. IN Carter 1985.

Macdonald, G.A., and A.T. Abbott

1970 Volcanoes in the Sea. Honolulu: University of Hawaii Press.

Macdonald, G.A., A.T. Abbott, and F.L. Peterson

1983 Volcanoes in the Sea. (Second Edition.) Honolulu: University of Hawaii Press.

Reinecke, J.E.

Ms. Survey of Hawaiian Sites: From Kailua, Kona, to Kalahuipuaa, Kohala. Unpublished manuscript. Dept. Anthro., B.P. Bishop Museum. (1930)

Renger, R.C.

1970 Archaeological Reconnaissance Survey of the Coastal Areas of Kaloko and Kukio, North Kona, Hawaii. Departmental Report Series 70-10. Dept. Anthro., B.P. Bishop Museum.

Rosendahl, P.H.

1973 Archaeological Salvage of the Ke-Ahole to Anaehoomalu Section of the Kailua-Kawaihae Road (Queen Kaahumanu Highway), Island of Hawaii. Departmental Report Series 73-3. Dept. Anthro., B.P. Bishop Museum.

1985 Preliminary Archaeological Reconnaissance Survey, Kukio Resort Development Project Area, Kukio 1st, North Kona, Island of Hawaii. PHRI Report 148-010285. Prepared for Phillips, Brandt, Reddick & Associates and Huehue Ranch.

Silva, C.

1985 Appendix A: Preliminary Historical Documentary Research. IN Walker and Rosendahl 1985.

Soehren, L.J.

1963 Archaeology and History in Kaupulehu and Makalawena, Kona, Hawai'i. Ms. Dept. Anthro., B.P. Bishop Museum.

Springer, H.K.

1985 Regional Notes from Kekaha: Kuki'o. IN Walker and Rosendahl 1985.

Walker, A.T., and P.H. Rosendahl

1985 Full Archaeological Reconnaissance Survey, Kukio Resort Development Project Area, Kukio 1st, North Kona, Island of Hawaii. PHRI Report 167-090385. Prepared for Phillips, Brandt, Reddick & Associates and Huehue Ranch.

1988 Archaeological Survey and Test Excavations, Kaupulehu Makai Resort Project Area, Lands of Kaupulehu and Kukio 1st, North Kona, Island of Hawaii (TMK:3-7-2-03:1). PHRI Report 213-032686. Prepared for Kaupulehu Developments.

Appendix D

Report 1427-100193

Archaeological Inventory Survey
Kaupulehu Resort Irrigation Project

Land of Kaupulehu, North Kona District
Island of Hawaii
(TMK:3-7-2-03:3)

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OCTOBER 1993

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SUMMARY

At the request of Mr. Lee Sichter of Belt Collins Hawaii, on behalf of their client, Kaupulehu Makai Venture, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the 27.1-acre Kaupulehu Resort Irrigation Project, situated in the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:3-7-2-03:3). The overall objective of the survey was to provide information sufficient for a Conservation District Use Permit and for satisfaction of all current historic preservation review requirements of the Hawaii County Planning Department (HCPD) and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD).

The survey field work was conducted September 16-17, 1993 under the supervision of Laboratory Director Susan T. Goodfellow, Ph.D. The field work comprised a 100%-coverage pedestrian survey, using transects spaced at intervals of ten meters or less. During the survey, no cultural remains were encountered. This was not unexpected, given the predicted scarcity of cultural remains between 400-800 ft AMSL in the general area, and given the narrowness of the survey corridor. In view of the negative results of the survey, it is concluded that the project area requires no further archaeological work.

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INTRODUCTION

BACKGROUND

At the request of Mr. Lee Sichter of Belt Collins Hawaii, on behalf of their client, Kaupulehu Makai Venture, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the c. 27.1-acre Kaupulehu Resort Irrigation Project, situated in the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:3-7-2-03:3). The overall objective of the survey was to provide information sufficient for a Conservation District Use Permit, and sufficient to satisfy all current historic preservation review requirements of the Hawaii County Planning Department (HCPD) and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD).

The survey field work was conducted September 16-17, 1993 under the supervision of Laboratory Director Susan T. Goodfellow, Ph.D. Approximately 2.5 labor days were expended in conducting the field work.

SCOPE OF WORK

The basic objective of an inventory survey is to identify all sites and features of potential archaeological significance present within a specified project area. An inventory survey comprises an initial level of archaeological investigation. It is conducted basically to determine the presence or absence of archaeological resources within a specified project area. It indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. Finally, it permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include further data collection— additional data collection involving detailed recording of sites and features, and selected limited excavations; and possibly subsequent mitigation—data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The basic objectives of the survey were fourfold: (a) to identify all sites and site complexes present within the project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

The following specific tasks were determined to constitute an adequate scope of work for the current survey:

1. Review archaeological and historical literature relevant to the project area, and conduct historical documentary research (emphasis on readily available literature and documentary resources) and interviews with appropriate and available local informants;

2. Conduct 100% coverage, variable-intensity pedestrian survey of the entire project area, to find and record (a) any previously identified sites and features, and (b) any previously unidentified sites and features;

3. Conduct limited subsurface testing (manual excavation) at selected sites (a) to determine the presence or absence of potentially significant subsurface cultural features or deposits, and (b) to obtain suitable samples for age determination analyses; and

4. Analyze field and historical research data, and prepare appropriate reports.

The above tasks were formulated based on (a) a review of readily available background literature, (b) basic familiarity with the general project area, (c) extensive familiarity with the current requirements of review authorities, and (d) discussions with Mr. Lee Sichter of Belt Collins Hawaii.

The inventory survey was carried out in accordance with the current standards for inventory-level survey required by DLNR-SHPD. The significance of all archaeological remains identified within the project area was assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the national Advisory Council on Historic Preservation (ACHP). DLNR-SHPD and HCPD both use these criteria to evaluate eligibility for the Hawaii State and National Registers of Historic Places.

To further facilitate client management decisions regarding the subsequent treatment of resources, the general significance of all archaeological remains identified during the survey was also evaluated in terms of three PHRI Cultural Resource Management (CRM) value modes which are derived from the previously mentioned federal evaluation criteria.

PROJECT AREA DESCRIPTION

The project area is a c. 100 ft wide corridor extending 1.9 miles (c. 10,200 ft), from Queen Kaahumanu Highway southeast to the 800 ft contour (Figure 1). The project area comprises c. 27.1 acres and includes a 3.7-acre irrigation lake. From Queen Kaahumanu Highway to about the area of the water tank, located at 450 ft AMSL, the corridor is paralleled by a northwest-southeast trending jeep trail.

The project area terrain ranges in elevation from c. 320 ft AMSL (above mean sea level) to c. 800 ft AMSL. The terrain is described in detail in the following composite description derived from several sources and presented in Walker and Rosendahl (1990):

> The terrain of the project area is generally rugged, gently sloping pahoehoe, and includes very broken terrain, such as aa lava flows. The geologic base of the project area is comprised of Recent (in a geologic time-frame) and Historic Hualalai basaltic lava flows of the Hualalai Volcanic Series. The majority of Recent flows age between 1,000-3,000 years before present (B.P.) with a small area near Puu Kolekole dating between 3,000-5000 years B.P. The Historic flows date to AD 1800 and 1801. Both aa and pahoehoe

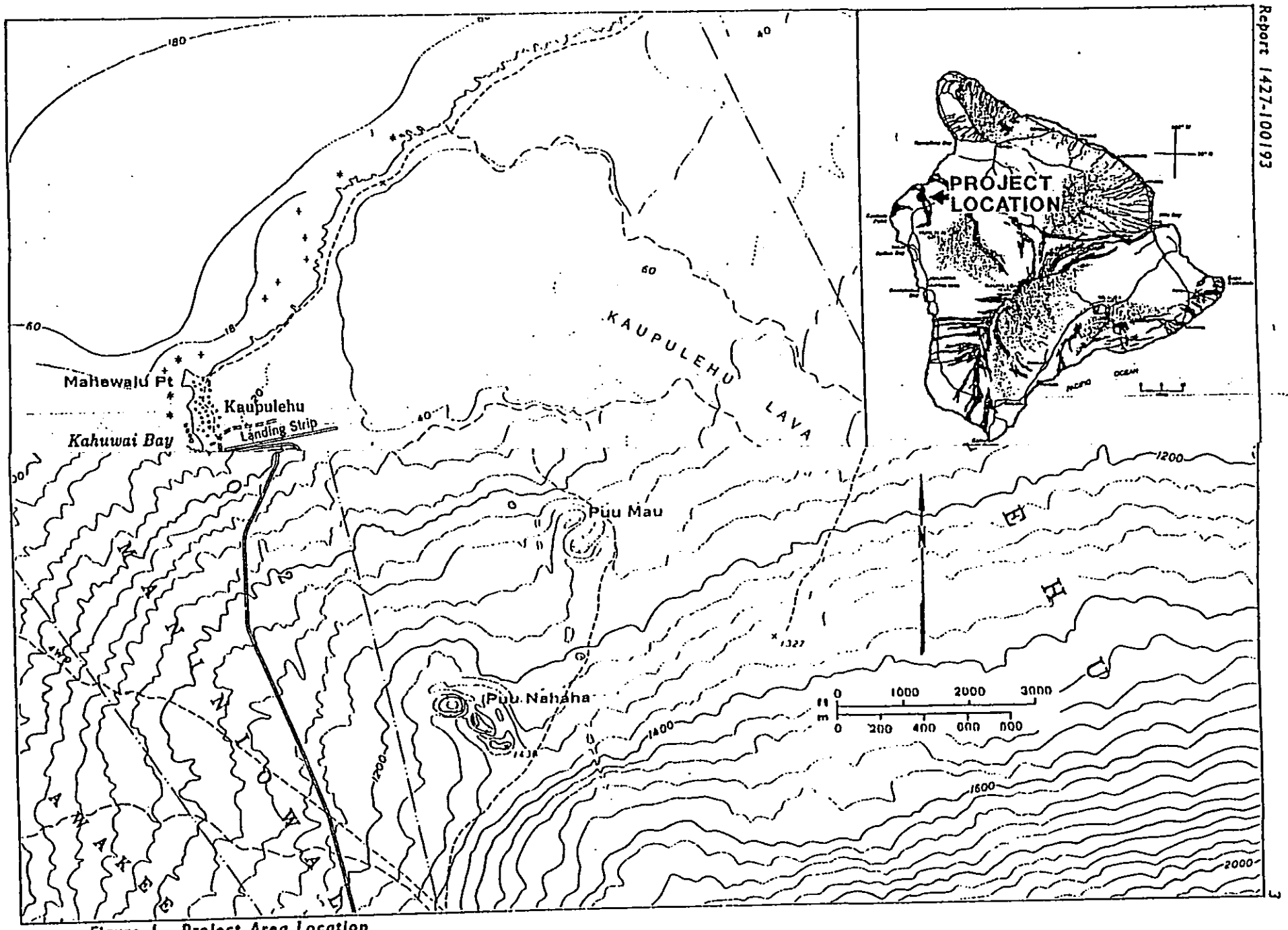

Figure 1. Project Area Location

CORRECTION

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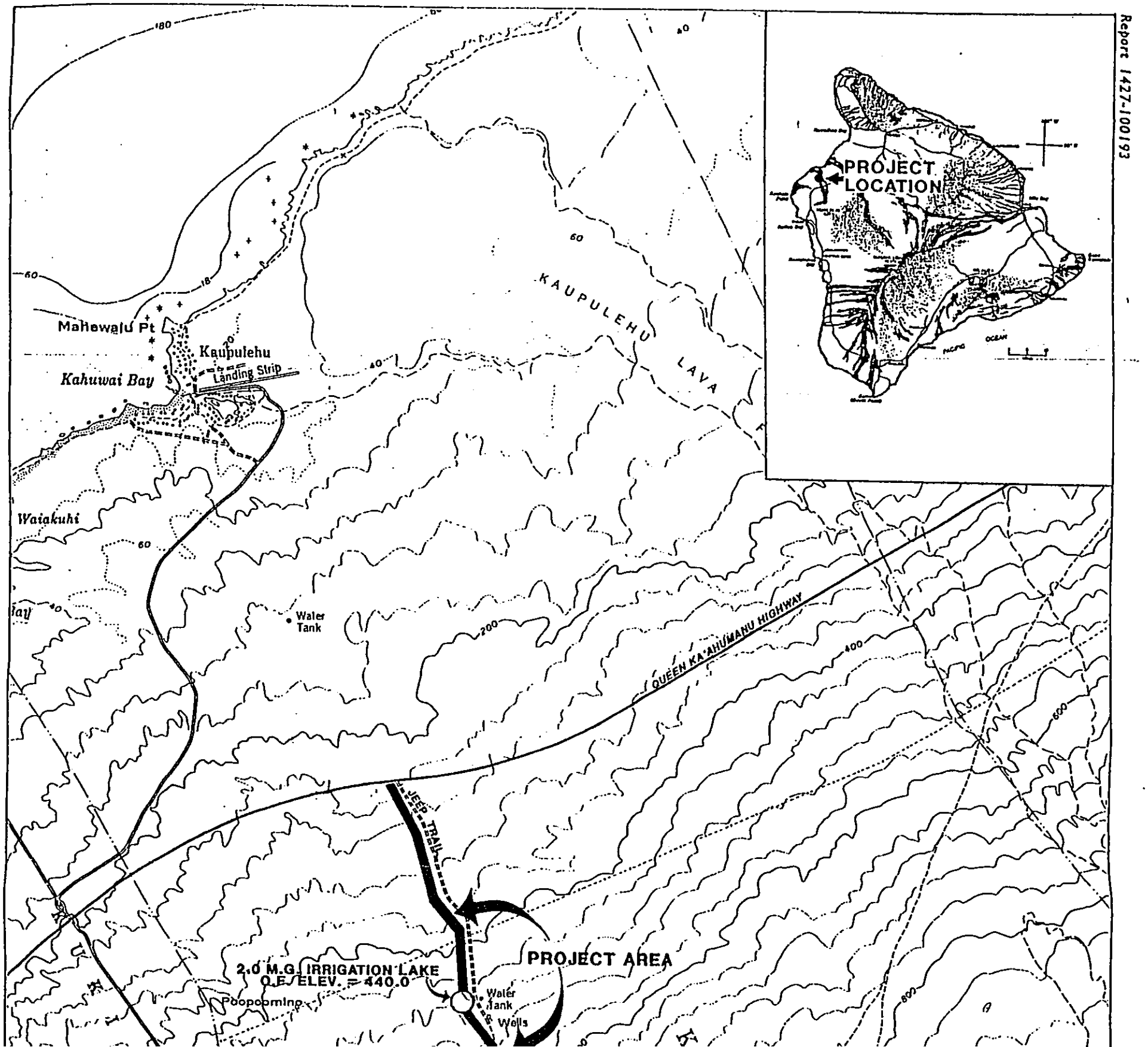
SEE FRAME(S)
IMMEDIATELY FOLLOWING


PROJECT LOCATION
Mahewalu Pt
Kaupulehu
Landing Strip
Kahuwai Bay
KAUPULEHU LAVA
Waiakuhi
Water Tank
QUEEN KA'AHUMANU HIGHWAY
JEEP TRAIL
PROJECT AREA
2.0 M.G. IRRIGATION LAKE
O.E. ELEV. = 440.0
Poopoomino
Water Tank & Wells
180
60
40
20
200
400
600

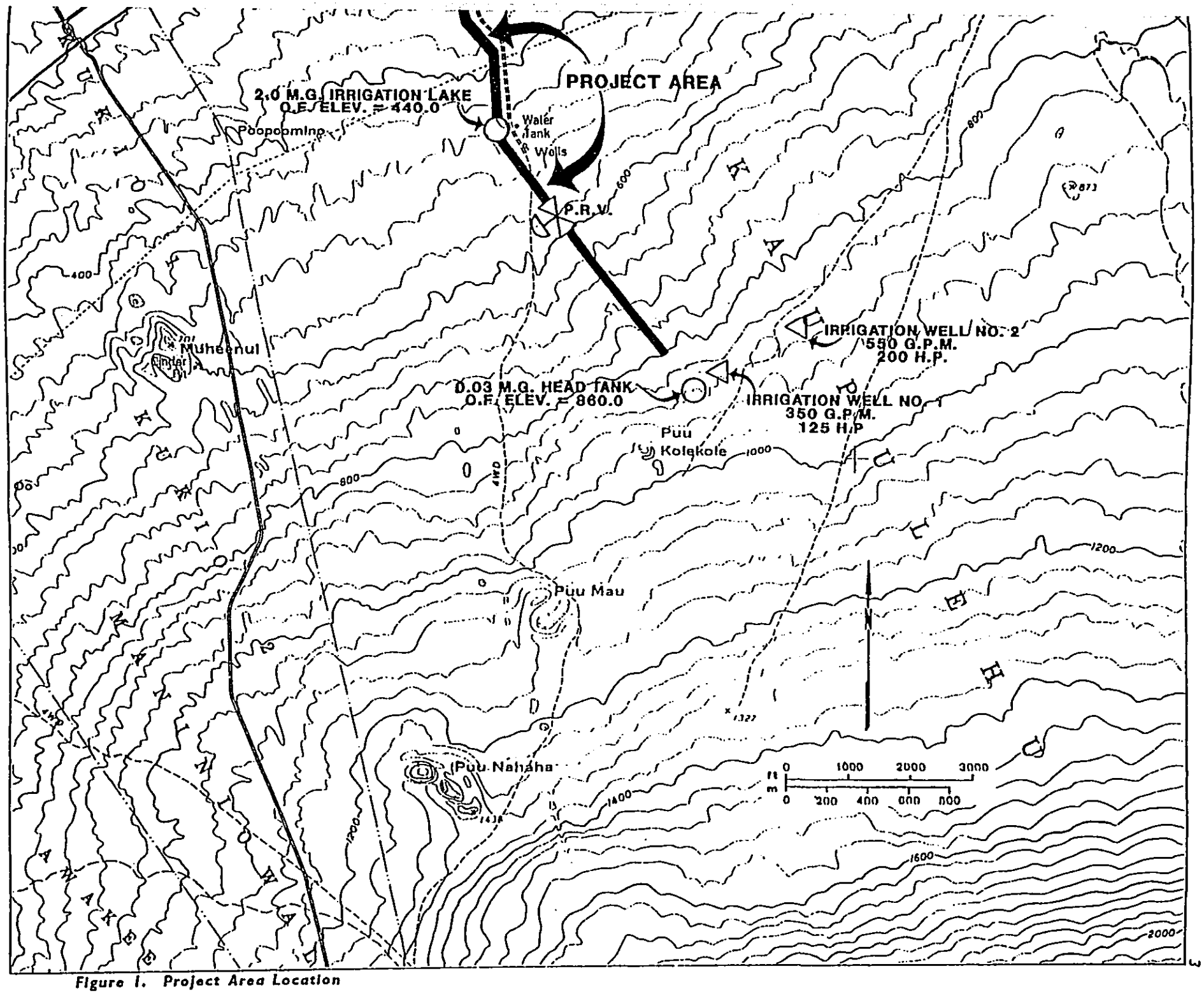


Figure 1. Project Area Location

flows are present within the project area. The aa and pahoehoe flows are generally poorly weathered and exhibit little or no soil development.

In their 1990 Archaeological Resources Assessment of the Kaupulehu Phase II Master Plan, Walker and Rosendahl note seven classifications of soil/terrain types present in their project area (Walker and Rosendahl 1990:4-6). Descriptions of the soils and terrain types and their distribution were based on (a) Sato et al. (1973), (b) color infra-red aerial photos (1979 and 1989; 1"=1,600' approx. scale), and (c) field observations made during earlier archaeological work. It is noted in Walker and Rosendahl (1990) that the distribution shown on the soil/terrain map is generalized and is subject to future modification. Of the seven soil/terrain types presented, two are within the current project area (Aa Lava Flows [includes historic aa flows] and Pahoehoe Lava Flows). These types are shown on Figure 2 and are discussed further below:

Aa Lava Flows - Comprises approximately 40% of the project area. This soil/terrain type includes the historic flow from Puhi-a-Pele (AD 1801). According to Sato et al. "[t]his lava has practically no soil covering and is bare of vegetation, except for mosses, lichens, ferns, and few small ohia trees...is rough and broken...[i]t is a mass of clinkery, hard glassy, sharp pieces piled in tumbled heaps" (Sato et al. 1973:34).

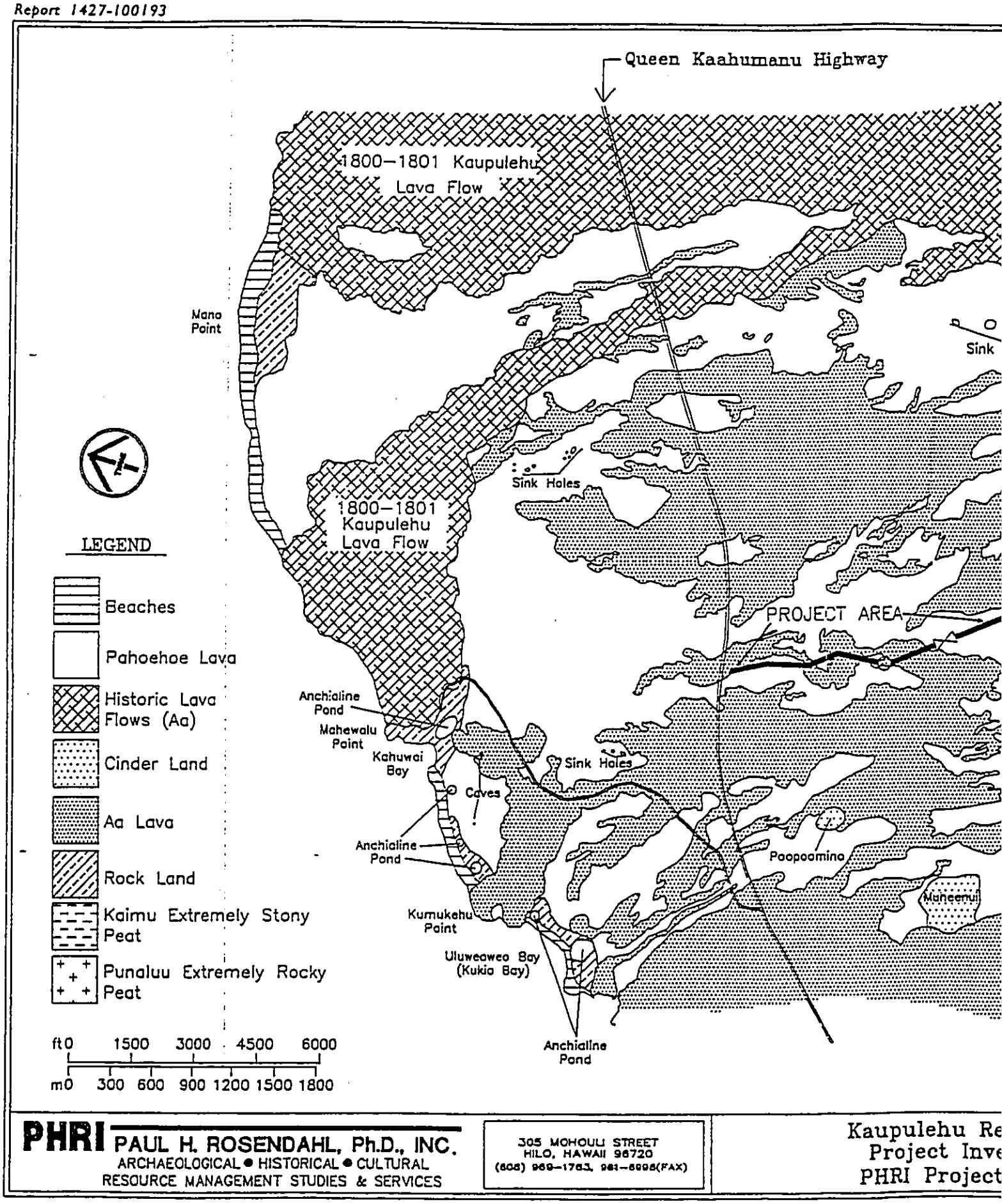
Pahoehoe Lava Flows - Comprises approximately 60% of the project area. This soil/terrain type consists solely of prehistoric period flows. According to Sato et al., "[t]his lava has a billowy, glassy surface that is relatively smooth..[i]n some areas, however, the surface is rough and broken, and there are hummocks and pressure domes. Pahoehoe lava has no soil covering and is typically bare of vegetation except for mosses and lichens. In areas of higher rainfall, however, scattered *`ohi`a* trees, *ohelo* berry, and *a`alii* have gained a foothold in cracks and crevices" (1973:34).

Annual rainfall in the general vicinity of the project area is an estimated 10-20 inches (Armstrong 1983). Vegetation in the project area consists almost entirely of fountain grass (*Pennisetum setaceum* [Forsk.] Chiev.), with mosses and lichens occurring on small portions of the pahoehoe flows.

A vegetation map initially presented in Walker and Rosendahl (1990) has been modified to show the bounds of the present project area (Figure 3). The intent of this map is to (a) show the relationship between vegetation and survey areas examined, (b) show the relationship between vegetation and site distribution patterns, if sites are identified, and (c) show the locations and extents of relatively unweathered lava flows barren of vegetation. The original map was prepared using (a) a botanical survey report prepared for Potomac Investment Associates by Camara (1989), (b) black-and-white (R.M. Towill Corp. 1988, 1"=200' approx. scale) and color infra-red (1979 and 1989, 1"=1600' scale approx.) aerial photographs, and (c) field observations made during previous surveys. The vegetation map should be considered as generalized and subject to modification.

There are three major vegetation types in the project area:

1. Barren Lava with No/Sparse Vegetation - This vegetation type is present at all elevations throughout the project area. The unnamed AD 1801 lava flow is included within this zone. The substrate of this vegetation type consists entirely of aa lava. The vegetation consists predominately of



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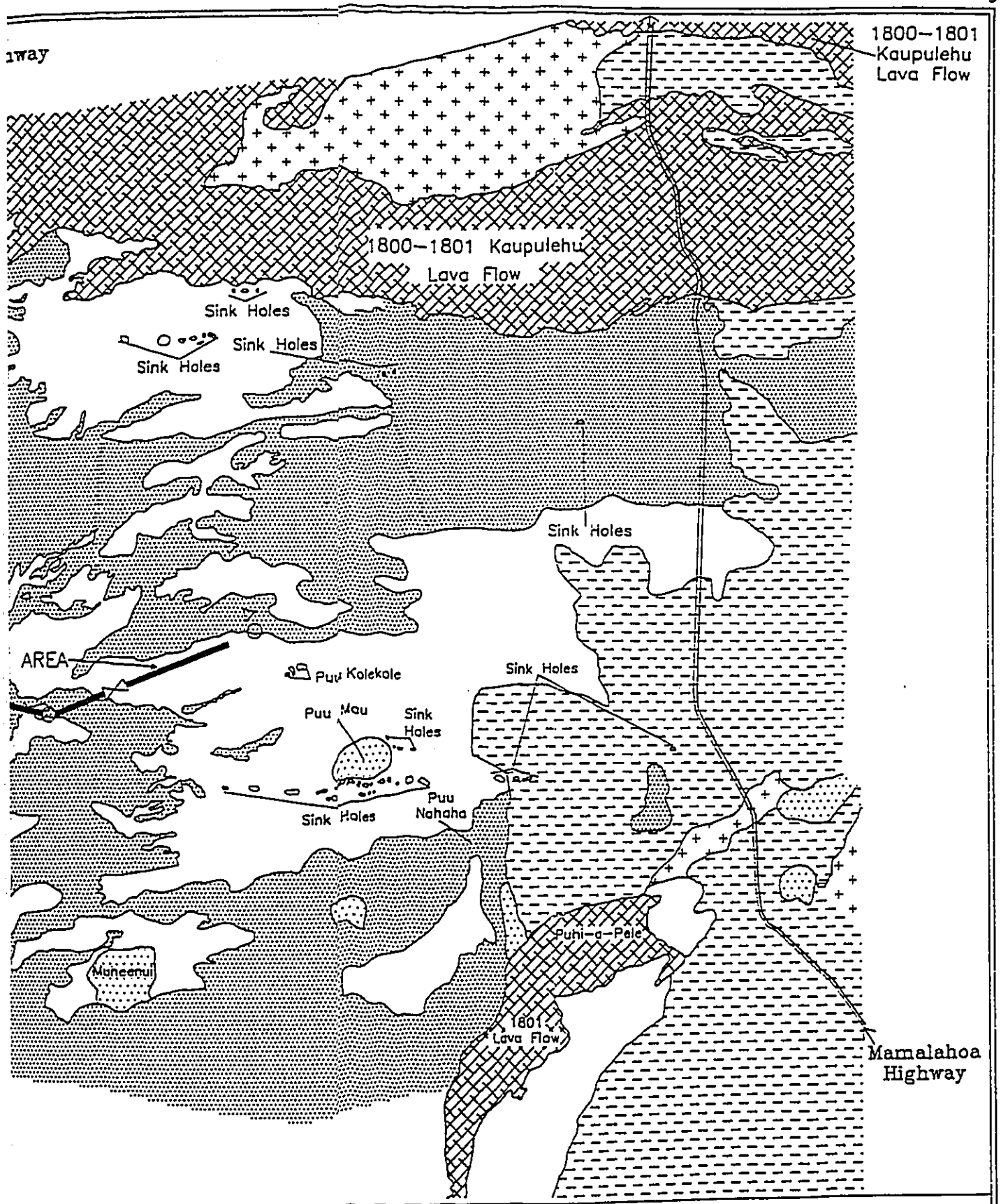
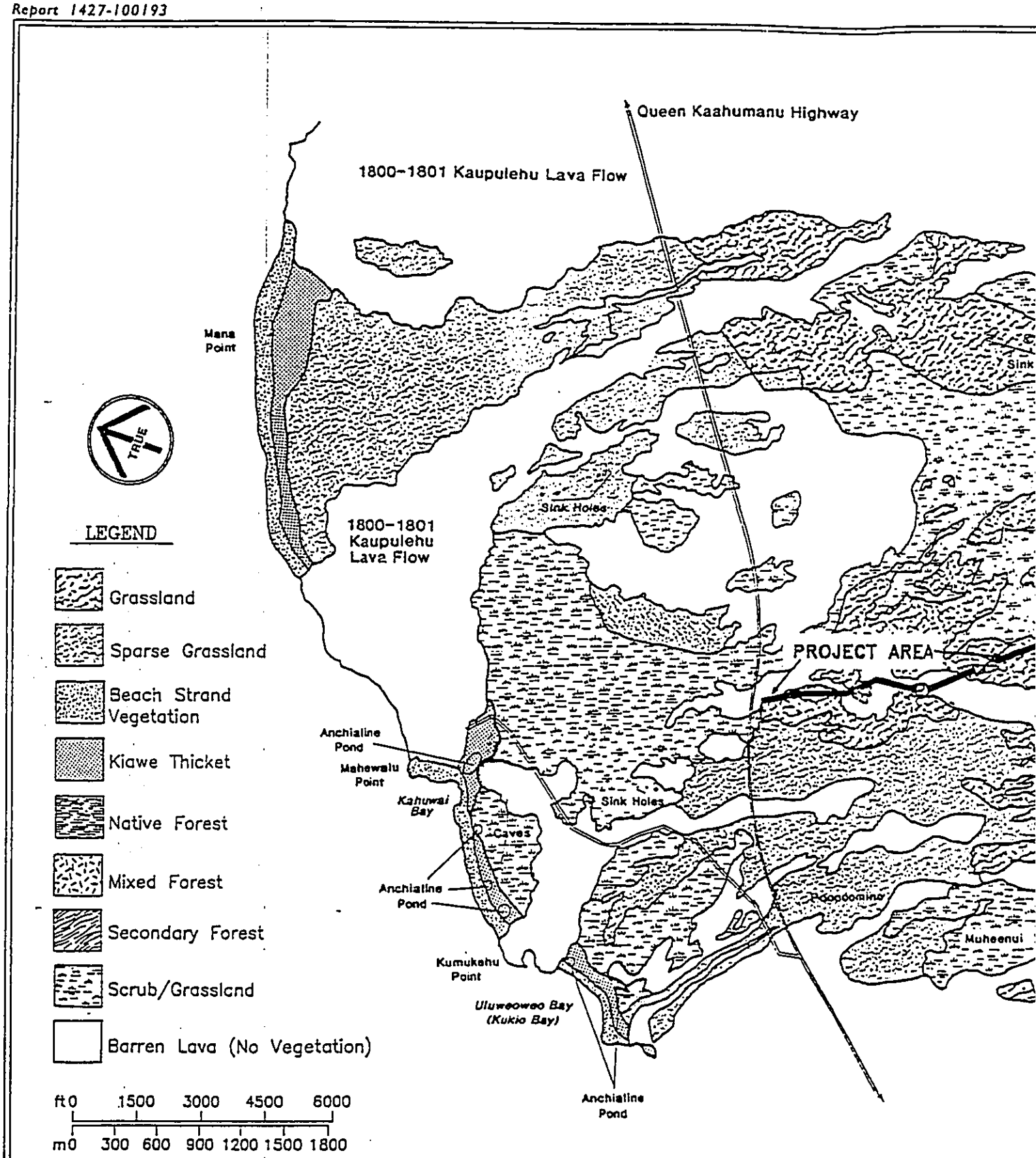


Kaupulehu Resort Irrigation
Project Inventory Survey
PHRI Project No. 93-1427

FIGURE 2.
Distribution of
Terrain Types



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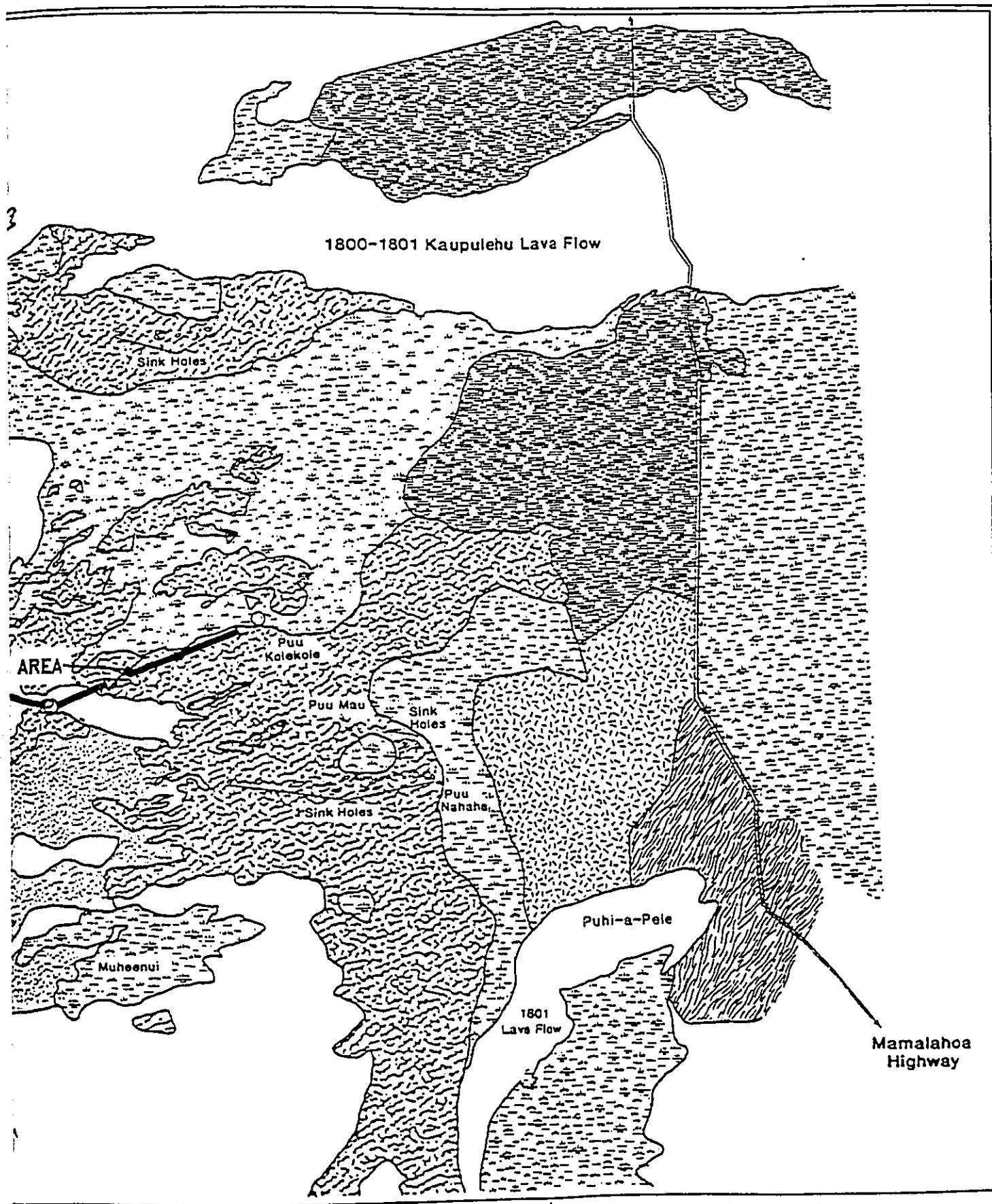


Kaupulehu Resort Irrigation
Project Inventory Survey
PHRI Project No. 93-1427

FIGURE 3.
Distribution of
Vegetation Types

solitary specimens of *'ohia* (*Metrosideros collina* [Forst.] Gray subsp. polymorpha [Gaud.] Rock), *kiawe* (*Prosopis pallida*, and *lama* (*Diospyros* sp.);

2. Sparse Grassland - This vegetation type is present at middle to lower elevations (200-950 ft AMSL) within the project area. The substrate of the type consists of both aa and pahoehoe lavas. Vegetation consists predominately of sparse grasses, *'uhaloa* (*Waltheria* sp.), and *'ilima* (*Sida* sp). Solitary *pua-pilo* (*Capparis sandwichiana* DC.), indigo, *lama*, and *kiawe* may also be present; and

3. Grassland - Between c. 240-1,550 ft elevation. The substrate of this vegetation type consists predominately of aa and pahoehoe lava. The Grassland type differs from Scrub Grassland in that grass comprises a larger percentage of the total vegetation. Fountain grass is one of the more common species of vegetation present, but the native *pili* is also present. Also present are *'uhaloa*, *'ilima*, and pluchea (*Pluchea indica* [L.] Less.).

PREVIOUS ARCHAEOLOGICAL WORK

A full discussion of previous archaeological studies within Kaupulehu *ahupua'a* and coastal areas of North Kona and South Kohala districts has been presented in Walker and Rosendahl (1990). Most of the following discussion is taken from that source; comments relevant to the present study and other data from other sources have been interpolated in the discussion where appropriate. Table 1 presents selected information concerning the archaeological projects.

Over the years there have been a number of archaeological studies conducted within Kaupulehu Ahupua'a (Figure 4). In 1930, J.E. Reinecke, while surveying sites along the western coast of Hawaii Island for the B.P. Bishop Museum, recorded four sites (Sites 122-125) along the Pacific Coast *makai* of the current project area (Reinecke n.d.). Reinecke inspected only the immediate shoreline, no more than a few hundred feet inland, and his recording of sites was sketchy, making definite correlation of his specific features with features subsequently recorded in the area difficult. Reinecke's sites were later included in an inventory of Hawaii Island sites prepared by B.P. Bishop Museum for the HCPD (Emory 1970). That inventory was based entirely on records existing in the Bishop Museum's Department of Anthropology and did not involve any field work.

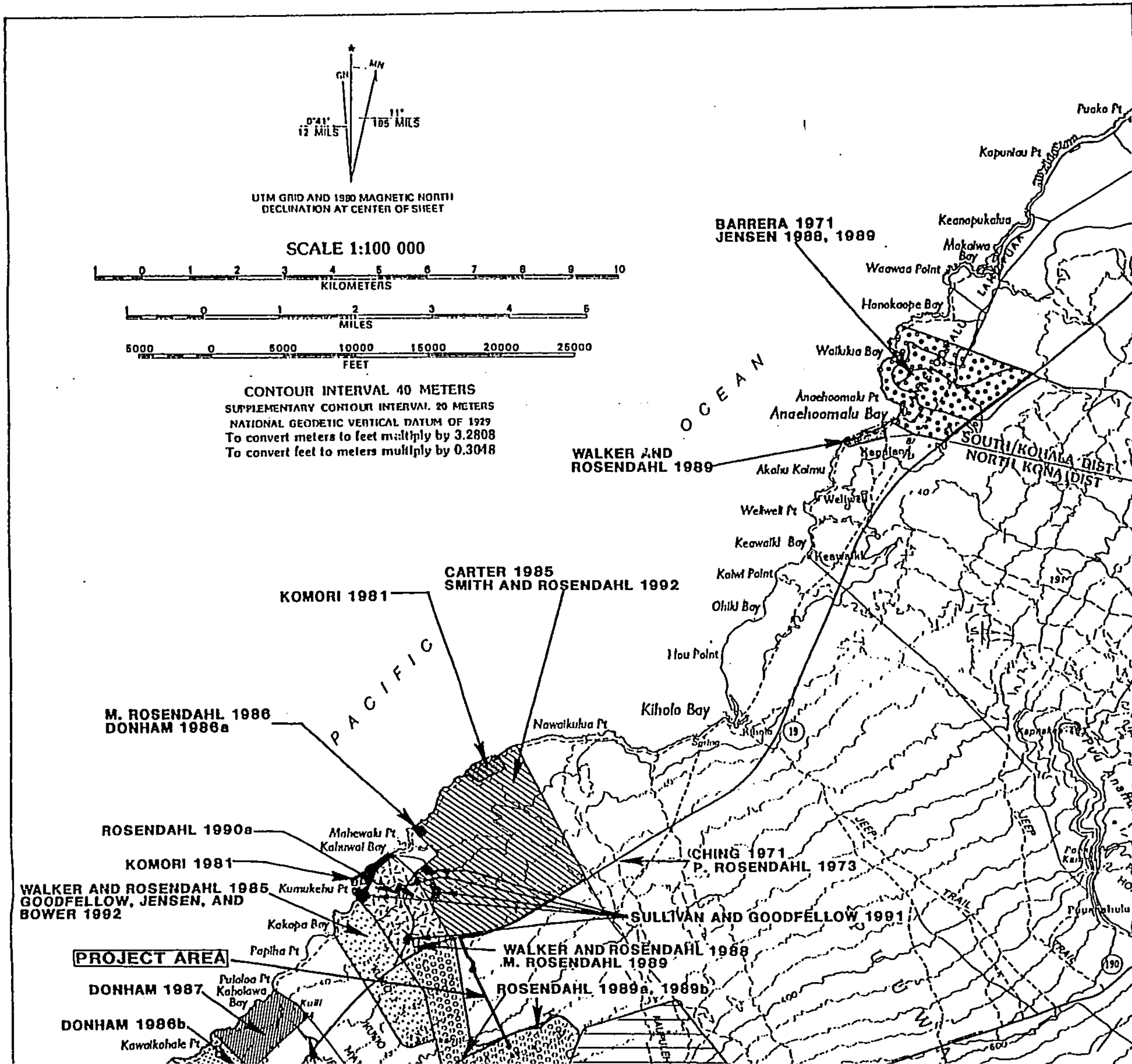
In early 1963, L.J. Soehren of Bishop Museum conducted a reconnaissance survey of Kaupulehu and Makalawena for B.P. Bishop Estate (Soehren 1963). Soehren identified 26 sites, of which 16 (Sites 1-13, 21-23) are located *makai* of the present project area. Three petroglyph sites identified by Soehren (Sites 19, 22, and 23) are also described in Cox and Stasack (1970). Soehren did not make recommendations concerning further archaeological work. Soehren's sites were later included in an inventory or Hawaii Island sites prepared in 1970 by B.P. Bishop Museum for the HCPD (Emory 1970). That inventory was based entirely on records existing in the museum's Department of Anthropology and did not involve any field work.

Between June-October 1970, the Parks Division of the DLNR conducted a surface survey of the Kailua-Kawaihae road corridor for the State Department of Transportation (Ching 1971).

Table 1.
Previous Archaeological Work in Kaupulehu and Surrounding Areas

Reference	Author(s)	Coverage	Zone	Ahupua'a
1930	Reinecke	R	C	Various
1963	Soehren	R	C	Kaupulehu/Malakawena
1970	Renger	R	C	Kaloko/Kukio 2nd
1971	Barrera	RE	CB	Anaehoomalu
1971	Ching	R	B	Various
1973	Rosendahl, P.H.	MD	B	Various
1981	Cordy	IED	CB	Kukio 1st and 2nd
1981	Komori	R	B	Kaupulehu
1985	Carter	R	CB	Kaupulehu
1985	Cordy	O	CB	Kalaoa/Ooma
1985	Walker and Rosendahl	R	CB	Kukio 1st
1986	Rosendahl, M.L.K.	R	C	Kaupulehu
1986a	Donham	R	C	Kaupulehu
1986b	Donham	R	C	Malakawena
1986	Silva	H	CBU	Malakawena
1986	Springer	ET	CBU	Awakee
1987	Springer	ET	CBU	Malakawena
1987	Donham	R	C	Awakee
1987	Silva	H	CBU	Awakee
1988	Jensen	IDR	CB	Anaehoomalu
1988	Rosendahl P.H.	R	B	Awakee
1988	Walker and Rosendahl	IED	C	Kaupulehu
1989	Jensen	DR	CB	Anaehoomalu
1989	Springer	ET	CBU	Kaupulehu
1989	Rosendahl M.L.K.	R	CB	Kaupulehu
1989	Walker, Kalima, and Rosendahl	R	C	Puuanahulu
1989a	Rosendahl, P.H.	R	B	Kaupulehu
1989b	Rosendahl, P.H.	R	B	Various
1990a	Rosendahl, P.H.	R	C	Kaupulehu
1990b	Rosendahl, P.H.	R	C	Kaupulehu
1991	Rosendahl, P.H.	R	B	Kaupulehu
1991	Sullivan and Goodfellow	MD	CB	Kaupulehu
1992	Smith and Rosendahl	R	CB	Kaupulehu
1992	Head, Goodfellow, and Rosendahl	R	BU	Kaupulehu
1992	Goodfellow and Head	ID	U	Kaupulehu
1992	Goodfellow, Jensen, and Bower	MD	CB	Kukio 1st

Key: R = Reconnaissance Survey, M = Mitigation, E = Excavation, DR = Data recovery, I = Intensive Survey, O = Regional Overview, D = Dating, C = Coastal Zone, ET = Ethnography, B = Barren Zone, H = Historical Research, U = Upland Zone


UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:100 000
KILOMETERS
MILES
FEET
CONTOUR INTERVAL 40 METERS
SUPPLEMENTARY CONTOUR INTERVAL 20 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by 0.3048
PACIFIC OCEAN
BARRERA 1971
JENSEN 1988, 1989
WALKER AND ROSENDAHL 1989
CARTER 1985
SMITH AND ROSENDAHL 1992
KOMORI 1981
M. ROSENDAHL 1986
DONHAM 1986a
ROSENDAHL 1990a
KOMORI 1981
WALKER AND ROSENDAHL 1985
GOODFELLOW, JENSEN, AND
BOWER 1992
PROJECT AREA
DONHAM 1987
DONHAM 1986b
CHING 1971
P. ROSENDAHL 1973
SULLIVAN AND GOODFELLOW 1991
WALKER AND ROSENDAHL 1988
M. ROSENDAHL 1989
ROSENDAHL 1989a, 1989b
SOUTH KOHALA DIST
NORTH KONA DIST
Puako Pt
Kapunlau Pt
Keanapukalua
Makalwa Bay
Waawaa Point
Hanokaape Bay
Waikoloa Bay
Anaehoomalu Pt
Anaehoomalu Bay
Akalu Kalmu
Weliwell Pt
Keawaiki Bay
Kalwi Point
Ohiki Bay
Hou Point
Kiholo Bay
Nawaikulua Pt
Mahewalu Pt
Kalanwai Bay
Kumukehu Pt
Kakapa Bay
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Kawalkohale Pt
JEEP
TRAIL
19
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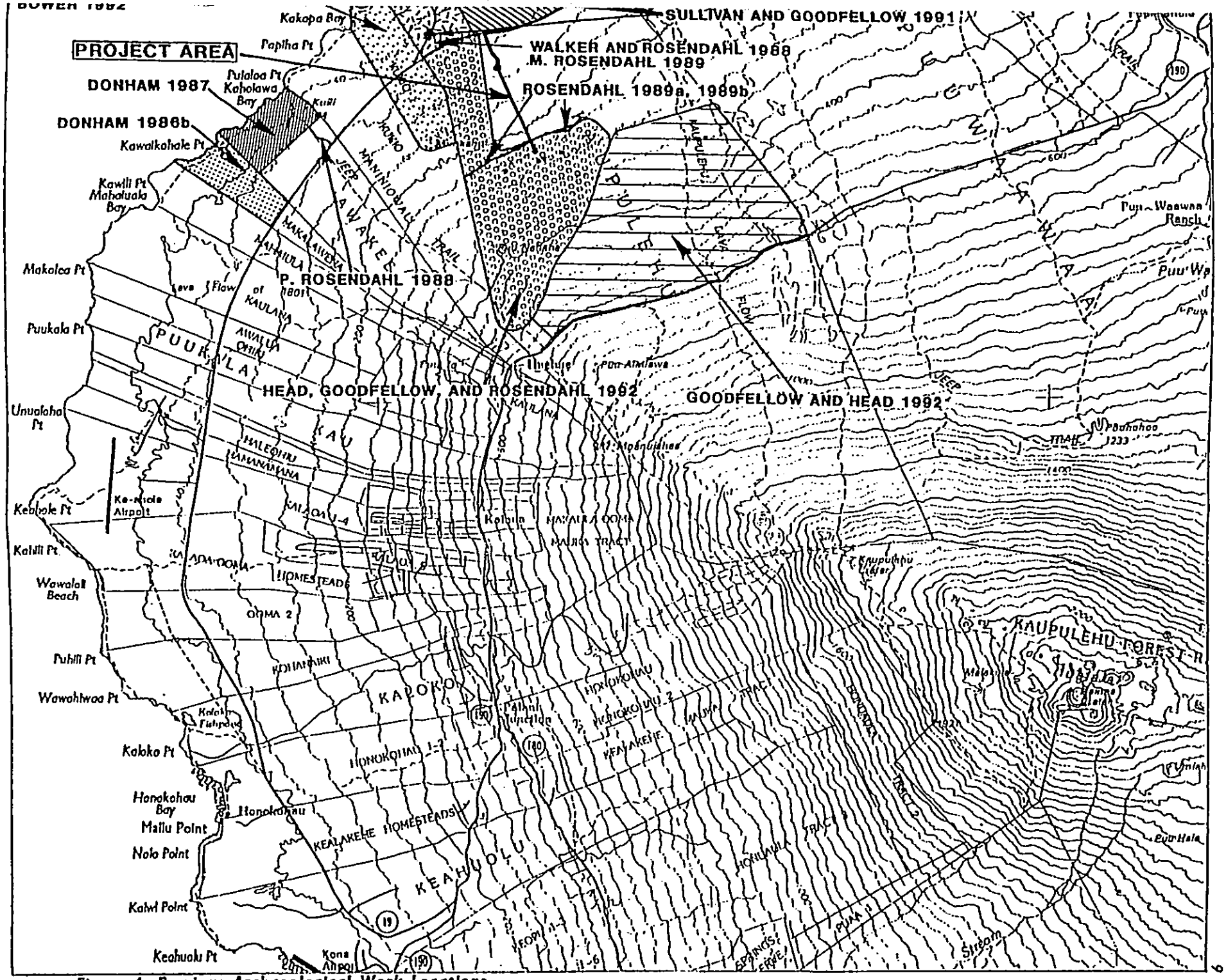

Figure 4. Previous Archaeological Work Locations

Ching identified numerous sites in his project area (SIHP Sites 1138-1141, 1143-1162, 1164-1167, 1190-1194, 1200, 1483, and 1494). Ching evaluated three sites (1140,1158 and 1160) as being of high significance and recommended the sites be saved because they were good examples of site types and were in excellent condition. Ching evaluated the remaining sites as being of low significance and recommended, with reservations, that the sites be destroyed following archaeological investigations (Ching 1971:5-7). One site, Site 1193 identified by Ching, had been previously identified as Site D21-7 in the Land of Kukio (Renger 1970).

In August 1972, in response to Ching's (1971) investigation, the Department of Anthropology, B.P. Bishop Museum, conducted archaeological salvage excavations and detailed recording of selected sites within the Kailua-Kawaihae road corridor (P.H. Rosendahl 1973). Seven sites (SIHP Sites 1140, 1141, 1157, 1158, 1160, 1162, and 1193) in the Land of Kaupulehu were included in the salvage work. Of this number, only Sites 1158 and 1160 appear to be within the present project area. Upon completion of that project, no further archaeological work was recommended for the seven sites. Based on ethnographic and ethnohistoric sources, coupled with results of the archaeological investigations, Rosendahl (1973) was able to present a model of aboriginal prehistoric Hawaiian settlement patterns for the portion of North Kona north of Kailua. Rosendahl's model is defined by four zones: a coastal habitation zone associated principally with the exploitation of various marine resources; a sloping, barren intermediate zone of recent volcanics almost devoid of soil or vegetation, associated mainly with temporary habitation and transportation between the coastal and inland zones; an upland habitation zone associated with agricultural exploitation; and an inland forest zone which was utilized but rarely inhabited. Rosendahl's upland settlement area applies principally to the slopes of Mount Hualalai, above Kailua; Rosendahl indicates that virtually nothing is known of the upland areas between the Lands of Mahaiula and Puuanahulu. Rosendahl's model was subsequently expanded upon by Hommon (1976). Hommon suggested that during the period of about AD 1400-1500, a shift in settlement patterns (inland expansion and permanent settlement) occurred through the development of permanent upland agriculture. Volcanic glass and radiocarbon age ranges from all sites investigated by Rosendahl indicate a time range of AD 1265-1855. Volcanic glass age ranges specifically from the Land of Kaupulehu yielded an overall date range of AD 1427-1763. No radiocarbon samples were submitted from the Land of Kaupulehu.

In April 1981, E. Komori of the Department of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of two parcels of land in the coastal portion of Kaupulehu for Cambridge Pacific, Inc. Komori identified 19 sites, all of which are located seaward of the present project area. Based on the findings of his survey, Komori evaluated the sites as "not unique for the leeward coast of the Island of Hawai'i. Therefore, *in situ* preservation of the structures is not necessary" (Komori 1981:21). However, Komori recommended a program of salvage excavations (including mapping); he also recommended that any human burials found be given proper treatment prior to construction work.

In September of 1984, the Department of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of the entire seaward portion of the Land of Kaupulehu (between Queen Kaahumanu Highway and the Pacific Ocean) for Barnwell Industries, Inc. (Carter 1985). The primary objectives of that survey were (a) to locate and record previously undocumented sites, (b) to relocate previously recorded sites, noting present condition, (c) to identify and locate areas with probable subsurface deposits, and (d) to recommend appropriate work for subsequent phases of archaeological investigations. Carter states in her report that objective (b), due to time constraints, was only partially met, and that previously identified Sites 1-5, 25, 26, 28, 29, 39, 41, 42, 43, and 202 were not field-checked. She also indicates that

her survey did not cover coastal areas (which had been examined previously) and lava flow interiors (1985:1,4). Carter's survey located 195 sites—47 previously identified and 148 newly identified (Carter states 151 new sites were found but she includes three sites [Sites 79, 80, and 91] previously recorded by Ching 1971 [Sites 1146-1152, 1144, and 1161]). Carter also states the identified sites contained numerous component features, but she does not say exactly how many (Carter 1985:5). Of the 195 sites, none are located within the present project area; Carter's *mauka* boundary (Queen Kaahumanu Highway) also forms the *makai* limits for the current project. Based on the findings of her 1984 survey, Carter recommended a program of "extensive survey" (including test excavations), intensive mapping, and treatment of human remains for one general and eight specific study areas (Carter 1985:29-33). She concludes that "recommendations regarding the preservation of specific sites will be contingent upon the results of extensive (Phase I) survey" (Carter 1985:27).

Within Carter's report is Marion Kelly's "Notes on the History of Kaupulehu" (Kelly 1985; Appendix C). Kelly describes Kekaha (*`aina malo`o*; a dry sunbaked land), which includes Kaupulehu, as an extensive lava-covered land of low rainfall and sparse vegetation encompassing a portion of Kona north of Kailua. Kelly's report includes discussions of (a) cultivation in Kekaha, (b) the meaning of the place name "Kaupulehu," (c) the *konohiki* of Kaupulehu, (d) petroglyphs at Kaupulehu, (e) Lono in Kona, (f) Kane at Kaupulehu, and (g) leases and development. In her report are also two short sub-appendices "The Destruction of the Great Fishpond of Paaiea" and "Kameeiamoku Captures the Fair American."

Kelly has indicated there is evidence that Kekaha land, though arid today, was once cultivated. Kelly quotes Ellis, who in 1842 noted that "...small gardens were seen among the barren rocks...wherever soil could be found sufficient to nourish sweet potato, the watermellon [sic], or even a few plants of tobacco..." (Ellis 1963:30-31). Kelly notes that, although their vegetable diet came mainly from the uplands of their *ahupua`a*, people may have been able to at least seasonally cultivate certain crops (Kelly 1985:89).

Kelly indicates the name "Kaupulehu" may mean "the roasted breadfruit," the `u being short for *`ulu*; or according to another source (Pukui and Elbert 1971:128,184), the name could be divided into the words *ka`upu* (meaning a kind of bird) and *lehu* (meaning numerous), together meaning "many birds of this kind" (Kelly 1985:89).

Kelly also indicates that Hawaiian chief Kameeiamoku, advisor to Kamehameha, resided in Kaupulehu and was involved in foreign trade. Her report also includes mythological references to Kaupulehu. The most prominent reference is to the god Lono, who is associated with Kona. Lono is said to have introduced the main food plants to Hawaii Island. Another supernatural figure referenced is the god Kane. Kane, in one legend, disguises himself as a young man and marries a chief's daughter at Kaupulehu. Eventually, he reveals his true identity and provides the villagers with a spring for drinking and healing (Kelly 1985:92,93).

While discussing the leases and development pertaining to Kaupulehu, Kelly indicates that in 1961, Bishop Estate leased for 65 years 18,228 acres of Kaupulehu Ahupua'a to Hualalai Development. In October of 1961, Hualalai Development subleased 62 acres of the land, the site of the Kona Village, to John M. Jackson, and in 1962 the same company subleased 7,000 acres to Gardner Anthony (Kelly 1985:93). In 1963, Jackson assigned the 62-acre sublease to his family-owned Copra and Trading Company, Inc., which later merged with Kona Village Property, Inc. (the merged companies retained the name of Island Copra and Trading Company, Inc.). Later the 62 acres were attained by a subsidiary of Cambridge Pacific, Inc.; in 1983, the same parcel, reduced to about 60 acres, was leased by Bishop Estate to Kona Village Partnership (AF Properties and AAE, Ltd., Colorado) (Kelly 1985:93).

In 1968, the lease on the bulk of Kaupulehu Ahupua'a went from Hualalai Development Corp. to Signal Oil Corp.; then in 1979, the lease went to Cambridge Pacific (Canada). Finally, in 1984, Barnwell Hawaiian Properties went into partnership with Cambridge Pacific, Inc., and the lease was assigned to Kaupulehu Development, a subsidiary of the partnership (Kelly 1985:94).

In her conclusion, Kelly recommends more documentation of 20th-century land use for Kaupulehu Ahupua'a. She also recommends more areal historical documentation be performed.

In April of 1986, PHRI conducted an archaeological field inspection of the Kona Village Expansion Site (M.L.K. Rosendahl 1986). The project area was situated on the AD 1801 Kaupulehu Lava Flow. The only site identified (Site 230-1) was a historic foot trail defined as a Type "A" single-file foot trail (M.L.K. Rosendahl 1986:2). Subsequently, PHRI inspected a revised Kona Village Expansion Site project area (Donham 1986a). With the exception of the previously identified trail (Site 230-1), no new archaeological sites were identified (Donham 1986a:2). Although physical preservation of the trail was not required, it was recommended that the trail's location be accurately plotted, limited historical documentary research be conducted, and that site preservation and incorporation of representative trail sections into the overall landscape design be considered.

Between February 10-March 6, 1986, PHRI conducted archaeological survey and test excavations at Kaupulehu Makai Resort project area, located in the coastal portion of the Lands of Kaupulehu (Walker and Rosendahl 1988). During the survey and testing, 53 sites (201 component features) were located. Of the 53 sites, 46 (139+ features) had been previously recorded and seven sites (63+ features) were newly identified. Formal features types encountered in the project area include walled shelter, walled enclosure, trail, lava formation, wall, cairn, platform, pit, cleared/leveled area, rock alignment, terrace, overhang shelter, pahoehoe clearing, walled pahoehoe clearing, petroglyph, burial, and ramp (possible). Functional types encountered in the project area include habitation, foot trail, transportation, pond wall, fishtrap (possible), boundary marker, ceremonial, quarry, marker, drift wall (possible), and indeterminate.

Thirty-six test units (57.75 sq m) were excavated at sites in the Walker and Rosendahl (1988) project area. The units yielded a variety of cultural remains, including portable artifacts, midden, and dating samples. The portable artifact collection (1,260 items) included fishing gear, tools, domestic implements, flaked stone, and miscellaneous modified lithic, bone, organic, and marine gastropod remains (c. 81%), miscellaneous invertebrate remains (c. 13%), bivalvia remains (3.5%), vertebrate remains (1.6%), and vegetal remains (0.97%). Ten radiocarbon and 44 volcanic glass dating samples were submitted for age determination analysis. The radiocarbon dates spanned a 925-year period (AD 1030-present); the volcanic glass dates spanned a 538-year period (AD 1282-1820).

Overall, the Walker and Rosendahl (1988) studies provided data useful in understanding both occupation and exploitation of the Kaupulehu coastal zone. The work documented both prehistoric and historic sites and indicated that early occupation in Kaupulehu most likely took place primarily near the coast. Included in the conclusion is a discussion addressing the nature of occupation (variety and distribution of functional site types, resources, and cultural activities; and age, duration, and intensity of occupation), intra-site comments, and regional development comments.

Of the eight sites Walker and Rosendahl identified in the Kaupulehu Makai Resort project area, six were assessed as significant only for information content (Sites 1161, 10964-10967,

and 10990). No further work was recommended for these six sites. For the remaining two sites further work in the form of additional data collection, preservation, and interpretive development was recommended.

In December of 1988, PHRI conducted an archaeological inventory survey of the Kaupulehu Resort Utility Corridor project area (M.L.K. Rosendahl 1989). The 100-foot wide corridor is situated adjacent to and immediately northeast of the Kaupulehu-Kukio boundary. It begins on the seaward end at Queen Kaahumanu Highway and extends inland ending at the Conservation District boundary (c. 850 ft AMSL). With the exception of two previously identified trails, Site D21-7/1193 (Renger 1970/Ching 1971) and Site 10977 (Walker and Rosendahl 1988), no new sites were identified. Sites 1193 and 10977 were evaluated as being significant for information content, cultural value, and as excellent examples of a site type (interpretive value), and they were recommended for preservation "as is" (M.L.K. Rosendahl 1989:12).

Phase II (Archaeological Data Recovery Work) of the Phased Mitigation Program for the Kaupulehu Makai Resort project area was conducted during October-November 1989. During the field work, one new site (14659) consisting of a single feature was identified, and additional features were identified at Sites 10948, 10955, 10959, 10991, and 10992 (Sullivan and Goodfellow 1991). Subsurface investigations consisted of formal excavation units placed at ten of the 12 sites identified as requiring further work, and a series of shovel tests placed along the coastal portion of the project area. One hundred eighty-three samples, including charcoal, soil/flotation, pollen, and ecofactual samples were collected during the excavations and were processed for the final report; and more than 2,000 portable artifacts were recovered *in situ* or during the processing of samples. All relevant structural features in the project area were mapped and recorded; where necessary, excavations were backfilled and excavated features were reconstructed for preservation (Sites 10947, 10968, 10969, 10991, and 10992).

Finally, as part of the data recovery work, several sites containing human remains were investigated. Data recovery at three of the known burial sites (10959, 10986, 10987) involved disinterment of the remains; this procedure was carried out in compliance with the guidelines established by the Burial Treatment Plan (Jensen and Rosendahl 1989) and in accordance with a State Department of Health permit. Following the identification of three of the individuals interred at Site 10991 by a lineal descendant (Mr. Robert Keakealani, since deceased), and at his request, Site 10991 was scheduled for preservation and was sealed to protect the burials. The osteological report for this project area was issued under separate cover (Kalima 1991).

The Phase II findings indicated that initial use of the Kaupulehu Makai Resort project area occurred between AD 1000-1300. Prehistoric activity appears to have been associated with exploitation of marine resources, with most features exhibiting evidence of temporary rather than permanent habitation.

In November of 1989, PHRI conducted Phase I (Site Identification) of an archaeological inventory survey of the irrigation system portion of the Kaupulehu Resort Mauka Utility Corridor project area (P.H. Rosendahl 1989a). The 100-ft wide corridor and two well pad sites are situated c. 1.3 miles inland of Queen Kaahumanu Highway, inland of and roughly parallel to the existing State Conservation District boundary, and they extend generally along the same elevation contour (850-900 ft AMSL). The corridor was c. 8,300 ft long and the well pads each measured c. 100 ft by 100 ft. A total of 19 sites and site complexes (c. 52 component features) were identified during the survey work. Formal site types included cairn, pahoehoe excavation,

enclosure, cave, surface midden scatter, trail, pahoehoe slab pile, and overhang. The majority of the sites consisted of pahoehoe excavations and cairns (42 features). Formal feature types included quarry (pahoehoe excavations), agriculture, temporary habitation, and transportation. One site, Site 720-12, previously identified as Site 1319 by Ching (1971), is a branch of Kiholo-Kaupulehu Trail. Although inventory survey-level recording and mapping (Phase II - Data Collection) were not carried out, it was apparent the sites would be evaluated as being significant for information content (P.H. Rosendahl 1989a). Because the corridor alignment could be modified, it was recommended that the sites be avoided and thus temporarily be preserved "as is." It was further recommended that (a) the alternative alignment centerline and well pad site deviations determined by the archaeologist during the site identification field work be utilized, and (b) that archaeological monitoring of all initial grubbing and grading be conducted by a qualified archaeologist (P.H. Rosendahl 1989a:2).

In May 1990 PHRI conducted an archaeological inventory survey of additional Kaupulehu Resort Utility Corridor areas (Rosendahl 1990; Letter Report 720-051090). The areas consisted of two corridor sections, a proposed reservoir site, and an electrical substation site. During the survey two previously identified sites (trail sections) and three newly identified sites (pahoehoe excavations and a blister cave) were identified within or immediately adjacent to the project area. Of the five sites, two trail sections were assessed as valuable as examples of site types and as culturally *significant. Preservation "as is" was recommended* for the trail sections. No further work was recommended for the remaining three sites.

In December of 1989, PHRI conducted Phase I (Site Identification) of an archaeological inventory survey of the expanded Kaupulehu Resort Mauka Utility Corridor and Proposed Reservoir Site project area (P.H. Rosendahl 1989b). The 100-ft wide corridor, situated 1.6-2.7 miles inland of Queen Kaahamanu Highway, measures c. 8,270 ft in length, and ranges in elevation from c. 850-1,350 ft AMSL. The proposed reservoir site consists of c. 2.1 acres situated at about 1,350 ft AMSL. The inventory survey identified one new site (Site 720-20; cave) and two previously recorded sites (Sites 1193 and 1319; trails) within or in the vicinity of the project area. Although no physical evidence of Sites 1193 and 1319 were observed during the survey, background research indicated they were within or in the vicinity of the project area. Site 720-20 was evaluated as being significant solely for information content, while Sites 1193 and 1319 were evaluated as being significant for information content, cultural value, and as excellent examples of site types (interpretive value). Because the corridor alignment could be realigned, it was recommended that Site 720-20 be avoided and thus temporarily preserved "as is." It was recommended that the approximate locations of Sites 1193 and 1319 (based on previous archaeological work, cartographic resources, and local informant information) be accurately plotted in the field with the aid of an archaeologist. Following accurate locational plotting, it was recommended that if the trails did cross the project area, areas they crossed should then be preserved, and pedestrian access to them be allowed (P.H. Rosendahl 1989b:2).

In early 1990, PHRI conducted an archaeological resources assessment study of the Kaupulehu Phase II Master Plan project area, consisting of c. 9,350 acres located in the Land of Kaupulehu. The objective of the survey was to provide information concerning archaeological resources within the general project area appropriate to and sufficient for preliminary development planning and preparation of a Conceptual Master Plan. In this project, 168 sites were identified. This total number included 159 sites that been previously identified and nine new sites. Kaupulehu Ahupua'a contained 15 sites that had minimally undergone inventory-level survey work and general significance assessments for them had been made previously. For the remainder of the sites, it was stated that inventory-level survey of the sites must be

conducted prior to assessing and presenting specific recommendations for them. The project area was then divided into three areas varying in potential (low-high) of potential for archaeological sites (archaeological sensitivity). The areas were depicted on a map which was estimated to be quite reliable, and it was recommended that this map be used as a guideline for future development planning and archaeological work within the area (Walker and Rosendahl 1990:ii).

In June 1990 PHRI conducted Phase I - Site Identification of an archaeological Inventory Survey of the Kaupulehu Phase II Mauka Utility Corridor (Rosendahl 1990c). Two sites were identified during the field work: Site 851-1, a habitation complex; and Site 1193, a trail.

In October-December 1990, PHRI conducted an archaeological inventory survey of the Kaupulehu Mauka Lands project area (Head *et al.* 1992). During the survey, 77 sites with 190 component features were located. Of the 77 sites, 17 had been previously located (but not recorded) and 60 were newly identified. The sites included the following formal feature types: alignment, C-shape, lava tube cave, cairn, cleared area, cupboard, enclosure, excavation, hearth, trail, mound, overhang, pahoehoe excavation, petroglyph, platform, terrace, upright, and wall. The feature types comprised the following functional types: temporary habitation, habitation, marker, indeterminate, agriculture/animal husbandry, agriculture, storage, water catchment, quarry, burial, habitation/possible burial, transportation, animal husbandry, boundary, ceremonial/marker, ceremonial/storage, habitation/burial, habitation/transportation, and recreation. Dating results indicated that the project area was initially utilized during prehistoric times, potentially as early as AD 1423, and that occupation continued through the historic period. Based on the interpretation of site distribution patterns and portable remains recovered from several of the sites, use of the project area was primarily associated with temporary habitation, dryland agriculture, and transportation.

In January 1991, PHRI conducted an archeological inventory survey of the Kaupulehu Makai Resort Intersection project area (P.H. Rosendahl 1991). The project area is at an elevation of 170-230 ft AMSL and consisted of about 20 acres *makai* of Queen Kaahumanu Highway. Four sites were identified during survey work. Formal feature types included lava tube cave (modified), charcoal concentration, and pahoehoe excavation. More recently, PHRI conducted an aerial and pedestrian site identification survey of the approximately 2,184-acre Ka'upulehu Makai - Lot 4 project area. This Phase I archaeological survey identified 197 sites consisting of 518 component features. Formal feature types identified included C-shape, double C-shape, U-shape, double U-shape, L-shape, J-shape, T-shape, crescent, enclosure, terrace, platform, possible shrine, wall, cairn, trail, cave, overhang, petroglyph, *papamu*, salt pan, modified outcrop, modified depression, pahoehoe excavations (with modification and or midden/cultural deposit), mound, alignment, and midden/cultural deposit.

The feature types were assigned the following functional types: habitation, possible habitation, burial, possible burial, transportation, marker, rock art, recreation, possible ceremonial, agriculture, possible agriculture, quarry, and indeterminate. In addition, c. 1,500 pahoehoe excavations (some with associated waterworn basalt hammerstones) were identified and were tabulated by survey sweep. One site (a previously identified trail) was found in the center of the project area, on the 1801 lava flow, and another was found in a *kipuka* of the other major *'a'a* flow (Smith and P.H. Rosendahl 1992).

PHRI also conducted an inventory survey of the c. 3,192-acre Ka'upulehu Mauka Lands Golf Course II Area and Remaining Area. During this examination of Barren Zone and Upland Zone lands, 33 sites consisting of 278+ component features were identified. One site (Site

1319, Kiholo-Ka'upulehu Trail) had been recorded previously. The following feature types were recorded: pahoehoe excavation, lava tube, enclosure, C-shape, mound, platform, cairn, modified outcrop, terrace, and slab-lined depression. Some features were composites of various formal types; e.g., lava tube caves with terraces, alignments, etc. Functional types included habitation (long-term and temporary), agriculture/animal husbandry, marker, quarry, transportation, and indeterminate. The data from this project indicated that the project area was occupied both historically and prehistorically, possibly as early as 1213 AD. Most of the occupations appeared to have been temporary (Goodfellow and Head 1992).

Archaeological work previously conducted in the general vicinity of the project area includes, but is not limited to, survey and testing along the coast of the Lands of Kukio 1st and 2nd and Maniniowali (Cordy 1981), reconnaissance surveys in Kaupulehu (outside the present project area), Kukio 1st, Awakee, Makalawena, and Kapalaoa (Renger 1970; Walker and Rosendahl 1985; Donham 1986b, 1987; P.H. Rosendahl 1990a,b; Walker and Rosendahl 1989), reconnaissance survey and data recovery excavations at Anaehoomalu (Barrera 1971; Jensen 1988, 1989), preliminary historical documentary research and regional notes on Makalawena and Awakee (Silva 1986, 1987; Springer 1986, 1987, 1989), and an overview of Hawaiian Island archaeology for the Ooma and Kalaoa area of North Kona (Cordy 1985). Cordy (1985) also includes notes relating to environmental zones, chronological information, site patterning, limited archival research, regional development/interpretation comments, and future considerations.

HISTORIC DOCUMENTARY RESEARCH *by Kepa Maly*

Introduction

The *ahupua'a* of Kau'pulehu is located in the North Kona District of the island of Hawai'i. Bounded on the north by Pu'uwa'awa'a Ahupua'a and on the south by Kukio Ahupua'a, Ka'upulehu extends westward from the sea to Mount Hualalai, which rises to an elevation of about 8,251 feet.

Ka'upulehu has a rich and varied history and many documents dealing with this area are available. This project deals with Ka'upulehu Mauka, or the upland zone of Ka'upulehu, and so the focus of this report will be on this area.

The name Ka'upulehu is translated by some sources as the roasted breadfruit, the '*u* being short for '*ulu* (Pukui et al. 1974:96). Eliza D. Maguire said the name Ka'upulehu is a contraction of Ka-imu-pulehu-a-ke-akua, the oven in which the god was roasted (1926:39). Various sources offer other interpretations of the name, many of them drawn from legends associated with the area. These legends will be discussed in detail below.

Place Names in Kau'pulehu

Place names have played an important role in the culture and history of the Hawaiian Islands. In ancient times, place names were important links between an area and a certain story or theme. Places often received their names according to the features of that area, or the kind of work done there. There are a number of places with interesting names in and around Ka'upulehu Ahupua'a.

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The entire portion of North Kona which lies between Honokohau and Kapalaoa was once known as Kekaha (Soehren 1963:1). Kekaha (where food does not grow) was a waterless land, often ravaged by Pele. Natives of the land often gave to these barren lava fields such epithets as Kekaha wekaweka (black Kekaha) and Kekaha wai 'ole (waterless Kekaha) (ibid.).

One Hawaiian saying concerns the beginning of the new fishing season off Kekaha:

> *Ola akula ka 'aina kaha, ua pua ka lehua i kai.*
>
> Life has come to the *kaha* lands for the lehua blooms are seen at sea.
>
> "Kaha Lands" refers to Kekaha, Kona, Hawaii. When the season for deep-sea fishing arrived, the canoes of the expert fishermen were seen going and coming (Pukui 1983:271).

Kekaha was also known as a land where the gusty Ho'olua wind blew. John Papa I'i, a 19th century Hawaiian historian and member of the court of Kamehameha III, wrote:

> A little more frequent was a cold wind from Kekaha, the Hoolua. Because of the calm of that land, people often slept outside of the tapa drying sites at night. It is said to be a land that grows cold with a dew-laden breeze, but perhaps not so cold as in Hilo when the Alahonua blows (I'i 1973:122).

The following names are listed in Soehren's report as being from the Boundary Cert. No. 160. They also appear on the Bishop Estate Map No. 2212. They are listed beginning at the shore between Ka'upulehu and Pu'uwa'awa'a and continuing clockwise around Ka'upulehu. Soehren notes:

> Interpretation of place names is often difficult without a knowledge of the local history. Descriptive names generally present no problems, but those which are commemorative can rarely be translated correctly without reference to the mo'olelo or story of its origin. The name Ka'upulehu is an excellent example. In the following lists, therefore, translations are not offered for all names (Soehren 1963:18).

Pohaku-o-ka-hae	banner rock
Ke-ahu-kau-pua'a	mound for placing pig
'Owe'owe	rattle; a *kipuka*
Pulu-'ohia	'ohia's mulch
Puako-wai	—
Pohaku-loa	long rock
Mawae	fissure
Pu'u Nahaha	broken hill
Maile-hahei	maile worn across shoulders
Pu'u Honua'ula	red earth hill
Palahalaha	level
Ka-wai-o-ka-la'i-puna	the water of the tranquil spring
Pulehu	cook in embers
Moa-nui-ahea	—
Puha-a-Pele	Pele's steaming
Po'opo'o-mino	dented hollow

The following names are also found within the boundaries of Ka'upulehu:

Kumu-kea Point	white base
Wai-a-kuhi Pond	—
Kahu-wai Bay	contraction of Kahua wai, place of water
Mahewalu Point	—
Puu Kolekole	—
Puu Mauu (Puu Mau-USGS map)	grass hill
Kileo	—
Puu Alauawa (perhaps Alauwa)	red-fish hill (?)
Hina-kapo-'ula	name of a goddess
Ka'upulehu Crater	—
Kalulu	the sheltered
Malekule	—
Lua-makani	wind pit
Hai-noa	free will offering
Ki-pahe'e	slippery slide
Na-wahine	the women
Pu'u Ma'au	gad-about hill

(ibid:15-16).

Soehren gives the names of two deep-sea fishing grounds (*ko'a*) in the vicinity of Ka'upulehu:

> Mahewalu, for 'opelu, is said to lie beyond Kalaeokamano [Shark Point]...which is actually in Pu'u Wa'awa'a, although close to the Ka'upulehu boundary. However, Mahewalu is also the name of a promontory formed by the Ka'upulehu lava flow on the northeast side of Kahuwai Bay. The exact location of the other fishing ground, Kaho'owaha, is also unknown, but it may well belong to Ka'upulehu. One of the landmarks of this ko'a is Kanaka-loa, a long stone lying on the side of Muhe'enui. Although this prominent hill is in Kuki'o it is close to the Ka'upulehu boundary. The stone was said to be a man and the hill a woman...(ibid.).

Ka'upulehu is said to have gone by the ancient name of Manuahi. This name translates as fire bird (Pukui et al. 1974:146) when broken into two words, *manu* (bird) and *ahi* (fire). Although Pukui et al. say that Manuahi is the ancient name for Ka'upulehu, according to other sources, Manuahi is a name for a place in Ka'upulehu and not for the entire *ahupua'a*. In fact, Soehren lists Manuahi as a village below Kileo and Akahipu'u, noted in the story of two girls eating breadfruit (see below).

Kaupulehu in Legend

Numerous legends are associated with the Ka'upulehu area. The Hawaiians believed that before men inhabited the islands, the gods came. These gods were responsible for all that was found in Hawaii. Jensen and Rosendahl (1989:3) tell about the presence of two gods in Ka'upulehu:

> ...The most prominent reference is to the God Lono, who is associated with Kona. Lono is said to have introduced the main food plants to Hawaii Island. Another reference is to the god Kane who, in one legend, disguises himself

> as a young man and marries a chief's daughter at Kaupulehu. Eventually he reveals his identity and provides the villagers with a spring for drinking and healing.

This story is described by John Reinecke, who collected information on Ka'upulehu during his survey of Kona sites for the Bishop Museum in 1930:

> A chief of Kaupulehu had a lovely daughter. One day a handsome young man appeared; he was the god Kane in disguise. The chief married his daughter to the young man because of his fine looks, but the stranger turned out to be a worthless husband; he slept day and night; he never worked. This angered the chief. Kane always spoke to the rest of the villagers, even his father-in-law, through his wife; the chief therefore had his daughter pester Kane until he could stand it no longer, to do something useful.
>
> At last Kane told his wife to have the chief command all the people of Kaupulehu to gather wood for one day. The chief hesitated at such a seemingly foolish demand, but finally sent his followers out to obey it. Then Kane ordered them to build a huge *imu*.
>
> He then went *mauka* and gathered all the *kalo* in a great patch. This he bundled all together, pulled up a *lehua* tree by the roots, tied the *kalo* to it, and carried the untrimmed tree down to the village, naturally to the amazement of all. The chief began to suspect that his son-in-law was a god.
>
> Kane made the villagers enlarge the *imu*, into which he put all the *kalo*. He then entered it with the *kalo*, just before sunset, and commanded his wife to cover him, ordering her not to open the *imu* until his return. She reluctantly obeyed.
>
> The *imu* was situated about a mile from the coast. Kane went underground until he reached the spot where the spring now is; here he emerged, the spring flowed forth, fresh water, as from a faucet (at low tide). Then he came and appeared to his wife, who cried out in alarm, thinking him a ghost. But he reassured her, and made her and the villagers follow him to the imu which they opened. And behold it was full of all sorts of food, pigs, fish, yams, *kalo*, and whatever else can be cooked in an oven. The people cried out, He is a god! and Kane revealed his identity.
>
> Then he had them follow him to the spring, which he gave them for drinking and for healing (and no doubt disappeared).
>
> If one will dive in twenty-five times, five times repeated five times, once in the morning and once in the evening until the required number is fulfilled, he will be cured of whatever ails him. Then he should dive once more to give thanks. No woman in her period may approach the spring, which is pure water (Reinecke 1930:93).

Another version of this story is told by Eliza D. Maguire in "The Waters of Kane." In it Maguire states that during the reign of a chiefess of Ka`upulehu, there was a severe drought. In response to her prayers, the god Kane came to help her. Kane ordered a large *imu* (oven) to be prepared, entered the oven, and was sealed in it, only to miraculously reappear in the sea

(1926:10). The place from which he emerged became a spring, known from then on as the waters of Kane. When the *imu* was opened, it was found to be filled with great quantities of cooked food, which relieved the famine caused by the drought. Thus the name Ka`upulehu is a contraction of the name given by Maguire in the opening of this report, Ka-imu-pulehu-a-ke-akua, the oven in which the god was roasted (ibid:39).

The location of the spring mentioned as the Wai o Kane is listed only as being at Ka'upulehu beach; however, it is probably the one indicated on the USGS Kiholo quad map, offshore at Kahuwai Bay (Soehren 1963:11).

Maguire recounts another legend for Ka'upulehu Ahupua'a:

> Pele met two girls, Pahinahina and Kolomuo, in the ancient village of Manuahi. The girls were roasting (pulehu) breadfruit ('ulu). When Pele asked for some it was Pahinahina who gladly shared her food. After Pele had eaten, she told the girl to go home and set up the lepa (kapu stick) around her home. That same night lava flowed from Hualalai, went underground and came up near Huehue, destroying the village of Manuahi and the fish pond of Paaiea. The home of Pahinahina, who shared her breadfruit, was spared.

Maguire (1926) tells a similar tale in the story "Two Girls Roasting Breadfruit."

Samuel Kamakau, another 19th century Hawaiian historian, refers to a similar story about breadfruit, but his tale involves Kamehameha and the Hualalai Flow of 1800-1802:

> The people believed that this earth-consuming flame came because of...his [Kamehameha's] refusing her [Pele] the tabu breadfruit of Kamehaikana which grew in the uplands of Huehue where the flow started (1961:184).

According to Kamakau, Pele may have had other reasons for causing the flow. Besides wanting the breadfruit, she wanted the *aku* of Hale'ohi'u and the *ahi* fish of Kiholo. Lastly, she was angry because Kamehameha was devoting himself to Kaheiheimalie (one of his wives) and neglecting Kaahumanu (another wife); of this Kamakau (1961:186) says:

> It was said that Pele herself was seen in the body of a woman leading a procession composed of a multitude of goddesses in human form dancing the hula and chanting:
>
> *Lilo ka makou kane i ka ha'awe 'olo'olo e*
> *Ha'alele ia ka ha'awe leilei e leilei e.*
>
> Our husband has gone to carry the bigger load [Kaheiheimalie]
> While the lighter load [Kaahumanu] is neglected.

Kamakau also states that at the time of Umialiloa (c. 1450 AD), *kauila* wood from Napu'u, a place near Ka'upulehu Waena, was used to make war clubs to be used when two brothers from Maui, Kiha-a-pi'ilani and Lono-a-pi'ilani, went to war (ibid:28). He writes of several battles in the vicinity of Ka'upulehu and neighboring Pu'uwa'awa'a. During one of these, Kekaulike (chief of Maui), and Alapa'i (chief of Hawaii), waged war, and Kekaulike cut down the trees throughout the land of Kona (ibid.).

Early Historical Accounts

During the reign of Kalani'opu'u in the 18th century, the lands of Kekaha belonged to the twins Kame'eiamoku and Kamanawa, half-brothers of Ke'eaumoku, Kamehameha's uncle (ibid:310). Kame'eiamoku was a very important and powerful chief. In the 1780s and early 1790s, Kame'eiamoku had his home here. When Captain Metcalf visited the area on his ship, *Eleanor,* Kame'eiamoku was subjected to humiliating treatment by Metcalf's crewmen while trading with them. Kame'eiamoku vowed to avenge his humiliation by capturing the next ship that came by (incidentally, the *Eleanor* was the ship responsible for a huge massacre of native people on Maui, the Olowalu Massacre). Ironically, the next ship was the schooner, *Fair American,* commanded by Metcalf's son Thomas. Kame'eiamoku captured the ship near Ka'upulehu and killed the entire crew, with the exception of the mate, Isaac Davis (Kamakau 1961:146-7). Although badly beaten, Davis survived, and Kame'eiamoku's men took pity upon him and nursed him back to health. Kamehameha, seeing an opportunity, enlisted Davis and another Englishman, John Young, as advisors. Young had been prevented from returning to his ship, the *Eleanor.* The two white men instructed the Hawaiians in operating the muskets and cannon (Kelly 1985:100).

During the later years of Kamehameha's life he frequently enjoyed fishing expeditions along the shores of Kekaha (Kamakau 1961:203). The ponds at Kiholo, which he had built in about 1810, were largely destroyed by the 1859 Mauna Loa flow (Soehren 1963:8).

Ka'upulehu was first mentioned by a foreigner in the journal of Archibald Menzies, who visited Hawaii with Captain Vancouver in 1792. He stated that the land was:

> ...barren and rugged with volcanic dregs and fragments of black lava...in consequence of which the inhabitants were obliged to have recourse to fishing for their sustenance (Menzies 1920:99).

Twenty years later, in 1812, John Papa I'i made similar observations: The sustenance of those lands was fish (1973:109). The lands noted by I'i were Kaelehuluhulu, the kaha lands (Kekaha) and Ooma (Ching 1971:33).

In 1823, 11 years after I'i made his observations, Ellis took a canoe trip from Kawaihae to Kailua in North Kona. Along the way he stopped off at Kaparaoa (Kapalaoa). Here he noted "...a small village on the beach, containing twenty-two houses...carved wooden idols..." and an abandoned heiau (1963:306). He also visited the village of Wainanarii (Wainanali'i) and mentioned the name of its chief, Waipo. Later that day his canoe landed at Kihoro (Kiholo), which he described as "...a straggling village, inhabited principally by fishermen" (ibid.). The fishpond of Wainanali'i at Kiholo Bay must have been quite impressive since it is the only one of the 19 fishponds along this coast that he described (Ching 1971:34). This pond was destroyed 36 years later by the Mauna Loa pahoehoe flow of 1859. However, when Ellis saw it, this fishpond was still in operation and "...well stocked with fish..." (ibid:308). Ka'upulehu was his last stop before returning to Kailua, but unfortunately nothing was noted about the village because he arrived so late and the villagers were sleeping (Ching 1971:35).

Fishing was the main occupation of the people who lived in Ka'upulehu Makai in the early 1800s. In 1840 and 1841, C. Wilkes, an explorer with the American Expedition, made a few observations about this area, including the following notes:

> ...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 the south, for food and clothing....The natives, during the rainy season, also plant in excavations among the lava rocks, sweet-potatoes, melons, and pine-apples, all of which produce a crop (Wilkes 1845:91).

Evidence of this salt manufacture is still seen along the coast in the numerous basalt and concrete salt pans (ibid:38).

Because of the barren and arid nature of the landscape, most people chose to travel by sea along the coast rather than overland. The earliest description by a western traveler through the inland area was written in 1880 by George Bowser:

> From Kiholo the road southwards is rough and laborious. Perpetual traveling over lava is very hard upon our horses, and it is impossible to travel faster than the slowest walk. On the road we met with some awful chasms of unknown depth and numberless cracks and fissures in the lava (Bowser IN Camara 1989:93).

An anonymous traveler in 1901 stated that:

> The road was bad from start to finish. Between Kiholo and Huehue it has the attractiveness of a stairway making a steep ascent towards the sparsely wooded slopes of Hualalai, with a couple of lava flows to be crossed (The Friend, 1901 IN Camara 1989:93).

Agriculture

Although Ka'upulehu's climate and land are harsh and unforgiving, the area provided a livelihood for hundreds of pre-contact residents. In addition to fishing, residents lived by gathering other seafood and seaweeds, raising fish in ponds, making salt, and growing vegetables in favorable locations (Camara 1989:5). Coastal residents went into the uplands to get wood for fuel, building materials, and tools. They may have tended agricultural plots in the cooler, wetter uplands of Ka'upulehu Waena (ibid.). These people survived in a place so hostile to the eyes of westerners that we can only marvel at and respect their resourcefulness (ibid.).

According to Ellis, Hawaiians living in Kekaha in 1824 were growing some crops in what he called barren rocks (Ellis 1963:30).

Although we may assume that the people of Ka'upulehu were among this group of Hawaiians growing crops in rocks, we cannot assume that the climate of that area was the same then as it is now (Kelly 1985:88). Kelly further adds:

> Previous to the flow of 1800, local conditions at Ka'upulehu may have been more conducive to cultivation. Ka'upulehu, from its history of being the residence of great chiefs, and from the presence of hundreds of petroglyphs, was for generations both a popular oasis with a brackish-water fishpond and a sanctuary for canoe travelers between Kiholo and Kailua. The people living in Kekaha may very well have been able to cultivate, at least seasonally,

> certain crops including: tobacco, sweet potatoes, and perhaps in the shelter of lava-rock pits, even bananas. In addition to seasonal rains as a source of water, heavy dew could have been conserved and evaporation reduced by mulching techniques.
>
> The shoreline dwellers probably received their main vegetable diet from the uplands of their ahupua'a; but, at least seasonally, they would have grown some plants closer to their coastal dwellings than the gardens in the uplands (ibid:89).

Handy and Handy (1972) describe these agricultural practices as well:

> Wherever a little soil could be heaped together along the dry lava coast of North Kona, a few sweet potatoes were planted by fishermen at such places as...Kaupulehu...Doubtless potatoes were planted on the upland of North Kona, on the lower slopes of Hualalai toward Pu'uwa'awa'a (1972:527).

In his book, *The Indigenous Trees of the Hawaiian Islands*, written in 1913, Joseph Rock states:

> The vegetation begins to become interesting at Huehue, near the lava flows on the northern flanks of Hualalai, and reaches its culminating point at Puuwaawaa, the richest floral section of any in the whole territory (Rock 1974:49).

At the turn of the 19th century, sandalwood (*'iliahi*) became an important commodity in Hawaii. According to Kamakau, the chiefs caused a famine by ordering the people to abandon their crops and go into the mountains of Kona to cut sandalwood (1961:204).

We later find that the King had reserved all the sandalwood for his own use, as well as all large trees such as one man cannot clasp (Kingdom of Hawaii, Constitution of 1840).

Land Tenure and Use

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 Great Mahele separated and defined the undivided land interests of the King and the high-ranking chiefs, and the *konohiki*, who were originally those in charge of tracts of land on behalf of the king or a chief (Chinen 1958:vii and Chinen 1961:13). More than 240 of the highest-ranking chiefs and *konohiki* in the kingdom joined Kamehameha III in this division. The first *mahele* was signed on January 27, 1848 by Kamehameha III and Princess Victoria Kamamalu, and by her guardians Mataio Kekuanaoa and Ione Ii. The last mahele was signed by the King and E. Enoka on March 7, 1848 (Chinen 1958:16).

The Mahele did not convey title to any land. The chiefs and *konohiki* were required to present their claims to The Land Commission to receive awards for lands quitclaimed to them by Kamehameha III. They were also required to pay commutations to the government in order to receive royal patents on their awards. Until an award was issued, title remained with the government. The lands awarded to the chiefs and *konohiki* became known as Konohiki Lands. Because there were few surveyors in Hawaii at the time of the Mahele, the lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land

could be surveyed. This expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

During this process all land was placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. These were all subject to the rights of native tenants (Laws of Hawaii, 1848:22). Native tenants were the common Hawaiian people who lived on the land and worked it for their subsistence. Questions concerning the nature of these rights began to arise as the King, the government, and *konohiki* began selling parcels of land. On December 21, 1849 the Privy Council attempted to clarify the situation by adopting four resolutions intended to protect the rights of native tenants referred to in the 1848 law (Chinen 1958:29).

These resolutions authorized the Land Commission to award fee simple title to all native tenants who occupied and improved any portion of Crown, Government, or Konohiki lands. These awards were to be free of commutation except for house lots located in the districts of Honolulu, Lahaina, and Hilo (ibid.).

Before receiving their awards from the Land Commission, the native tenants were required to prove that they cultivated the land for a living. They were not permitted to acquire wastelands or lands which they cultivated with the seeming intention of enlarging their lots. Once a claim was confirmed, a survey was required before the Land Commission was authorized to issue any award. These lands became known as Kuleana Lands (ibid:30). Until its dissolution on March 31, 1855, the Land Commission issued thousands of awards to the native tenants for their *kuleana*; even so, less than 30,000 acres of land were awarded to the native tenants as Kuleana Lands.

At the time of the Great Mahele, Ka'upulehu, along with Kaloko to the south was awarded to Lot Kamehameha. Lot Kamehameha was the grandson of Kamehameha I, and he had selected these lands for his own. Both of them contained natural fish ponds. Such ponds were highly prized, and at the time of the Mahele, they were usually retained by the *ali'i*. Other North Kona lands were retained for this reason by various other *ali'i*.

The Indices to Land Commission Award titles list the following for LCA 7715, which was the award given to Lot Kamehameha:

> LCA 7715 to Lot Kamehameha Book 10:622 Apana 10, Royal Patent 7843 Book 29:179 for Kaupulehu, Kona, Hawaii.
>
> By action of the Privy Council on Aug. 29, 1850, as recorded on page 423 of Vol. 3 of Privy Council Records, a Resolution was passed for his relief as follows:
>
> Resolved that in consideration of the relinquishment of Kahikinui on East Maui, by Lot Kamehameha to the Government in former division of lands, the Minister of the Interior is hereby authorized to grant Royal Patents to Lot for his lands, said to be eighteen in number, without further division or commutation (p.64-65).

No kuleana awards were listed in the Indices for land in Ka'upulehu, meaning that no one except *ali'i* had put in a claim for any lands there.

Boundary descriptions for LCA 7715, as recorded in the Royal Patent File, are kept at the State Archives:

> CERTIFICATE OF BOUNDARIES OF THE LAND of Kaupulehu...having been filed the 13th day of May, 1886 by J.M. Alexander for and in behalf of Mrs. Bernice Pauahi Bishop's Estate.
>
> Beginning at the SW corner of Puu Waawaa at the seaward extremity of the ledge called Pohakuokahae, whence the Govt. trig. station on Akahipuu is S 2 degree, 31 ft. 43 inches W (true) 36137 feet; thence the boundaries run by the true meridian to corners marked by ahus over rectangles cut in rock with crosses cut on surrounding rocks as follows...area 2345 acres (as surveyed by J.M. Alexander 1885)

Information in the Native Testimony as well as the Native Register indicates only that this land was awarded to Lot; no other data was given.

Land Index Records contained various records on Ka'upulehu Ahupua'a, which are listed here:

> INT. DEPT. Aug 27, 1850
> Set apart for Lot Kapuaiwa in Land Division. See list of lands attached to letter from Miriam Kekuanaoa to the Minister of the Interior (John Young).
>
> INT. DEPT. May 28, 1861
> In letter from P.H. Kapaiki, to Minister of the Interior, entering complaint against the action of a person who had under his control the remnant of the Government lands in slaughtering goats belonging to him & others running on the above land.
>
> INT. DEPT. MATTERS Oct. 10, 1861
> R. Keelikolani to Lot Kamehameha, informing him of the receipt of Birds of Kaupulehu from Maiai (k), his hoaaina, forty in number, that 20 went to his younger brother, 5 to herself, and the remaining 15 are his.
>
> INT DEPT. April 25, 1866
> In report by J. H. Kalaiheana showing that the above ahupuaa is a Crown Land.
>
> INT DEPT. Dec. 18, 1867
> In letter by Charles Wall stating that he has heard that some natives have gone to Honolulu for the purpose of leasing the above land. Desires that the same be leased to him.
>
> INT. DEPT. May 3, 1873
> In letter from John Broad to John Dominis applying to lease the above ahupuaa at $200 a year, for a term of 10 years.

INT. DEPT. May 12, 1873
In letter from R. Keelikolani to John O. Dominis acknowledging the receipt of his favor pertaining to the matter of leasing the above land & Keauhou - Suggest that the lauhala on said Kaupulehu, the fishery, the coconut grove & all the beach land be reserved---Also states that the lands of Kahaluu, Keopu & Kaloko be not included in said lease.

INT. DEPT. Bk.14.p.211 Apr. 30, 1877
In letter from Minister of the Interior to the Commissioner of Boundaries that Dr. G. Trousseau had informed him under date of Apr. 12, that Mr. Lyman can not give his decision until advised by His Excellency respecting the boundaries of Kaupulehu & Honuaula.

INT. DEPT. Feb. 9, 1910
Comm of Public Lands-to-Governor. Enclosing papers concerning the above land, the lands of Kau and Haleohiu, in Kona, Hawaii. It appearing that the Territory had deed to Allan S. Wall, under Grant 5067, 112 acres of the above land, that through some error in the survey, it developed that the Govt had granted 7.2 acres of the land of Kau belonging to Mrs. Egan. That an understanding was had at the adjustment of boundaries that Mrs. Egan be given 7.2 acres of the land of Haleohiu in exchange for the area taken from her land.

Kona Village Resort

Although fishing had been the main occupation in Ka'upulehu, by about 1860 ranching began to dominate the economy. During this time the population in this area dwindled, and by the early 1900s most of the native population had moved elsewhere (Ching 1971:38). During the twentieth century, a few Hawaiian families lived at Ka'upulehu, until the tsunami of 1946 swept the whole area. From that time on, the area was home only to pigs and wild goats, and occasionally was visited by fishermen and boaters (Clark 1985:120). In 1956, a wealthy yachtsman, Johnno Jackson, and his wife Helen, sailed past Ka'upulehu during a visit to the islands. They put in at Kahuwai Bay and soon decided that they had found an ideal location for a small, secluded luxury resort village (ibid.).

In 1961, Bishop Estate leased 18,228 acres of Ka'upulehu Ahupuaa to Hualalai Development for 65 years. Later that same year, Hualalai Development subleased 62 acres of the land, the site of the Kona Village, to John M. Jackson, and in 1962 the company subleased 7,000 acres of the land *mauka* of the Mamalahoa Highway to Garner Anthony (Kelly 1985:93).

Clark elaborates on the birth of the Kona Village Resort:

> During the early 1960s, construction began on a complex that eventually became the Kona Village Resort. Ka'upulehu at the time was accessible only by aircraft or boat, so Jackson's first priority was the construction of a 2,600-foot landing strip to expedite transportation of the laborers to and from the work site and that could later be used to bring in guests. He purchased an LCVP, a military landing craft capable of carrying vehicles and personnel, and used it to transport much of the lumber, materials, and equipment that his project demanded. He built a power generating plant, and he sank a 550-foot well shaft for water. While construction was in progress, Jackson lived

> aboard his schooner, anchored in Kahuwai Bay. During a particularly bad storm, high winds and heavy surf forced the boat into the shallow reef and rocks bordering the bay, destroying the craft beyond repair, but Jackson salvaged as much of the wreck as he could and converted it into the Shipwreck Bar, still a popular attraction in the resort village. The original complex, completed in June 1964, was named Jackson Village (ibid.).

In 1963, Jackson assigned the 62-acre sublease to his family-owned corporation, Island Copra and Trading Company, Inc., which later merged with Kona Village Property, Inc. (the merged companies retained the name Island Copra and Trading Company, Inc.). Later, the 62 acres were taken over by a subsidiary of Cambridge Pacific, Inc. In 1963, the same parcel, reduced to c. 60 acres, was leased by Bishop Estate to Kona Village partnership (Kelly 1985:93).

Because the project required a large amount of capital, Jackson brought in Signal Oil Company as a partner and as a result, in 1968, the lease on the bulk of Ka'upulehu Ahupua'a was transferred from Hualalai Development Corp. to Signal Oil Corp. The resort's name was changed to Kona Village Resort, and Signal Oil eventually bought Jackson out. Since the purchase by Signal Oil, ownership of the resort has changed several times. It was transferred to Cambridge Pacific (Canada) in 1979. In 1984 Barnwell Hawaiian Properties joined in a partnership with Cambridge Pacific, Inc., and the lease was assigned to Ka'upulehu Developments, a subsidiary of the partnership Barnwell Hawaiian Properties and Cambridge Pacific (Kelly 1985:94). Despite the many turnovers, the Kona Village Resort continues to be a first-class luxury resort in a secluded tropical setting, providing a variety of amenities and recreational activities. The resort has also preserved and incorporated the rich historical background of Ka'upulehu in its contemporary activities (ibid.).

Today, besides the hotels, there are summer homes along this coast as well as huts of squatters, who are primarily fishermen. Large areas of the land in the North Kona District are still devoted to ranching (Ching 1971:38).

Informant Interviews

On August 21, 1990, the author spoke with Mr. Joe Makaai (Uncle Joe), a resident of Ka'upulehu in his youth. Uncle Joe explained that the name Ka'upulehu was not short for Ka'ulupulehu as some people thought. Instead, Ka'ulupulehu was up *mauka*, and the name stood for the man who was "pulehued" (cooked). The following paraphrased story, by Uncle Joe, is similar to the one above by Maguire:

> In the *wa kahiko* (ancient days), Ka'upulehu was a desolate place. There was no food for anyone there, no fish, no water; it was a time of famine. One day a man appeared. He told the people to prepare an *imu*. The people thought this was very strange, because they had nothing to put into it, but they did as he requested. While they prepared the *imu* the man slept, and when he awoke the *imu* was ready. He stood by the side of the *imu* and said to them, "Eia ka'u makana ia'oukou" (this is my gift to you) then he jumped into the *imu* and laid down. He told them to cover him up, and though they were terrified, they did as he asked. After they were done, they all left the area because they were afraid of what had happened. Some hours later though, the man appeared out of nowhere and told them that the *imu* was ready. They uncovered the *imu* and found to their surprise that it was full of food. There was *'ulu*, sweet

> potato, fish, pig, and other foods such as they had never seen before. They realized that this man was a *kupua* (a person who could change forms). They were very happy but still they felt this was not enough food to feed all of them. The man set to work dividing the food among the different families. He told them "Don't worry there is enough for all of you many times over." Though they were happy at the food they still were unhappy because they had no water. When the man heard this he told them "go *makai*." They did as he said and at the beach there was a bubbling in the sea, and a well of fresh water came from the ocean. The people took their calabash and got the fresh water and drank it. They were so happy for all this man had done for them. This man was Kane, a god, and from that time on the spring where they had gotten their water from was called Waiokane (waters of Kane), and they never had famine again.

Uncle Joe told a another story similar to Maguire's tale of the two girls roasting breadfruit. The story below is paraphrased from Uncle Joe:

> One day Pele, dressed as a poor old lady, went up to two sisters who were cooking *'ulu*. She asked one sister, "When your *'ulu* is cooked, with whom do you intend to share it?" This sister was stingy and told her, "This is my *'ulu* and I'm not going to share it with anyone. If you want *'ulu*, pick your own. There are plenty over there—and cook it yourself." Pele then went to the other sister and asked her the same question. This sister looked at the lady and her *'ulu* and said, "This *'ulu* is too big for me, I will share it with you when it is done." She had just put it on the fire, but Pele told her, "It is cooked already, take it off the fire." The girl said, "No it can't be, I just put it on." But Pele reassured her, and the girl listened to her and took it off. When she cut the *`ulu* open, she was amazed to find that it was cooked, and she halved it and gave half to Pele. She began to wonder if this lady was a *kupua*, since she knew about the *`ulu*. After they were done eating she invited the lady to her home and they rested. When they awoke Pele told the girl, "Go and mark the four corners of your property as soon as I leave." The girl thought this was strange but she sensed the lady was a *kupua*, or spirit, and so she did as she was told. Her sister saw her and laughed at her, saying she was ridiculous to be doing such a thing. But the girl affirmed that she was going to do it and advised her sister to stay on her own side and not enter the marked-off property. That evening a lava flow came down Ka`ulupulehu, covering everything, including the stingy sister, who tried to get away. She was turned into a rock. The generous girl's home, which she had marked as she was told, was spared, and the girl knew that the lady had been Pele.

Uncle Joe said that Puhi-a-Pele is the area where that flow came down, and if you look at it carefully, you will see that it is the body of Pele sleeping with her head to the north. He also said that the area that had not been inundated with lava contained breadfruit and *kukui* trees and one coconut tree that can be found there to this day.

Uncle Joe spoke fondly of his childhood in Ka'upulehu. Donkeys were the only means of transportation from Kiholo to Mahai'ula. He rode his donkey to elementary school in Kalaoa. People also rode donkeys to Kalaoa to trade fish for goods in the Ahuna and Akuna stores. These stores were owned by Chinese families and no longer exist.

He said that all the people who lived on the coast were fishermen and that his grandfather was a great *'opelu* fisherman. His father also fished until he got married, at which time he became a cowboy at Pu'uwa'awa'a Ranch, up *mauka*. Uncle Joe spoke of Waiakuhi Pond, which is where people used to get *'opae* (shrimp) for fishing, and of the many brackish ponds along the coast, which were used for clothes-washing and other domestic chores.

When Uncle Joe was a child, he and the other children made up their own fun. They created a small *holua* (slide), which they covered with grass and slid down on coconut leaves. They also used to explore the many large caves along the coast where he said they found large canoes and *koa* logs. When he asked his grandfather about these things he was told that when people died, families put the objects in the burial caves along with the bodies. These caves have been closed up since the opening of the Kona Village Hotel.

Uncle Joe also mentioned that since there was no grass along the coast they used to feed their donkeys *kiawe* beans, which they picked up from the ground. He said the donkeys loved to eat them (pers. comm. August 21, 1990).

Jean Greenwell, President of the Kona Historical Society, supplied several items of information relevant to the Ka'upulehu area. She mentioned that it was land commissioned to Lot Kamehameha, and consisted of 23,545 acres. She also mentioned that the old name for the area was Manuahi. From the journal of H.M. Greenwell (who was a farmer and rancher in Kona during the late 1800s and early 1900s), she found that sheep were raised in the uplands of Ka'upulehu in 1880 and that a man named George Clark had 200 sheep here. Greenwell's journal also shows that in August of 1884 Clark had leased land from Greenwell for $350 per year, in addition to which he agreed to pay $100 (per year) for raising stock.

Hannah Springer has been a resident on the land *mauka*, at Huehue Ranch, for many years and is familiar with the area. Hannah provided another interpretation of the name Ka'upulehu. She said that she was told that the name stood for the *imu* that puffed (*pu*) with the ashes (*lehu*), because, as in the tale that Uncle Joe told, when the *imu* was opened, the body of Kane was not in it, and the ashes puffed out with the absence of the body. No other source consulted during this research mentioned this explanation of the name. Springer also explained (correctly) that the commonly held belief that Ka'upulehu means the *imu pulehu* involves a contradiction in terms. This is because the type of cooking done in an *imu* is called *kalua* (to bake) and *pulehu* means to cook on hot coals or broil.

Springer also mentioned the story of the two girls eating breadfruit, but like Uncle Joe, she thinks that this incident took place up *mauka* and not on the coast, and so that area is Ka'ulupulehu and *makai* is Ka'upulehu, two different areas. She mentioned the name Manuahi and said that it is a name for a place in Ka'upulehu and not the old name for the whole area.

She stated that her mother and another man of that area, Robert Keakealani, both knew of the area that Uncle Joe mentioned in the Kaulupulehu story, noting that it was an area with one coconut tree. It seemed significant to her and the people who knew of it, and she stated that one day she would find that area.

Springer mentioned Kame'eiamoku at Ka'upulehu and his capture of the *Fair American*, c. 1790. She said that he was one of three brothers who were advisors to the King and that he and his twin are the figures depicted on the seal of the government of Hawaii.

She made reference to Kahuwai Bay, the site of Kona Village, where springs bubble. The people there used to fish for *'opelu*, weave *hala* and *loulu*, and traded with the people at Kalaoa.

Hu'ehu'e Ranch was founded by John Avery McGuire. His first wife was a woman named Luka who had 600 acres at Kukio and 200 acres at Kaulana. McGuire made his living trapping wild *pipi* (cows), and over time he acquired more land. His second wife, Eliza Davis Low, translated the book *Kona Legends*, cited earlier in this report.

CHRONOLOGICAL FRAMEWORK

The establishment of a chronological framework is a primary goal for inventory survey projects, as such a framework provides a context in which to view general settlement patterns. The chronological framework presented below is based on dating results derived from Rosendahl (1973), Sullivan and Goodfellow (1991), Head and Goodfellow (1992), and Goodfellow, Jensen, and Bower (1992) (Table 2). Correlation of these results with important cultural developments follows the chronologies for South Kohala-North Kona area presented in Donham (1987:142-145) and Jensen (1989, 1990). These chronologies include data collected by Cordy (1981, 1985, 1986), Hommon (1976), and Kirch (1980, 1985).

Initial occupation of West Hawaii appears to have occurred between AD 600-800, with occupation being restricted to the southern end of South Kohala around Anaehoomalu Bay. Jensen characterized the early occupation of this area as follows:

> For the earlier time periods, it is possible to envision sporadic exploitation of the coastal and upland resources of West Hawaii by small groups who resided elsewhere during most of the year, probably along the windward coast (Jensen 1978).

Shortly after this period of initial occupation, beginning perhaps as early as AD 900 in some areas, population increases in the more favorable windward zones led to more frequent exploitation of agriculturally marginal lands in West Hawaii (Barrera 1971, Kirch 1985). Areas in the northern end of North Kona and the southern end of South Kohala appear to have been utilized first, followed by more general exploitation of West Hawaii lands by AD 1000. Increased use of these areas was generally marked by the establishment of small, relatively isolated pockets of semi-permanent to permanent occupations at certain favorable coastal locations. Evidence for the spread of this pattern into Ka'upulehu derives from Kahuwai Bay, where a cave shelter (Site 10959, Feature A) yielded a calendric range of AD 1040-1425. The population throughout this period of expansion (AD 900-1200) into West Hawaii appears to have been relatively low (Kirch 1985).

According to Kirch, the population remained fairly stable until AD 1200, at which time there was a pronounced increase (Kirch 1985:288). Data from the Kekaha region suggests, however, that dispersion of the population would have been restricted by the barren conditions and the lack of fresh water, which characterizes much of the region, and that population growth would have been limited to coastal areas such as Anaehoomalu, Kiholo, Kaupulehu and Kukio (Jensen 1989). Age determination data from Kaupulehu indicate, however, that sites dating between AD 1200-1400 are fairly rare and provide little support for a population increase prior to AD 1400. Similarly, although initial occupation appears to have occurred primarily on the coast, sites established after AD 1200 occur in the barren and upland zones as well, suggesting that settlement of Kaupulehu was not substantially restricted by the barren conditions in the upland and barren zones. Coastal resources continued to be exploited sporadically by non-resident populations, while habitation sites appear to have been selected based on proximity to available water and established coastal residential areas.

Table 2.
Summary of Dating Results for Kaupulehu Ahupua'a

Site/Feat.	Formal Type	Function	Dating Results (AD)
Coastal Zone			
10954 A	Midden deposit	Habitation	1390-1665 (C14) 1665-1940 (C14) 1673-1764 (VG)
10955 C	Cave shelter	Habitation	1654-1702 (VG)
10956 A	Cave shelter	Habitation	1582-1749 (VG)
10956 B	Cave shelter	Habitation	1644-1712 (VG)
10958 A	Modified outcrop	Habitation	1780-1820 (VG)
10959 A	Cave shelter	Habitation	1040-1425 (C14) 1523-1785 (VG)
10959 C	Terrace	Habitation/ceremonial	1380-1650 (C14) 1417-1477 (VG) 1650-1955 (C14)
10959 D	Pavement	Habitation/ceremonial	1410-1640 (C14)
Barren Zone			
1160	Cave	Habitation	1645-1763 (VG)
10968 A	Cave shelter	Habitation	1533-1769 (VG)
10969 A	Enclosure	Habitation/ceremonial	1620-1890 (C14) 1722-1750 (VG)
10974 A	Cave shelter	Habitation	1688-1772 (VG)
10976	Cave shelter	Habitation	1620-1890 (C14)
10978	Cave shelter	Habitation	1659-1755 (VG)
10979	Cave shelter	Habitation	1653-1736 (VG)
10985 A	Cave shelter	Habitation	1410-1635 (C14) 1671-1699 (VG)
10986 A	Terrace	Habitation/ceremonial	1630-1718 (VG)
10986 K	Cave	Ceremonial	1440-1650 (C14)
10986 G	Platform	Habitation/ceremonial	1743-1787 (VG)
10987 A	Terrace	Habitation/ceremonial	1707-1919 (C14) 1680-1728 (VG)
10987 C	Slab paved area	Habitation/ceremonial	1282-1390 (VG)
10989 A	Cave shelter	Temporary habitation	1790-1940 (C14) 1555-1741 (VG)
10990 A	Cave shelter	Habitation	1508-1588 (VG)
10993 A	Cave shelter	Habitation	1387-1567 (VG)
10993 B	Cave shelter	Habitation	1569-1605 (VG)
10995 B	Cave shelter	Habitation	1595-1714 (VG)
10995 C	Terrace	Habitation	1687-1727 (VG)
Upland Zone			
14579 A	Lava tube cave	Temporary habitation	1429-1667 (C14) 1790-1955 (C14)
14579 B	Enclosure	Temporary habitation	1423-1635 (C14) modern
14768 E	Hearth	Temporary habitation	1638-1955 (C14)
14802	Hearth	Temporary habitation	1433-1639 (C14) 1792-1950 (C14)
14821 B	Hearth	Temporary habitation	1446-1701 (C14)
14824	Lava tube cave	Temporary habitation	1664-1891 (C14)
17931	Lava tube	Temporary habitation	1482-1681 (C14) 1634-1949 (C14)
17932 B	Lava tube	Temporary habitation	1390-1680 (C14)
17932 D	Lava tube	Temporary habitation	1213-1423 (C14)
17934	Lava tube	Temporary habitation	1651-1955 (C14)
17938 A2	Lava tube	Temporary habitation	1458-1660 (C14) 1795-1946 (C14)
17940 B	Lava tube	Temporary habitation	1798-1944 (C14)

Cordy's work suggests that as the population increased in certain parts of North Kona, substantial uninhabited zones remained between established residential areas (Cordy 1981:173). These zones may have served as a means of delimiting specific resource catchment zones along the coast, as well as to provide room for further growth. As noted above, spread of settlement into less favorable portions of Kaupulehu appears to have started between AD 1200-1400 (Table 2), and was accompanied by increased use of temporary features throughout the region. Kirch argues that these expansions were representative of large-scale population growth occurring throughout West Hawaii and posits that the population nearly doubled each century between AD 1200 and 1600 (Kirch 1985:288). It was during this expansion period that the *ahupua'a* territorial system is thought to have combined with pre-existing social stratification systems to form the Hawaiian socio-political structure documented from the historic period (Kirch 1985, Donham 1987:142).

Initial occupation of upland areas also appears to have begun during Kirch's Expansion Period, starting around AD 1400 at Lapakahi (Rosendahl 1972:495) and varying between AD 1300-1500 in the *ahupua'a* between North Kohala and South Kona. Initial movement into the uplands most likely involved small populations living in temporary shelters associated with marginal agriculture and use of upland trail systems. Larger scale expansion and settlement of the upland regions was predicated on developments in agricultural technology, however, and would have occurred somewhat later. In his study of prehistoric sites in O'oma and Kalaoa Ahupua'a, Cordy (1985:38) proposed that upland populations were small until AD 1500-1600 and that intensive agriculture was not developed in the area until AD 1500. As part of his argument, Cordy reviewed dates from 24 sites in Kalaoa and O'oma and listed the earliest date recovered from each *ahupua'a*. The earliest dates for Kalaoa 5 at that time were AD 1400 (for a temporary habitation feature) and AD 1510 (for a permanent habitation feature). The earliest known date for Kalaoa 4 was AD 1610 for a temporary habitation feature, and AD 1680 for a permanent habitation feature. All of these dates were obtained from coastal sites.

While research since 1985 has provided additional early dates for Hamanamana, Kalaoa, O'oma and Kohana-iki, Cordy's chronology for gradual settlement and agricultural intensification is generally consistent with the data for Kaupulehu presented in Table 2. Of the six sites dated prior to AD 1400, the majority are temporary to semi-permanent habitations located on the coast or at the interface of the coast with the barren zone, suggesting that population growth was initially restricted to the lower elevations where fresh water and coastal resources were more readily available. Spread of settlement to the barren and upland zones started between AD 1200-1400, becoming gradually more frequent after AD 1400. While the majority of sites in the barren and upland zones have been interpreted as agricultural sites (Walker and Rosendahl 1990, Goodfellow and Head 1992), supporting the argument that upland settlement was agriculturally motivated, all of the dated sites in these zones are habitations. Based on the presence of agricultural sites in Kealakehe that date to c. AD 1511-1638 (Walker and Rosendahl 1988b), however, it seems likely that intensification of agriculture in Kaupulehu and the rest of North Kona may have occurred by AD 1550-1650.

Rosendahl argues that expansion of occupation into upland areas and the concurrent intensification of agriculture in West Hawaii was followed by specialization of production in coastal and upland areas, culminating in significantly altered economic and social patterns sometime around AD 1500 (Rosendahl 1972:499). Hommon, following Rosendahl, argues that increased specialization in coastal and upland production led to the establishment of a variety of reciprocal ties between the two areas, and to exchange of specialized commodities (Hommon 1976:258). Concurrent settlement of upland and coastal areas is not documented for the historic period, however, and may have ended shortly after the Expansion Period.

The dating results from Kaupulehu generally support this pattern, although the association of the proposed population increase with specialization and coastal-inland trade has yet to be established. Occupation of Kaupulehu between AD 1500-1700 appears to have been characterized by high population and an increased range of activities. Of the 39 sites and features listed in Table 2, 12 yielded dates between AD 1500-1750, while over 26 yielded date ranges between AD 1650-1955. That population growth was accompanied by increased activities is evidenced by the appearance of sites with ceremonial functions, a greater number of permanent habitations, and an increased range of formal feature types associated with habitation and agriculture.

According to Kirch, population growth levelled off by AD 1600, and was followed by a regional population decline after c. AD 1700 (Kirch 1985). Data from Awakee (Donham 1987a) support this model, documenting that population began to decline between AD 1700-1800. Jensen notes a decrease in utilization of non-permanent features at Anaehoomalu after AD 1700, and argues that the hypothesized changes in settlement patterns, induced by the evolution of upland agriculture and initiation of trade, could easily account for a population decline such as that modelled by Kirch (Jensen 1989: 112). Additional explanations for the purported population decline have been advanced by Kirch and others, including the appearance of major economic and political centers such as Kawaihae, Waimea and Kailua, and the development of major prehistoric transportation routes which linked population centers with one another, both of which may have contributed to reduce dependence on the coastal areas between Kailua and Kawaihae (Jensen 1989: 112). By the mid-1800s, permanent coastal sites were generally abandoned.

In his recent archaeological investigations near Pauoa Bay, Welch (1989) re-evaluated existing cultural chronologies for Anaehoomalu and Kalahuipuaa, based primarily on a re-evaluation of volcanic glass dating results obtained from various sources. The accepted chronologies, particularly those advocated by Kirch (1985) and Hommon (1976), were generated in large part on the basis of volcanic glass dates which were in turn based on an age formula developed in the 1970s by Morgenstein. Welch's research involved recalculating the volcanic glass age estimates using the range of alteration formulas available in the literature: (a) Michel's exponential formula, based on induced hydration experiments involving Puuwaawaa glass, (b) the Mohlab formula which assumes that patina develops at 51.10 microns-squared/ 1,000 years under certain conditions of temperature and humidity (Kona airport mean values are used for these variables), and (c) Morgenstein's linear formula. The results obtained with all three formulas were then compared.

The results of Welch's comparison appear to document that significantly different dates can be achieved for individual samples of volcanic glass, depending on the formula selected for calculation (Welch 1989:97):

> Relative to the linear formula, the exponential formula reduces the age of recent specimens and increases the age of earlier specimens. As a result, longer spans of occupation are indicated than previously reported on the basis of Morgenstein's dates. Hawaiian occupation of these areas... [may thus date] both earlier and later than previously estimated.

Based on this observation, Welch suggested that use of the Morgenstein formula may have artificially created the population "decline" which was first suggested by Hommon (1976) and later supported by data from Anaehoomalu (Barrera 1971) and Kalahuipuaa (Kirch 1979). Several shortcomings in these arguments were previously noted by Clark (1987), not the least of which was the fact that the dating results obtained using Morgenstein's formula for volcanic

glass hydration rates could not be easily reconciled with the available radiocarbon dates. Use of the more recent formulas used by Mohlab and Michels significantly increases the number of post-1750 dates on datable samples, and leads one inevitably to Welch's conclusion that for much of West Hawaii:

> "..abandonment of many of the sites does not seem to have occurred until at least 1800, while Anaehoomalu [and some other areas] appears to have been occupied until 1900..." (Welch 1989:97).

Use of these same formulas may push estimates of initial occupation back in time as well, thus extending the occupational sequence for the entire region. While there are currently no artifact seriations which can be used to substantiate this model for the earlier end of the sequence, extension of the sequence into the 19th and 20th centuries should be supported by the recovery of historic-era artifact types and/or artifacts manufactured from historically introduced materials.

Evidence from Kaupulehu supports Welch's contention. Over 26 of the sites in the project area yielded date ranges between AD 1650-1955 (Table 2), seven of which were clearly post-contact. Perhaps more compelling, however, is the evidence provided by the historic documentary research for this report. Journals written by early western explorers such as Menzies and Metcalf indicate that there was frequent contact between ships and the native people in the Kaupulehu area. There is evidence that the early historic inhabitants of Kaupelehu manufactured salt, harvested seaweed, and practiced some agriculture, in addition to their exploitation of marine resources.

By the end of the 1800s, land use in North Kona-South Kohala had undergone significant alterations from the dryland cultivation and fishing practiced during prehistoric and protohistoric times. Maly summarizes the gradual replacement of Hawaiian lifestyle in this area as the result of two major factors: the 1801 eruption of Hualalai and changing land use patterns over the last 150 years. The lava flows from Hualalai reclaimed much of the land used for settlement, agriculture and fishponds, reducing the land to a shadow of its former condition. Introduction of foreign plants and animals brought about additional changes, as once-barren lava fields became overgrown with *kiawe* and other weedy shrubs, and goat and cattle raising became a mainstay of local industry. The 1850s saw the development of large-scale commercial ranching and agriculture as a result of the shift to private land-ownership brought about by the Mahele and an 1850 law permitting foreigners to own land. Coffee, grazing land, tobacco and sugar cane gradually replaced traditional subsistence crops such as taro and *uala*, stripped the land of forests, and caused disruptions in the water catchment systems. As the water resources dried up and Western land use practices replaced traditional methods, Hawaiian communities gradually disappeared (Maly, this report). After 1890, coffee became the leading agricultural crop in western Hawaii, while eastern Hawaii shifted to large-scale sugar cane and macadamia nut production (Schilt 1984: 24-25).

The tsunami of 1949 swept the coastal portion of the *ahupua'a*, and the few native families that had been living there never moved back. In 1956, while sailing off Kaupulehu, an investor named Johnno Jackson and his wife were impressed enough with the area to believe that it could be developed into a small, secluded, luxury resort. The original Kona Village Resort complex was completed in June 1964, and the concept proved successful. The rest of the *ahupua'a* remains largely undeveloped.

SETTLEMENT PATTERN MODELS

A second goal of the current projects was the refinement of a settlement pattern for Kaupulehu Ahupua'a. In order to accomplish this task, however, it was first necessary to review and evaluate previous settlement pattern models for West Hawaii and synthesize the pertinent concepts with the observations of site patterning observed in previous studies of Kaupulehu. Once these tasks have been completed, the implications of this synthesis for predicting site distribution patterns in the current project area will be discussed.

Review of Previous Models

Apart from the general chronological models for Hawaiian settlement proposed by Kirch (1979) and Hommon (1976), settlement pattern models for West Hawaii are primarily based on the interrelationship of environment and cultural adaptation. Land use and site distribution patterns are viewed as direct outgrowths of environmental conditions within the region, such that rich environments would support larger, permanent populations and poor environments would support smaller, more transitory populations. These models generally separate West Hawaii into environmental zones and make predictions concerning the type of land use and site distribution patterns that would develop in response to the terrain and resources present within each zone. Five such models are outlined below.

Rosendahl (1973:60-61, 65-66) proposed general patterns of aboriginal settlement for the North Kona area, based on ethnohistoric and ethnographic sources. From these sources, Rosendahl divided the area of occupation into three principal environmental zones: a narrow and arid coastal zone associated with the exploitation of marine resources; a sloping, rocky, barren, midland zone; and an upland habitation- agricultural zone. He notes that the forest zone, further inland, was used, but rarely inhabited. Rosendahl summarized these occupational zones as follows:

> **Coastal Occupation** - Housing appeared as small clusters or fishing hamlets, along the shore and frequently found near fishponds and small bays. The inhabitants were principally engaged in marine exploitation (including in-shore and deep-water fishing, gathering shellfish, production of salt and aqua-culture). Very limited agriculture including coconut, sweet potatoes, and possibly bananas raised in small beach areas and tiny pockets of sand and gravel in barren flows. These may have provided supplies for travellers going by canoe between Kailua and Kawaihae.
>
> **Barren Zone Occupation** - Temporary shelter and the mauka-makai foot trails evidence the movement of people and goods between the coast and uplands. Both terrestrial and marine resources midden remains from habitation evidence access to both upland and coastal zones. Artifacts and structural remains are indicative of recurrent use of temporary occupation features.
>
> **Upland Occupation** - This appears to be a major occupation area, with scattered, small residential hamlets (probably above 2,000 ft and 25 inches-per-year rainfall). Extensive agriculture exploitation is indicated and composed of dryland swidden cultivation. The principal crops were dryland taro and sweet potato, with other crops including breadfruit, bananas, paper mulberry, ti, and sugar cane.

Although Rosendahl's model lacks clear geographic definition of the environmental zones, and doesn't describe potential changes in the land use patterns associated with each zone through time, it does provide information concerning expected site distribution and land use patterns within each zone. Further, the overall generality of the model removes it from the restricted context of Rosendahl's original study area, and improves its utility for examining areas to the south.

Davis' work in the Keahole Agricultural Park also resulted in the identification of three terrestrial or environmental zones applicable to the current study area (Davis 1977:19-21). A summary of these zones is as follows:

> **Coastal Zone** - Consists of barren, rocky shorelines, isolated bays with coralline beach formations, inland ponds, brackish basal water, fresh water springs, and strand vegetation occurring in limited soil deposits. It originates at the coastline and extends to approximately 300 meters inland, or from the 0-9 meter contour (0-30 feet).
>
> **Transitional or Barren Zone** - Consists of bare, non-disintegrated lavas, arid conditions, limited dry scrub vegetation (fountain grass, lantana and *noni*), which increases east the of highway. Little or no soil development is in evidence. This zone originates at the 9-12 meter contour (30-39 feet), or 300-600 meters inland from coast (984-1969 feet), and extends to the 130 meter contour (425 feet).
>
> **The Upland Forest Zone** - Consists of moderate soil development and adequate rainfall. This zone begins with the appearance of *koa-haole* and Christmas-berry, and continues to a mixed, broadleaf forest vegetation. It originates at 130 meter contour (425 feet), continuing east.

Although Davis included little information concerning the types of sites expected in the lower two zones, he made the following observations about site types in the upland forest zone:

> Here also begins the lower margin of the upland agricultural systems with extensive prehistoric site remains including house enclosures, stone platforms, high stacked ahu (cairns), stone walls and the numerous stone mounds suggesting that the local crop was largely sweet potato (Davis 1977:21).

The primary utility of Davis' model is the combination of clear geographical criteria with vegetation data to define the three environmental zones. With the exception of the comments on upland site patterns, however, Davis fails to take the next step and describe the site distribution and land use patterns expected within each zone. Chronological associations are also neglected, making Davis' model little more than a study in ecological zonation in North Kona rather than a model of adaptation to the environment through time.

Cordy summarized archaeological findings in the Lands of 'O'oma and Kalaoa (1985). Like Rosendahl (1973) and Davis (1977) he divided the study area into three environmental zones and examined site locations and types within each land unit. The zones are described in the following.

The Coastal Zone extends from the shoreline to 164 ft (50 meters), with a maximum elevation of 20 ft (six meters). It is composed of low pahoehoe with some sand beaches. Features here include trails, caves, enclosures, platforms, pools, cairns, C-shapes, and pavings.

Cordy suggests that there are at least 22 permanent house sites located right along the shore. The permanent structures at the sites included platforms, enclosures, and pavings with relatively shallow fill.

Also located in the Coastal Zone, according to Cordy, are sites interpreted as temporary dwelling areas, with feature types such as caves and C-shaped shelters. These are located just inland of the Coastal Zone, at the interface with the Barren Zone, or along the shore in areas not used as permanent housing. Two very large structures interpreted as *heiau* were found in 'O'oma 1, in the Coastal Zone.

The Barren Zone is a band from the 20 ft contour (six meters) to c. 0.8-1.4 kilometers inland, with sites that appeared to consist mostly of a few *mauka-makai* trails, the early historic Mamalahoa Trail (which parallels the shore), a few C-shaped structures and caves near the trails, and cairns that may have been associated with the trails. With some exceptions, habitation sites contained only shallow deposits and appeared to be temporary, with shallow deposits.

At the 200-400 ft level (61-122 meters) of Kalaoa 5 and 'O'oma 1, site density increased, according to Cordy, and he reported large numbers of cave shelters in tubes branching off of sinks and on the floors of the sinks. These were marked by extensive features that Cordy felt may have been indicative of recurrent, short-term usage. A number of surface cairns in the vicinity might have marked trail locations and associated caves. A single historic, walled, permanent structure (with associated features) was found near the upper end of the Barren Zone (ibid.:32).

The Upland Zone consisted of rough aa and soil terrain, and extended from the 426-ft elevation to 3,379 ft (130-1,030 meters), and up to six kilometers from shore. Only three archaeological investigations had been conducted at the time of Cordy's work in this zone, but indications of upland agricultural features, platforms, mounds, and walls were noted. Cordy reported virtually continuous sites beginning at the c. 450 ft elevation extending up to at least the 800 ft contour (and perhaps beyond). There were indications that this was the lower margin of an upland agricultural system. Present were house enclosures, stone platforms, high-stacked *ahu*, and stone walls. there were also numerous stone mounds, suggesting that the local crop was largely sweet potato (Davis IN Cordy 1985).

By including both well-defined geographical data for each zone and clear descriptions of the formal and functional site types encountered to date in each area, Cordy's model has considerably greater utility for predicting site distribution in unsurveyed areas than those proposed by either Davis or Rosendahl. The model has the further advantage of tying site distribution patterns to the regional chronology, if only in general terms, and lays the groundwork for future research in North Kona.

Hammatt followed the same basic zonation proposed by Cordy, but did not discuss the definition of his zones in any detail (Hammatt 1987:69-71). His model, which was formulated for an intermediate elevation parcel in Kealakehe, was intended to provide a picture of upland settlement to contrast with the more frequently studied coast. Hammatt argued that the lack of trails connecting the uplands with coastal settlements suggested less formalized integration of the uplands with the coast. This was in contrast to the models posited by Rosendahl (1973) and Hommon (1976). That some level of interaction between the uplands and coast existed was indicated by the presence of marine midden in upland sites, but the lack of artifacts associated with marine exploitation and the small quantity of marine midden suggest a fairly irregular or tentative network. Based on his survey data, Hammatt observed that upland Kealakehe was

characterized by scattered house lots associated with cultivation of sweet potato and taro in small garden plots. Cultivation was extended into arable microenvironments at lower elevations, conforming to the "belt of residence" about half a mile wide at the lower edge of the forest boundary where taro and breadfruit could be easily cultivated. This main *mauka* agricultural vegetation zone is closely related to the 50" isohyet rainfall line which veers inland north of Kailua town (Hammatt 1987:70). This inland shift of the upland-intermediate zone boundary would have resulted in greater expenditures of time and labor on the part of coastal residents commuting to upland agricultural areas, as compared to their neighbors to the south. Hammatt argues that the twelve kilometer round trip from the coast to his study area would have promoted greater specialization toward either fishing or farming rather than the practice of both occupations, which was certainly common in the lands to the south. This occupational specialization is supported by the artifact assemblage which includes only four artifacts, small amounts of marine material, and no artifacts with a clear marine related purpose.

Hammatt's model differs from the models presented above in several ways. First, it is clearly restricted to the upland zone, and consequently provides little information concerning site distribution patterns in the region as a whole. Second, the model places a greater emphasis on coastal-upland interaction, perhaps due to the apparent negative evidence for the type of interaction posited for the population centers in North Kona-South Kohala. It should be noted, however, that Hammatt's study area was located in the intermediate zone, not the uplands, and lacked habitation structures. His arguments on the nature of the artifact and ecofact assemblages within the uplands are thus somewhat suspect, and should be reevaluated in the context of actual upland sites. Finally, Hammatt's model is limited by the absence of a chronological framework to refine site distribution data through time.

Barrera, like Hammatt, adopted the three environment zones described by Cordy (1985). The project area upon which his model is based corresponds to that of his 1985 Keahole Point study (1985a) in coastal and intermediate Kalaoa. Based on data from survey and excavations within the parcel, Barrera posited the following model of settlement and land use within North Kona:

> Certain especially favorable locations (small protected bays such as Kaloko, North Kona, Anaehoomalu, South Kohala, for example) were being exploited by the tenth and eleventh centuries. A permanent inland agriculturally-oriented population developed by the 15th century, preceding most of the permanent coastal habitation. This is supported by recent excavation data in sites four miles from the ocean in the ahupuaa of Kohanaiki. Here several permanent habitation structures and a large, well-built Men's House situated in the midst of agricultural fields were being utilized by the late 15th century. There was indirect access to ocean products through trade, and possibly temporary or intermittent direct access (Barrera 1987). Lateral expansion from the early exploitation centers along the relatively less productive coastlines did not occur until the 16th century. This is followed in the late 17th and early 18th centuries by a period during which temporary coastal habitation evolves into more permanent occupation with full time exploitation of marine and agricultural resources. The end of the sequence is marked by an abandonment of the agricultural fields in the early 18th century, with a concentration on marine resources and a tendency towards nucleation of coastal settlements that was interrupted by historic contact (Barrera 1987:231).

Despite the clear focus of subsistence activities on exploitation of locally available marine and avian resources, and the later addition of animal husbandry, Barrera notes that some form of coastal-upland interaction was also present during the occupation sequence.

> It is difficult to ascertain the degree of interaction with the uplands, either directly or through trade or gift exchange with residents of that area, but clear evidence that this took place is present in the form of kukui shells in many of the coastal sites. The main problem in this regard is the differential preservation of the various remains in the archaeological record. We have lots of mollusc shells and a fair amount of fish, mammal and bird bone but virtually no highly perishable vegetal remains (Barrera 1987:226).

Habitation sites in the project area ranged from temporary to permanent, depending on the occupation period, and included a category of "crude" shelters which Barrera interpreted as hunting blinds and/or storage areas. He notes that coastal populations were generally small in all phases, not because of the arid conditions in this area, but because of the limits of the marine environment.

It should be noted that the widely held view that the availability of water was a prime element limiting population size along the coast does not stand up to scrutiny. The limiting factor was in fact the relatively poor capacity of the marine environment to provide subsistence (Barrera 1987:231).

Barrera's model, like Cordy's, combines site distribution and land use patterns with elements of a regional chronology. His model provides specific data on patterns within his study area, and notes the probability of interaction between the coast and uplands without making it the entire focus of his model, in the manner of Hammatt's discussion. Once the study area findings are extrapolated to the larger region, however, Barrera emphasizes broad patterns at the expense of more utilitarian information on site distribution and land use patterns within the various ecozones. The end result is a general framework rather than a predictive model.

Synthesis of Models with Site Distribution Data

The preceding models, though varying in detail, have several common elements. First, there is general agreement on separation of the region into three basic environmental zones: the coastal zone, the barren or intermediate zone, and the upland zone. Second, all five models associate the coastal zone with marine exploitation and the upland zone with dryland cultivation. Depending on their locations, sites within the barren zone are interpreted as extensions of either coastal or upland settlement, or related to travel between the coastal and upland zones (e.g, trails, shelters, etc.). Third and finally, all of the models posit some level of interaction between the coast and uplands, although there is little agreement concerning the nature and intensity of this interaction. Of the three models that actually define geographic boundaries for the environmental zones, Davis' stands out as offering the greatest detail, especially in terms of biotic distinctions between zones. Rosendahl provides more analysis of the types of subsistence activities associated with each zone, while Cordy provides information concerning site functions beyond subsistence. Only two of the models, those proposed by Cordy and Barrera, present their hypotheses in the context of a regional chronology. As was stated above, however, Barrera's model becomes too generalized at this point and offers little more than a restatement of the chronological framework outlined in the beginning of this section. Cordy's model, in contrast, provides sufficient detail to differentiate site distribution patterns through time.

Synthesizing the best elements of the five models with the data on site patterning derived from previous archaeological and historic documentary research, the following settlement pattern model is posited for Kaupulehu *ahupua'a*:

> **Coastal Zone:** Consists of barren, rocky shorelines, isolated bays with coralline beach formations, inland ponds, brackish basal water, fresh water springs, and strand vegetation occurring in limited soil deposits. It originates at the coastline and extends to approximately 300 meters inland, or from the 0-9 meter contour (0-30 feet). Formal feature types include caves, cairns, c-shapes, enclosures, footpaths and trails, midden scatters, overhangs, pahoehoe excavations, *papamu*, petroglyphs, platforms, pools, salt pans, terraces, walled shelters, and wall fragments. Functional types consist primarily of habitations (both temporary and permanent), quarry, transportation, burial or shrine, art/communication and marker.
>
> The majority of sites are prehistoric, with habitation sites providing evidence of greater permanence and increasing nucleation through time. Permanent habitation sites are located along the shore and are frequently found near small bays; while temporary habitations (caves and C-shaped shelters) are located just inland of the Coastal Zone, at the interface with the Barren Zone, or along the shore in areas not used for permanent habitation. Ceremonial structures are rare, but appear to be positively correlated with permanent habitations.
>
> The inhabitants were principally engaged in marine exploitation (including in-shore and deep-water fishing, gathering shellfish, production of salt and aquaculture). Agriculture was limited to cultivation of coconut, sweet potatoes, and possibly bananas in small beach areas or in tiny pockets of sand and gravel in barren flows; and may have provided supplies for travellers going by canoe between Kailua and Kawaihae.
>
> **Barren Zone** - Consists of bare, non-disintegrated lavas, arid conditions, limited dry scrub vegetation (fountain grass, lantana and *noni*), which increases east of the highway. Little or no soil development is in evidence. This zone originates at the 9-12 meter contour (30-39 feet), or 300-600 meters inland from the coast (984-1,969 feet), and extends to the 130 meter contour (425 feet). Sites consist mostly of a few *mauka-makai* trails, cairns, caves, C-shapes, enclosures, modified outcrops, pahoehoe quarries, crude platforms and walled structures, terraces and wall alignments.
>
> With some exceptions, habitation sites contain only shallow deposits and appear to be temporary, with shallow deposits. At the 100-400 ft level site density increases and cave shelters in tubes branching off of sinks and on the floors of the sinks become a common site type. These features are generally marked by extensive features indicative of recurrent, short-term use. A number of surface cairns in the vicinity may mark trail locations and associated caves. Apart from boundary walls, trails and some cairns, the majority of features appear to be associated with prehistoric use of the zone. Temporary shelters and the *mauka-makai* foot trails evidence the movement of people and goods between the coast and uplands. The presence of both terrestrial and marine resources in midden remains associated with tempo-

rary habitations evidences access to both upland and coastal zones, while artifact assemblages and structural remains are indicative of recurrent, short-term use.

Upland Forest Zone - Consists of rough aa terrain with moderate soil development and adequate rainfall. Extends from the 426-ft elevation to 3,379 ft (130-1,030 meters), up to six kilometers from shore. This zone begins with the appearance of *koa-haole* and Christmas-berry, and continues to a mixed, broadleaf forest vegetation. This appears to be a major occupation area, with scattered, small residential hamlets (probably above 2,000 ft and 25 inches-per-year rainfall). Feature types consist of the Kiholo-Kaupulehu and Kukio-Huehue Trails (Sites 1319 and 1193), upland agricultural features, platforms, mounds, and walls, with virtually continuous sites beginning at the c. 800 ft elevation extending up to at least the 2,200 ft contour (and perhaps beyond). Features found at the uppermost elevations of the parcel represent the northern extension of the Kona Agricultural System, and include house enclosures, stone platforms, high-stacked *ahu*, stone walls and *numerous stone mounds*. Although a large number of features are associated with prehistoric land use, subsequent ranching and large-scale agriculture during the historic period have obscured or destroyed much of the earlier patterning, making it difficult to establish the original distribution of prehistoric features. Primary land use during prehistoric times is associated with dryland swidden cultivation. The principal crops were dryland taro and sweet potato, with other crops including breadfruit, bananas, paper mulberry, ti, and sugar cane. Historic period land use is associated with ranching, habitation and large-scale agriculture.

Implications for the Current Project

The current project area does not contain any portion of the Coastal Zone, but does contain portions of the Barren and Upland Zones. Based on factors discussed above, the Barren zone extends from the Queen Ka'ahumanu Highway along the western boundary of the project area (c. 80-120-ft elevation), inland to approximately the 400-foot elevation. Site types within the Barren Zone are expected to reflect transitory occupation and to include types such as C-shapes and cave/sink complexes and transportation routes between the coast and the Upland Zone. The Upland Zone begins at approximately the 450-ft contour and continues inland to the easternmost edge of the project area (c. 800-foot elevation) and beyond. Given the distribution of sites encountered within the *ahupua'a*, however, few sites are expected between 450-800 ft. If any sites are present at these elevation, site types would include pahoehoe excavations, cave/sink complexes, trails and cairns.

FIELD METHODS

The field work for the current project consisted of a 100% pedestrian survey. The survey was conducted on September 16-17, 1993, by PHRI Laboratory Director Susan T. Goodfellow, Ph.D., and Lab Technician Earl Fujishige, B.A. The project area consisted of a 1.9 mile long by 100 ft. wide corridor. The survey was accomplished using transects spaced at intervals of 10 meters or less. The transects were oriented parallel to the centerline of the corridor. Visibility in the project area was good on the barren 'a'a and pahoehoe flows and moderate in the grassland area.

FINDINGS AND CONCLUSION

During the field survey, no archaeological remains of any significance were identified. This was not unexpected, given the predicted scarcity of cultural remains between 400-800 ft AMSL in the general area, and given the narrowness of the survey corridor.

The results of the current investigation generally conformed to the project expectations. The negative findings add support to the argument that the portion of the Barren Zone between 400-800 ft AMSL was largely un-utilized, with the exception of cinder cone areas and lava tubes, and trails that extended from the coast to the uplands In view of the negative results of the inventory survey, it is concluded that the project area requires no further archaeological work.

It should be noted that the recommendation presented here is given with the general qualification that during any development activity involving the extensive modification of the land surface, there is always the possibility, however remote, that previously unknown or unexpected subsurface cultural features, deposits, or burials might be encountered. In such a situation, archaeological consultation should be sought immediately.

REFERENCES CITED

ACHP (Advisory Council on Historic Preservation)
1985 Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review. Advisory Council on Historic Preservation (Draft Report, August), Washington, D.C.

Armstrong, R.W. (ed.)
1983 *Atlas of Hawaii.* Honolulu: University of Hawai'i Press. (Second edition)

Barrera, W.M., Jr.
1971 'Anaeho'omalu: A Hawaiian Oasis. Preliminary Report of Salvage Research in South Kohala, Hawaii. *Pacific Anthropological Records* No. 15. Department of Anthropology, B.P. Bishop Museum.

Board of Commissioners
1929 Indices of Awards made by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Star Bulletin Press, Honolulu.

Bower, P., and A.T. Walker
1991 Interim Report: Regent Kona Coast Resort Mitigation Program - Phase II. Land of Kuki'o 1st, North Kona District, Island of Hawai'i (TMK:3-7-2-04:Por.5,16). PHRI Report 1009-072991. Prepared for Hu'ehu'e Ranch Associates, L.P. and PBR Hawai'i.

Camara, B.
1989 The Botanical Resources of Ka'upulehu Waena: A Preliminary Survey. Geographical Factors of Hawai'i. Prepared for Potomac Investment Associates.

Carter, L.A.
1985 An Archaeological Reconnaissance of the Makai Parcel of Ka'upulehu Ahupua'a, North Kona, Hawai'i Island. Ms.020585. Department of Anthropology, B.P. Bishop Museum.

CFR (Code of Federal Regulations)
36 CFR Part 60 National Register of Historic Places. Department of the Interior, National Park Service, Washington, D.C.

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

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

Ching, F.K.W.
1971 The Archaeology of South Kohala and North Kona: From the Ahupua'a of Lalamilo to the Ahupua'a of Hamanamana. Surface Survey, Kailua-Kawaihae Road Corridor (Section III). *Hawaii State Archaeological Journal* 71-1. Division of State Parks, Department of Land and Natural Resources.

Clark, J.R.K.
1985 *Beaches of the Big Island*. Honolulu: University of Hawaii Press.

Cordy, R.
1981 *A Study of Prehistoric Social Change: The Development of Complex Societies in the Hawaiian Islands*. New York: Academic Press. (Virtually identical to author's 1978 Ph.D. dissertation [Anthropology, University of Hawaii], with addition of an epilogue).

1985 Working Paper 1: Hawai'i Island Archaeology, 'O'oma & Kalaoa Ahupua'a, Kekaha, North Kona. TMK:7-3. Historic Sites Section, Division of State Parks, Department of Land and Natural Resources.

Cox, J.H., and E. Stasack
1970 Hawaiian Petroglyphs. *B.P. Bishop Museum Special Publication* 60. B.P. Bishop Museum Press, Honolulu.

Donham, T.K.
1986a Archaeological Field Inspection, Revised Kona Village Expansion Site, Land of Ka'upulehu, North Kona, Island of Hawai'i. PHRI Report 241-060286. Prepared for Belt, Collins & Associates.

1986b Archaeological Reconnaissance Survey, Makalawena Coastal Development Area, Land of Makalawena, North Kona, Island of Hawai'i. PHRI Report 245-091886. Prepared for the Kamehameha Schools/Bernice P. Bishop Estate and Phillips, Brandt, Reddick & Associates, Inc.

1987a Archaeological Reconnaissance Survey, Proposed Awakee Resort Development Project Area, Land of Awake'e, North Kona, Island of Hawai'i. PHRI Report 265-011387. Prepared for Kahala Capital Corporation.

1987b Archaeological Survey and Testing, 'O'oma II Resort Project Area, Land of 'O'oma II, North Kona, Island of Hawai'i. PHRI Report 245-081286. Prepared for Helber, Hastert, Van Horn & Kimura.

Ellis, W.
1963 *Journal of William Ellis*. Honolulu: Advertiser Publishing Co., Ltd.

Emory, K.P.
1970 Inventory of Archaeological and Historical Sites in the Districts of Kona and Ka'u and in Anaehoomalu, South Kohala, Island of Hawaii. Departmental Report Series 70-12. Department of Anthropology, B.P. Bishop Museum.

Goodfellow, S.T., and J. Head
1992 Archaeological Inventory Survey, Ka'upulehu Mauka Lands Golf Course II Area and Remaining Area. Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK: 7-2-3:03). PHRI Report 1142-070892. Prepared for Potomac Investment Associates.

Goodfellow, S.T., P.M. Jensen, and P. Bower
1992 Archaeological Mitigation Program, Phase II - Archaeological Data Recovery, Regent Kona Coast Resort. Land of Kuki'o 1st, North Kona District, Island of Hawai'i (TMK:3-7-2-04:5,16). PHRI Report 1009-090992. Prepared for PBR Hawai'i-Hilo Office.

Handy, E.S.C., and E.G. Handy
1972 Native Planters in Old Hawaii. *B.P. Bishop Museum Bulletin* 233. Bishop Museum Press, Honolulu. (with M.K. Pukui)

Head, J.A., S.T. Goodfellow, and P.H. Rosendahl
1992 Archaeological Inventory Survey, Kaupulehu Mauka Lands Project Area. Land of Kaupulehu, North Kona District (TMK:3-7-2-03:3). PHRI Report 897-030691. Prepared for Potomac Investment Associates.

Hommon, R.
1976 The Formation of Primitive States in Pre-Contact Hawai'i. Ph.D. dissertation, University of Arizona, Tucson. University Microfilms, Inc., Ann Arbor, Michigan.

I'i, J.P.
1973 *Fragments of Hawaiian History*. Honolulu: Bishop Museum Press.

Jensen, P.M.
1988 Archaeological Data Recovery and Intensive Survey, Resort Expansion Area and Selected Undeveloped Resort Parcels, Waikoloa Beach Resort, Lands of Waikoloa and 'Anaeho'omalu, South Kohala, Island of Hawai'i. PHRI Report 371-031488. Prepared for Transcontinental Development Company.

1989 Archaeological Data Recovery Program, Lots 1, 2, 6, 7, 17, 24, Waikoloa Beach Resort, Land of 'Anaeho'omalu, South Kohala District, Island of Hawai'i. PHRI Report 468-061489. Prepared for Transcontinental Development Company.

1991 Archaeological Data Recovery Plan, Mauna Lani Cove and Adjacent Golf Course Relocation Project Area, Lands of Kalahuipua'a and Waikoloa, South Kohala District, Island of Hawai'i. PHRI Report 1026-020191. Prepared for Mauna Lani Resort, Inc.

Jensen, P.M., and P.H. Rosendahl
1989 Archaeological Mitigation Program, Ka'upulehu Makai Resort, Land of Kaupulehu, North Kona District, Island of Hawai'i. Phase I: Mitigation Plan for Data Recovery, Interim Site Preservation, and Burial Treatment. PHRI Report 593-0601890. Prepared for Ka'upulehu Developments and Belt, Collins & Associates.

Kamakau, S.
1961 *Ruling Chiefs of Hawaii*. Honolulu: The Kamehameha Schools Press.

Kelly, M.
1985 Appendix C: Notes on the History of Ka'upulehu. IN Carter 1985.

Kirch, P.V.
1979 Marine Exploitation in Prehistoric Hawai'i: Archaeological Investigations at Kalahuipua'a, Hawai'i Island. *Pacific Anthropological Records* No. 29. Department of Anthropology, B.P. Bishop Museum, Honolulu.

1985 *Feathered Gods and Fishhooks*. Honolulu: University of Hawai'i Press.

Komori, E.
1981 Archaeological Reconnaissance Survey of Makai Area (TMK:7-2-3:2) at Ka'upulehu, Hawai'i Island. Manuscript 071081. Department of Anthropology, B.P. Bishop Museum.

Maguire, E.D.
1926 *Kona Legends*. Honolulu: Paradise of the Pacific Press.

Maly, K. (translator)
In prep *Ka 'ao Ho 'oniua Pu 'uwai no Ka-Miki* (The Heart-Stirring Story of Ka-Miki). A translation of a legendary account of people and places of the Island of Hawai'i. Manuscript, Paul H. Rosendahl, Ph.D., Inc.

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

Newman, T.S.
1970 Hawaiian Fishing and Farming on the Island of Hawai'i in A.D. 1778. Division of State Parks, Department of Land and Natural Resources, Honolulu.

Puku'i, M.K.
1983 Olelo Noeau. *B.P. Bishop Museum Special Publication* 71. Bishop Museum Press, Honolulu.

Puku'i, M.K., S.H. Elbert, and E.T. Mookini
1974 *Place Names of Hawaii*. Honolulu: University of Hawaii Press.

Reinecke, J.E.
n.d. Survey of Hawaiian Sites, 1929-1930. Manuscript in Department of Anthropology, B.P. Bishop Museum.

Renger, R.C.
1970 Archaeological Reconnaissance Survey of the Coastal Areas of Kaloko and Kuki'o, North Kona, Hawaii. Departmental Report Series 70-10. Department of Anthropology, B.P. Bishop Museum.

Rock, J.F.
1974 *The Indigenous Trees of the Hawaiian Islands*. Rutland, Vermont: Charles E. Tuttle Company.

Rosendahl, M.L.K.

1986 Archaeological Field Inspection, Kona Village Expansion Site, Land of Ka'upulehu, North Kona, Island of Hawai'i. PHRI Report 230-041686. Prepared for Belt, Collins & Associates.

1989 Archaeological Inventory Survey, Ka'upulehu Resort Utility Corridor Project Area, Land of Kaupulehu, District of North Kona, Island of Hawai'i. PHRI Report 511-012389. Prepared for Ka'upulehu Developments and Belt, Collins & Associates.

Rosendahl, P.H.

1973 Archaeological Salvage of the Ke-Ahole to 'Anaeho'omalu Section of the Kailua-Kawaihae Road (Queen Ka'ahamanu Highway), Island of Hawai'i. Departmental Report Series 73-3. Department of Anthropology, B.P. Bishop Museum.

1988 Addendum Report: Archaeological Reconnaissance Survey, Awakee Access Road Corridor, Awakee Resort, Land of Awakee, North Kona, Island of Hawaii (TMK:3-7-2-04:3). PHRI Report 478-082088. Prepared for Kahala Capital Corporation

1989a Archeological Inventory Survey, Phase I - Site Identification, Ka'upulehu Mauka Utility Corridor, Irrigation System Portion, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-03:3). PHRI Report 720-111189. Prepared for Potomac Investment Associates.

1989b Addendum Report: Archaeological Inventory Survey, Phase I - Site Identification, Ka'upulehu Mauka Utility Corridor and Proposed Reservoir Site, Land of Ka'upulehu, North Kona District, Island of Hawaii (TMK:3-7-2-03:3). PHRI Report 720-112789. Prepared for Potomac Investment Associates.

1990a Supplemental Archaeological Inventory Survey, Ka'upulehu Makai Resort, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-03:Por.1). PHRI Report 779-011290. Prepared for Ka'upulehu Hotel Venture.

1990b Supplemental Archaeological Inventory Survey, Proposed Construction Access Road and Office and Storage Sites, Ka'upulehu Makai Resort, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-02:Por.1). PHRI Report 778-011790. Prepared for Ka'upulehu Hotel Venture.

1990c Archaeological Inventory Survey, Phase I - Site Identification, Ka'upulehu Phase II Mauka Utility Corridor, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-03:3). PHRI Report 851-060590. Prepared for Potomac Investment Associates.

1990d Addendum Report: Archaeological Inventory Survey, Ka'upulehu Resort Utility Corridor, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-03:3). PHRI Report 720-051090. Prepared for Potomac Investment Associates.

1991 Archaeological Inventory Survey, Ka'upulehu Makai Resort Intersection, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-02:Por.1). PHRI Report 1008-010991. Prepared for Potomac Investment Associates.

Sato, H.H., W. Ikeda, R. Paeth, R. Smythe, and M. Takehiro, Jr.
1973 Soil Survey of the Island of Hawai'i, State of Hawai'i. U.S. Department of Agriculture-Soil Conservation Service and the University of Hawai'i Agriculture Experiment Station. Government Printing Office, Washington, D.C.

Schmitt, R.C.
1973 The Missionary Censuses of Hawai'i. *Pacific Anthropological Records* No. 20. Department of Anthropology, B.P. Bishop Museum, Honolulu.

Silva, C.
1986 Appendix A: Preliminary Historical Documentary Research. IN Donham 1986b:108-120.

1987 Appendix A: Preliminary Historical Documentary Research. IN Donham 1987:152-169.

Smith, A.K., and P.H. Rosendahl
1992 *Ka'upulehu Makai - Lot 4 Phased Archaeological Inventory Survey, Phase I - Site Identification, Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK:3-7-2-03:Por.1).* PHRI Report 1141-021392. Prepared for Belt, Collins & Associates.

Soehren, L.J.
1963 Archaeology and History in Ka'upulehu and Makalawena, Kona, Hawai'i. Manuscript. Department of Anthropology, B.P. Bishop Museum.

Springer, H.K., and Associates
1986 Appendix B: Regional Notes from Kekaha: Makalawena. IN Donham 1986b:121-141.

1987 Appendix B: Regional Notes from Kekaha: Awake'e. IN Donham 1987:170-179.

1989 Regional Notes from Kekaha: Ka'upulehu, An Ethnography, Ka'upulehu Ma Uka Conservation and Agricultural Lands. Hannah Kihalani Springer and Associates, Kukui'ohiwai, Ka'upulehu. Prepared for Potomac Investment Associates.

Sullivan, R.B., and S.T. Goodfellow
1991 Ka'upulehu Makai Resort Phased Archaeological Mitigation Program, Phase II Archaeological Data Recovery. Land of Ka'upulehu, North Kona District, Island of Hawai'i (TMK: 3-7-2-03:1). PHRI Report 593-042291. Prepared for Kaupulehu Developments.

Sullivan, R.B., and P.H. Rosendahl
1989 Interim Report: Background, Summary of Methodology and Findings, and Additional Tasks Performed, Archaeological Mitigation Project, Ka'upulehu Makai Resort, Land of Ka'upulehu, North Kona District, Island of Hawai'i, Phase I: Mitigation Plan for Data Recovery, Interim Site Preservation and Burial Treatment. PHRI Report 593-060189. Prepared for Ka'upulehu Developments and Belt, Collins & Associates.

Walker, A.T., and P.H. Rosendahl

1985 Full Archaeological Reconnaissance Survey, Kuki'o Resort Development Project Area, Kuki'o 1st, North Kona, Island of Hawai'i. PHRI Report 167-090385. Prepared for Phillips, Brandt, Reddick & Associates and Hu'ehu'e Ranch.

1988a Archaeological Survey and Test Excavations, Ka'upulehu Makai Resort Project Area, Land of Ka'upulehu, North Kona, Island of Hawai'i. PHRI Report 213-032686. Prepared for Ka'upulehu Developments.

1988b Intensive Archaeological Survey and Test Excavations, Proposed Kealakehe Reservoir Site, Land of Kealakehe, North Kona District, Island of Hawaii. PHRI Report 369-052388. Prepared for Hawaii County Department of Water Supply.

1990 Archaeological Resources Assessment, Ka'upulehu Phase II Master Plan, Land of Ka'upulehu, North Kona District, Island of Hawai'i. PHRI Report 642-021590. Prepared for Potomac Investment Associates.

Walker, A.T., L. Kalima, and P.H. Rosendahl

1989 Archaeological Inventory Survey, Royal Vistas Estates Development, Land of Puuanahulu, North District, Island of Hawaii. PHRI Report 659-060190. Prepared for Premier Resort Development.

Wilkes, C.

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

Appendix E

RC-0026

Addendum Archaeological Inventory Survey for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area–Conservation District

Ka'ūpūlehu Ahupua'a
North Kona District
Island of Hawai'i

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Addendum Archaeological Inventory Survey for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area—Conservation District

Ka'ūpūlehu Ahupua'a
North Kona District
Island of Hawai'i

RECHTMAN CONSULTING

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Table

Table 1. Site Significance and Treatment Recommendations. 9

Introduction

At the request of Roger Harris of PIA Kona Limited Partnership, Lee Sichter of Belt Collins Hawaii, and Guy Lam of Kekaha Venture, Inc., Rechtman Consulting conducted an archaeological survey of seven selected project/improvement areas in Conservation District zoned land within the overall Ka'ūpūlehu Mauka Project Area (Figure 1). A companion report is currently being prepared for the physical continuation of one improvement area (an access road) and an additional improvement area (proposed well sites) in Agricultural District zoned land (Rechtman n.d.). Also under preparation is a cultural impact assessment for potential traditional resources within the study area (Rechtman and Rudolph n.d.) The current survey was conducted as an addendum to the comprehensive inventory surveys completed by Paul H. Rosendahl, Ph.D., Inc. (PHRI) in 1990 (Head et al. 1996) and in 1992 (Goodfellow and Head 1995). Much of the combined current project area had been surveyed before (Head et al. 1996).

This report is intended to accompany an Environmental Assessment (EA) as well as fulfilling the requirements of the County of Hawai'i Planning Department and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) with respect to permit approvals for land-altering and development activities.

This addendum-style report format follows Rechtman and Henry (2000) for documenting the current study areas and was decided upon in consultation with Ross Cordy, Ph.D., Archaeology Branch Chief, DLNR-SHPD. This report briefly discusses the background for the general project area, presents descriptions of the seven specific current project areas, outlines field methods and findings, and provides significance evaluations and recommended treatments for the identified historic resources. For a detailed description of previous archaeological work in the vicinity, a summary of historical documentary research, and a discussion of settlement patterns relevant to this area, see Head et al (1996) and Goodfellow and Head (1995).

Background

In 1990 and 1992, Paul H. Rosendahl, Ph.D., Inc., (PHRI) conducted archaeological inventory surveys of the Ka'ūpūlehu Mauka Lands, in the upland portions of Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. (TMK:3-7-2-03:3) (Goodfellow and Head 1995, Head et al. 1996) (Figure 2). As a result of those surveys, 5600 acres were inventoried with various intensities of surface coverage, and 109 sites were documented. The 469 features contained within the recorded sites included a wide range of formal and functional types. A follow-up survey of a 300-acre portion of the previously surveyed lands was undertaken by Rechtman and Henry (2000) (see Figure 2). During that survey one additional site with two features (both *ahu*) was recorded.

The results of the previous surveys indicate that the general area was occupied during both the Historic and Pre-Contact Periods, potentially as early as AD 1450. Four of the current project areas (Areas 1, 2, 3, and 7) were included in the Head et al. (1996) survey. Only one site was recorded in any these areas; SIHP Site 10977 (Hu'ehu'e–Ka'ūpūlehu Trail) traverses current Area 3 (see Figure 2). Current Areas 4, 5, and 6 lie immediately west of the land covered by Head et al. (1996) (c.f. Figures 1 and 2).

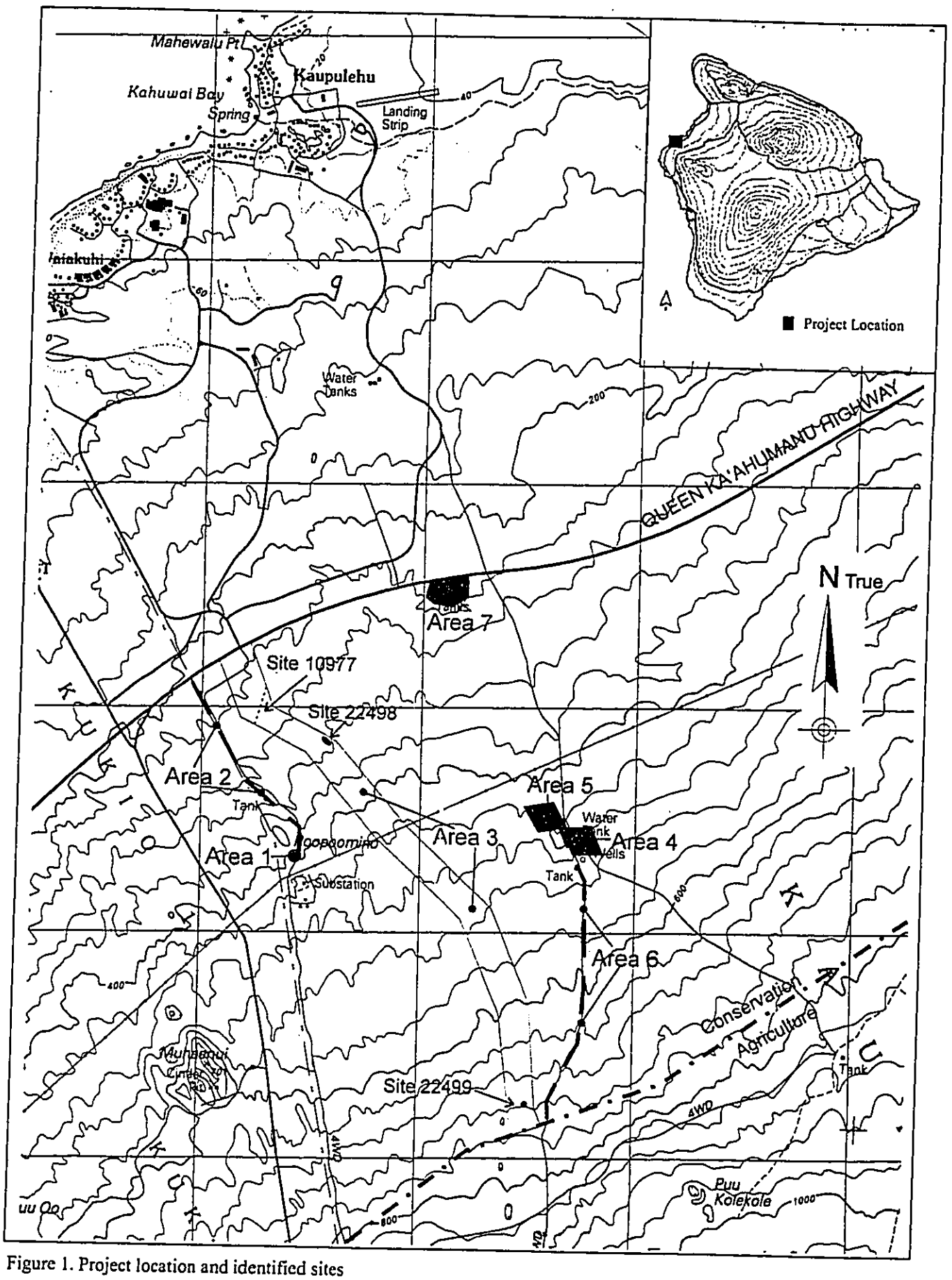

Figure 1. Project location and identified sites

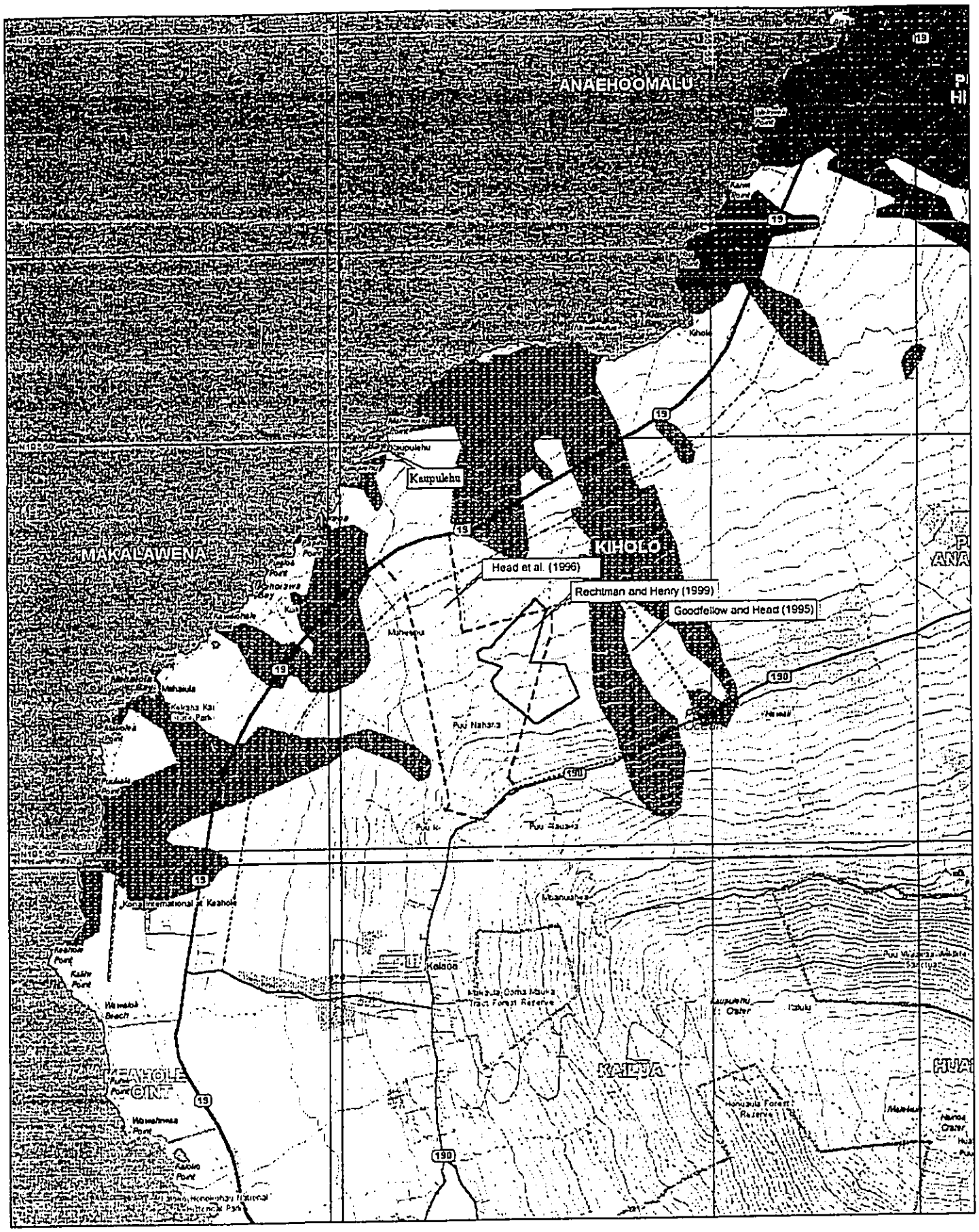

Figure 2. Prior study areas.

Project Area Description

As previously stated, this report covers seven discontinuous project areas within state zoned Conservation District land (see Figure 1). The general project area ranges in elevation from 200 to 760 feet (61 to 232 meters) above sea level. The terrain encompasses both *pāhoehoe* and *'a'ā* flows and is dominated by fountain grass (*Pennisteum sectaceum*) with scattered native and exotic schrubs. These include *'ilima* (*Sida cordifolia*), *indigo* (*Indigfera suffruticossa*), *kiawe* (*Prosopis pallida*), *lama* (*Diospyros sandwicensis*), silver oak (*Grevillea robusta*), and *'ōhi'a lehua* (*Metrosideros polymorpha*). Descriptions of the seven specific areas are as follows:

Area 1 is on the southeast margin of Pu'u Po'opo'omino adjacent to an existing paved roadway at an elevation of roughly 400 feet. This area is the location of a proposed 0.5 MG potable water tank, and is situated within broken *pāhoehoe.*

Area 2 extends from the proposed 0.5 MG potable water tank at Area 1 northwesterly within an existing utility corridor alongside the paved roadway to Queen Ka'ahumanu Highway. This area is the location of a proposed 16-inch waterline.

Area 3 is a 400-foot wide corridor, within which a final 100-foot wide corridor will be selected for a proposed access road. The ultimate decision on the location of the 100-foot corridor will be based on both engineering constraints and avoidance of any archaeological resources. This corridor extends from Queen Ka'ahumanu Highway through Conservation District land into Agriculture District land to the clubhouse area of the proposed Hualālai Links Golf Course. Archaeological survey for the proposed golf course area has already been completed and approved (Rechtman and Henry 2000). Only the portion of the corridor in Conservation land was investigated as part of this study; the portion in Agricultural land is addressed in a separate report (Rechtman n.d.).

Area 4 is six acres adjacent to and east of an existing 2 MG irrigation lake and paved roadway at an elevation ranging from 440 to 480 feet. This area is the proposed location of another 2 MG irrigation lake.

Similar to Area 4, Area 5 is six acres adjacent to and north of the existing 2 MG irrigation lake and east of a paved roadway at an elevation ranging from 400 to 440 feet. This area is the proposed location of a third 2 MG irrigation lake.

Area 6 is a corridor for an 8-inch waterline that conforms to an existing service road leading from Areas 4 and 5 in a southerly direction to the Conservation/Agriculture District boundary.

Area 7 is 4 acres for a proposed percolation pit adjacent to and south of Queen Ka'ahumanu Highway.

Fieldwork

On July 24, 25 and August 16, 2000, an archaeological survey of the seven study areas was completed. The fieldwork was directed by Robert B, Rechtman, Ph.D. with the assistance of Dennis S. Dougherty, B.A., Matthew R. Clark, B.A., and Richard Rudolph, B.A..

Methods

The individual project areas were subject to an intensive pedestrian reconnaissance. Crew members walked transects spaced at 10-meter intervals. Sites identified during the reconnaissance were described and plotted on a project area map. Any sites identified within the 400-foot wide proposed road corridor (Area 3), which could be avoided when selecting the final 100-foot wide alignment were only minimally recorded. Sites within Area 3 that could not be avoided were thoroughly documented.

Findings

This section describes the results of previous investigations within the specific project areas as well as the results of the current study; and provides description of the archaeological sites encountered.

Area 1

During the earlier study (Head et al. 1996) this area was comprehensively surveyed and no archaeological sites were found. Similarly, this area was intensively investigated during the current survey with the same result, no sites encountered.

Area 2

This area is an existing utility corridor that has an approved breach through SIHP Site 10977. No additional sites were recorded in the corridor during the earlier survey (Head et al. 1996) and none were encountered during the current work.

Area 3

This is the largest single area within the current improvements proposal, and was surveyed at varying intensities during the earlier study (Head et al. 1996). One site was recorded during the earlier work, SIHP 10977. During the current investigation, Area 3 was intensively surveyed, and Site 10977 was recorded relative to the proposed roadway corridor (Figure 3). Site 10977 is the Hu'ehu'e-Ka'ūpūlehu Trail, which in its entirety extended from the shore at Kahuwai Bay to Hu'ehu'e Ranch near Akahipu'u. This well documented trail traverses the entire 400-foot wide corridor that makes up Area 3. The trail itself is a worn path across *pāhoehoe* (Figure 4), except at the western edge of the corridor where it crosses *'a'ā*. In this area the 'a'ā has been cleared away (Figure 5), exposing the underlying *pāhoehoe*. Two intact *ahu* (A and B), constructed of stacked pāhoehoe slabs, were observed adjacent to the trail along with what appeared to be a third collapsed *ahu* (see Figure 3 and 4). *Ahu* A has a 90-centimeter diameter and is 40 centimeters high; *Ahu* B is 60 centimeters high with a 60-centimeter diameter. The worn path varies from 50 centimeters to 1.5 meters wide.

Two additional sites were recorded during the current survey, SIHP 22498 and SIHP 22499 (see Figure 1). Site 22498 comprises two lava blister shelters, interpreted as pre-Contact temporary habitations. The blisters are part of the same tube formation that is oriented 300/120 degrees true north (Figure 6). At the north end of the site, from the *makai*-most shelter entrance it is 44 feet (13.5 meters)@215 degrees true north to the corridor centerline (at stake 6); at the south end of the site, from the *makai*-most shelter opening it is 75 feet (23 meters)@230 degrees from the shelter entrance to the corridor centerline (at stake 7). Both the northern blister and southern blister have *makai* and *mauka* entrances/exits. Within the shelters there is a light scatter of *Cypraea* and *Conus* shell, but no soil development has occurred.

Site 22499 is a modified outcrop near the Conservation/Agriculture District boundary near a graded utility road (see Figure 2). From the center of the site to the corridor centerline (at post 49) it is 77 feet (23.5 meters)@325 degrees. The site consists of a 3 x 2 meter pile (40 centimeters high) of large *pāhoehoe* boulders on top of smaller cobbles placed against a bedrock outcrop (Figure 7). No portable cultural remains were observed at the site, and it is interpreted as an agricultural feature.

Area 4

This area was not surveyed during any of the earlier work. During the current study this *pāhoehoe* landscape was intensively surveyed. Construction of the existing 2 MG lake and associated infrastructure had altered the extreme eastern portion of the area, however, most of the area is in its natural state. No archaeological sites were observed in this area during the current field survey.

Area 5

This area was not surveyed during the earlier investigations. During the current study this *pāhoehoe* and *'a'ā* landscape was intensively surveyed. Construction of the existing 2 MG lake and associated infrastructure had altered the extreme northern portion of the area, however, most of the area is in its natural state. During the current field survey no archaeological sites were identified in this area.

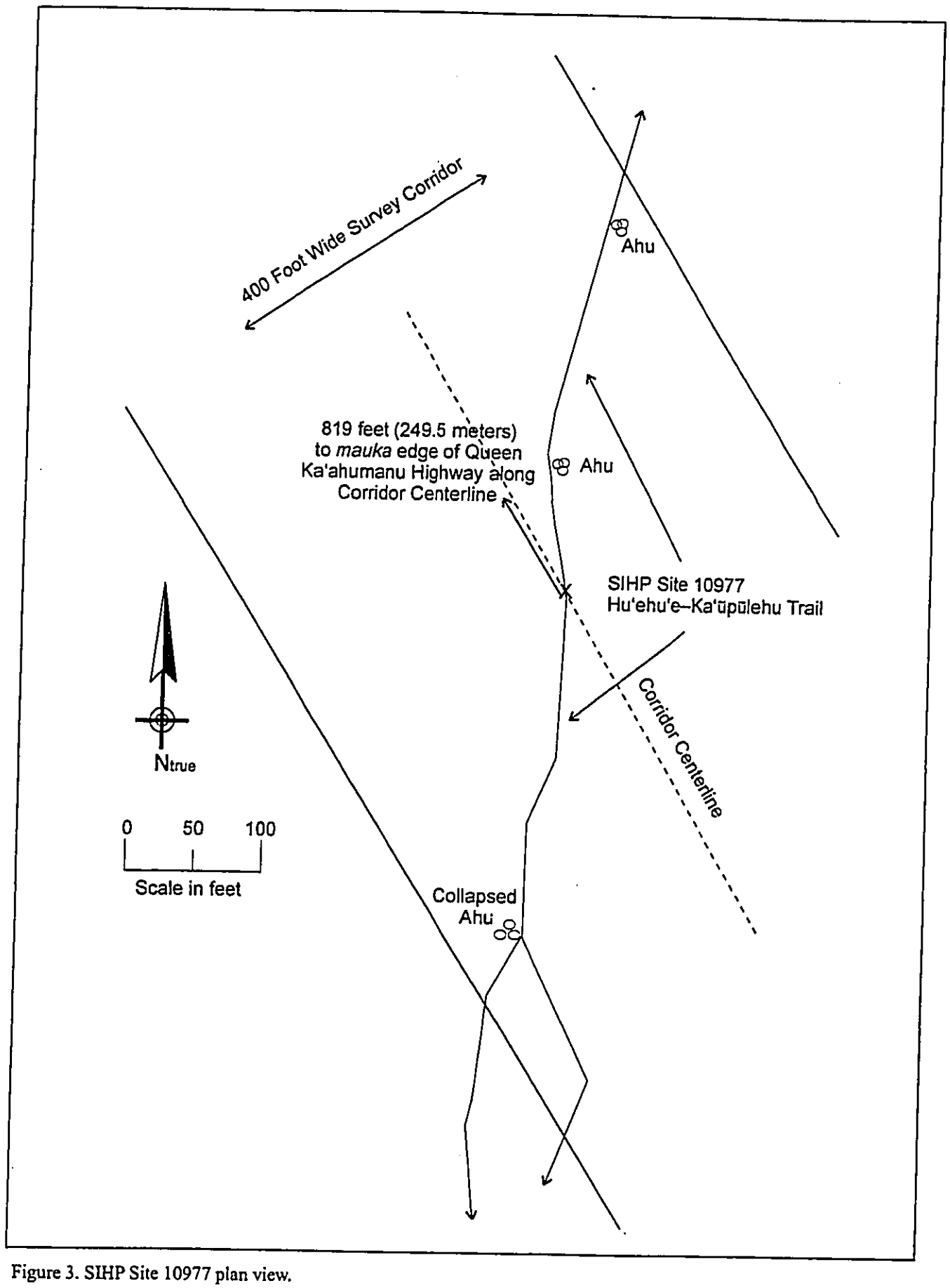

Figure 3. SIHP Site 10977 plan view.

Figure 4. SIHP Site 10977 across *pāhoehoe.*

Figure 5. SHIP Site 10977 across *'a'a.*

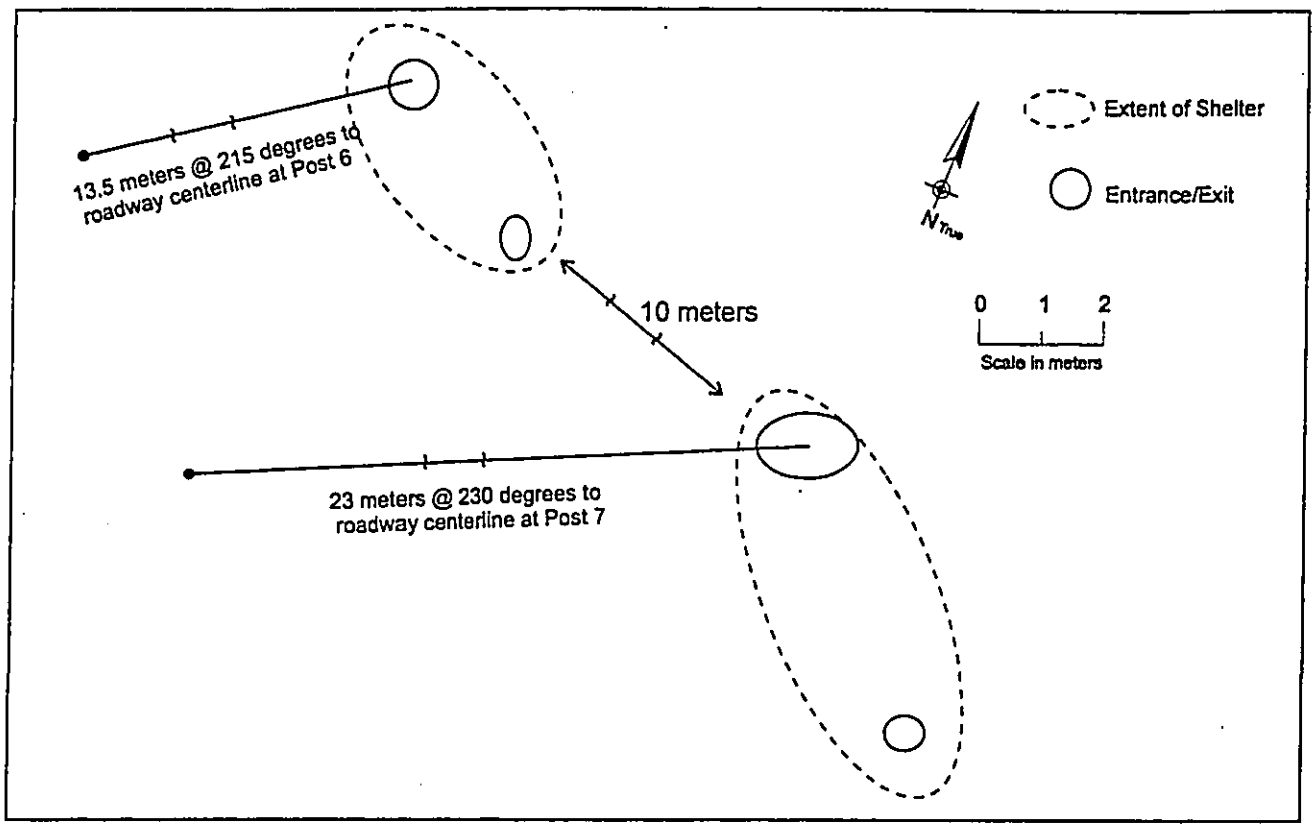

Figure 6. SIHP Site 22498 plan view.

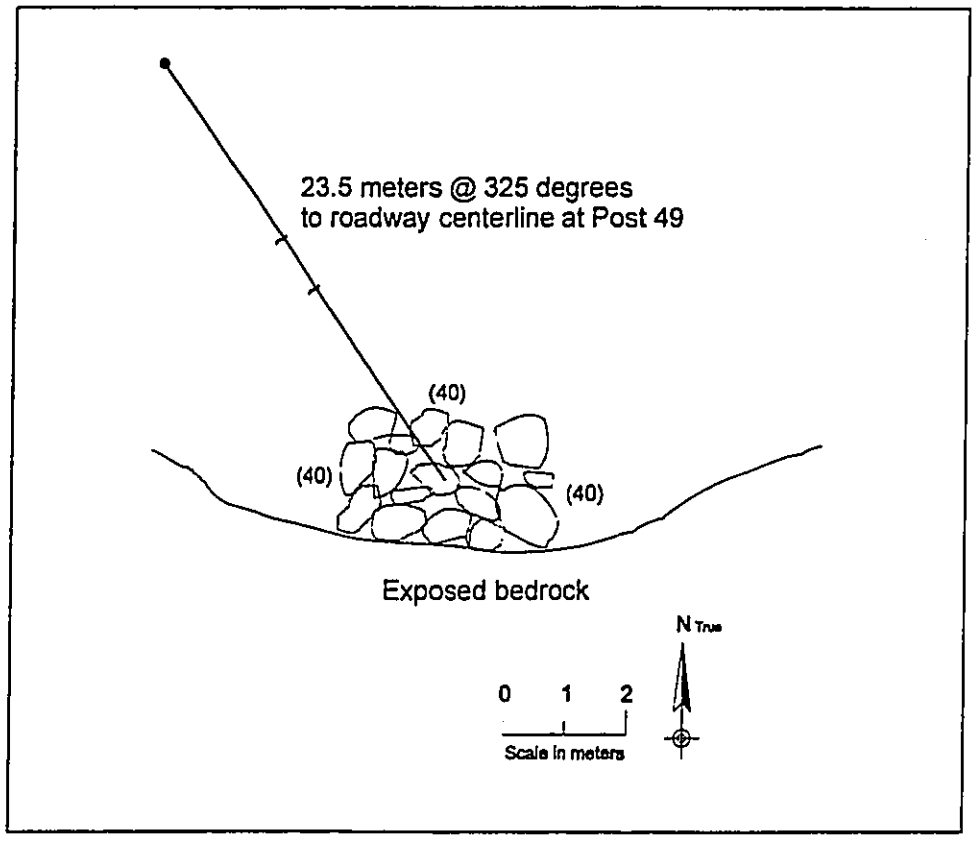

Figure 7. SIHP Site 22499 plan view.

Area 6

This corridor (wide enough to place an 8-inch water line) lies immediately adjacent to an improved dirt road. The prior establishment of the road has completely altered the proposed corridor. This area was not surveyed during the earlier studies. During the current study a transect 20 meters wide, centered on the 3 meter wide road, was surveyed. No archaeological sites was recorded within the survey transect.

Area 7

This four acre area of *pāhoehoe* and *'a'ā* was included in the earlier (Head et al. 1996) survey, and no sites were found. During the current investigation the area was resurveyed with the same result. The southern portion of this area, adjacent to Queen Ka'ahumanu Highway, had previously been mechanically altered for drainage control purposes associated with the highway.

Site Significance, Impact Assessment, and Recommended Treatments

The three sites documented during the current study (all within Area 3) are assessed for their significance based on criteria established and promoted by DLNR-SHPD and contained in the draft Hawai'i Administrative Rules 13§13-284-6, dated 1998. 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 evaluations for the three sites are discussed below and are presented in **Table 1.**

Table 1. Site Significance and Treatment Recommendations

Site No.	*Function*	*Temporal Association*	*Significance*	*Treatment*
SIHP 10977	Trail	Pre-Contact/Historic	A, D, E	One breach with interpretive restoration
SIHP 22498	Temp. Habitation	Pre-Contact	D	Preservation through avoidance
SIHP 22499	Agricultural	Pre-Contact	D	Preservation through avoidance

SIHP 10977

The Hu'ehu'e-Ka'ūpūlehu Trail has previously been determined significant under Criteria A, D and E. This significant landmark will be impacted by the proposed roadway construction. It is recommended that only one new breach takes place and that a treatment plan be prepared for the resource. This treatment plan should include restoration and interpretation elements that are consistent with the restoration and interpretation for the more *makai* portions of this trail that exist within the Hualālai resort area (Rechtman 1999).

SIHP 22498

SIHP Site 22498 is considered significant under Criterion D for the data it possesses relative to pre-Contact residential use of the arid barrens of Kekaha. However, it will not be impacted by any of the proposed improvements/developments; thus, preservation through avoidance is the recommended treatment for this temporary habitation site.

SIHP 22499

This modified outcrop, interpreted as an agricultural feature, is considered significant under Criterion D for the data potential it contains relative to pre-Contact land use patterns. The proposed improvements/developments will not impact this agricultural feature; thus, preservation through avoidance is the recommended treatment.

References Cited

Goodfellow, S. T., and J. A. Head
1995 Archaeological Inventory Survey, Kaupulehu Mauka Lands Golf Course II Area and Remaining Area, Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:7-2-3:03). PHRI Report 1142-031595. Prepared for Potomac Investment Associates, Western Division.

Head, J. A., S. T. Goodfellow, and P. H. Rosendahl
1996 Archaeological Inventory Survey - Ka'ūpūlehu Mauka Lands Project Area, Land of Ka'ūpūlehu, North Kona District, Island of Hawaii (TMK:3-7-2-03:3). PHRI Report 897-050596. Prepared for Potomac Investment Associates.

Rechtman, R. B.
1999 Historic Sites Preservation and Interpretation Plan, Hualālai at Historic Ka'ūpūlehu, Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. PHRI Report 1675-060199. Prepared for Hualālai Development Company.

Rechtman, R. B.
n.d. Addendum Archaeological Inventory Survey for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area—Agricultural District, Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. In Preparation.

Rechtman, R. B., and J. D. Henry
2000 Addendum Archaeological Inventory Survey Ka'ūpūlehu Mauka Lands Project Area, Land of Ka'ūpūlehu, North Kona District, Island of Hawaii. PHRI Report 2038-030300. Prepared for Kekaha Venture, Inc. and PIA Kona Limited Partnership.

Rechtman, R. B., and R. Rudolph
n.d Cultural Impact Assessment, Ka'ūpūlehu Mauka Lands Project Area—Conservation District, Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. In Preparation.

Appendix F

RC-0036

Cultural Impact Assessment for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area– Conservation District

Ka'ūpūlehu Ahupua'a
North Kona District
Island of Hawai'i

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Cultural Impact Assessment
for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area—Conservation District

Ka'ūpūlehu Ahupua'a
North Kona District
Island of Hawai'i

RECHTMAN CONSULTING

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INTRODUCTION

At the request of Lee Sichter of Belt Collins Hawaii, Rechtman Consulting conducted a Cultural Impact Assessment (CIA) for a general project/improvement area in Conservation District zoned land within the overall Ka'ūpūlehu Mauka Project Area (Figure 1). A companion Archaeological Inventory Survey report for seven specific development areas, within the general area, has already been completed (Rechtman 2000). A similar CIA study was completed for the *makai* portions of the *ahupua'a*, associated with improvements to the Hualālai Resort (Maly and Rosendahl 1997); and an exhaustive archival and oral history study has been conducted for Ka'ūpūlehu (Maly 1998). The information contained in this latter study, combined with two new oral history interviews, forms the basis for the interpretations presented in the current study.

This report is intended to accompany an Environmental Assessment (EA) compliant with Chapter 343 HRS, as well as fulfilling the requirements of the County of Hawai'i Planning Department and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) with respect to permit approvals for land-altering and development activities. This study has been prepared in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai'i, November 19, 1997.

This report begins with a description of the general project area and the proposed development activities. This is followed by an abbreviated discussion of the legendary and historical background of Ka'ūpūlehu Ahupua'a. It is a comprehension of this background that facilitates a more complete understanding of the potential significance of both the cultural landscape and of specific places, or traditional cultural properties, within that landscape. Previously documented (Maly 1998) oral-historical and archival information is used to identify culturally significant properties within the current study area, and information provided in two newly conducted interviews is used to support and expand on the interpretation of the significant places. Two traditional cultural properties and a third resource of potential cultural significance are identified; potential impacts to these resources are discussed, and possible mitigation measures are presented.

PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The general project area ranges in elevation from 200 to 760 feet (61 to 232 meters) above sea level. The terrain encompasses both *pāhoehoe* and *'a'ā* flows and is dominated by fountain grass (*Pennisteum sectaceum*) with scattered native and exotic shrubs. These include *'ilima* (*Sida cordifolia*), *indigo* (*Indigfera suffruticossa*), *kiawe* (*Prosopis pallida*), *lama* (*Diospyros sandwicensis*), silver oak (*Grevillea robusta*), and *'ōhi'a lehua* (*Metrosideros polymorpha*).

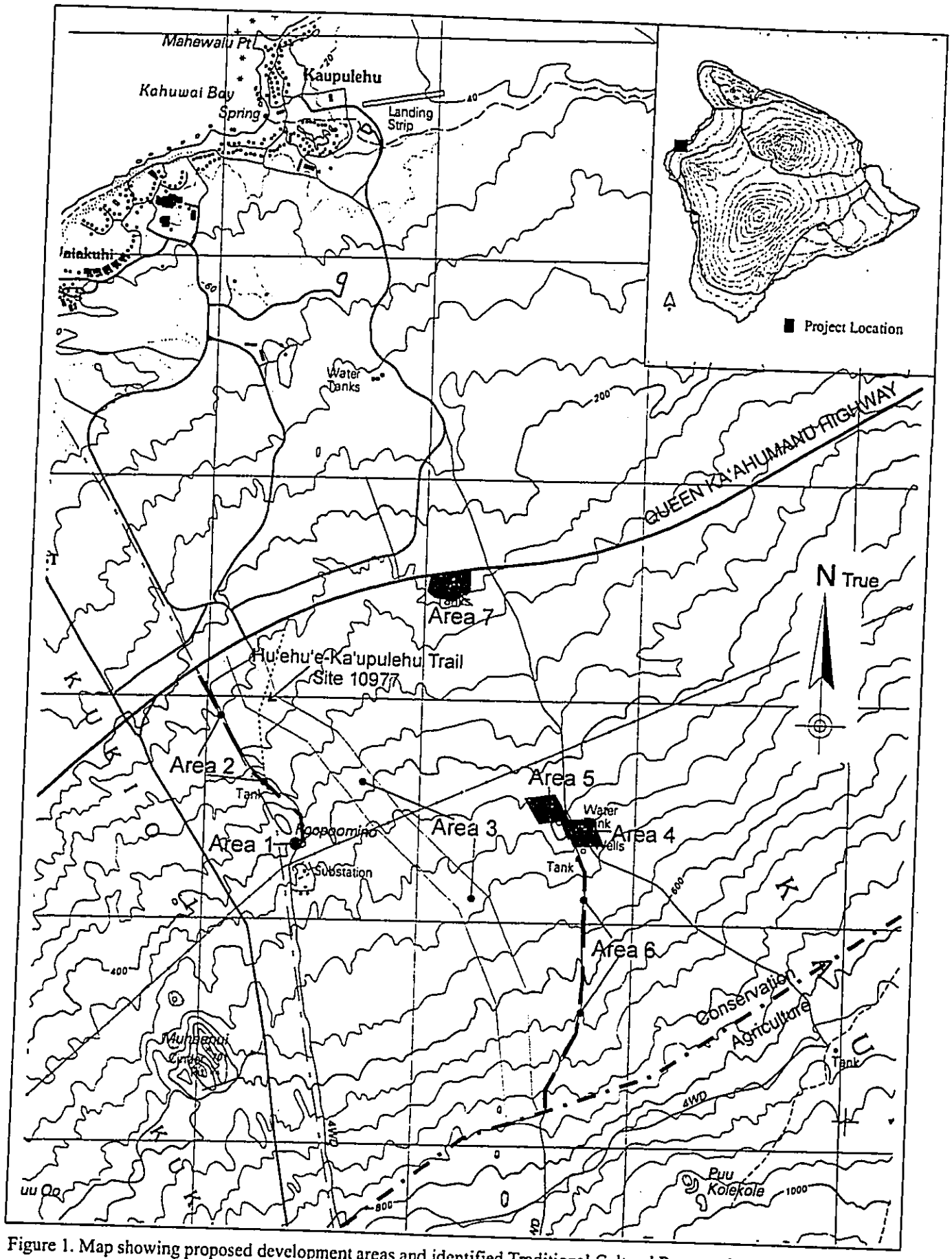

Figure 1. Map showing proposed development areas and identified Traditional Cultural Property locations.

The proposed development activities are restricted to seven specific areas. Area 1 is on the southeast margin of Pu'u Po'opo'omino adjacent to an existing paved roadway at an elevation of roughly 400 feet. This area is the location of a proposed 0.5 MG potable water tank, and is situated within broken *pāhoehoe*. Area 2 extends from the proposed 0.5 MG potable water tank at Area 1 northwesterly within a preexisting county and state approved utility corridor alongside the paved roadway to Queen Ka'ahumanu Highway. This area is the location of a proposed 16-inch waterline, and although it breaches a known historic trail, it does so within the prior approved corridor. Area 3 is a 400-foot wide corridor, within which a final 100-foot wide corridor will be selected for a proposed access road. The ultimate decision on the location of the 100-foot corridor will be based on both engineering constraints and avoidance of any archaeological resources. This corridor extends from Queen Ka'ahumanu Highway through Conservation District land into Agriculture District land to the clubhouse area of the proposed Hualālai Links Golf Course. Archaeological survey for the proposed golf course area has already been completed and approved (Rechtman and Henry 2000). Area 4 is six acres adjacent to and east of an existing 2 MG irrigation lake and paved roadway at an elevation ranging from 440 to 480 feet. This area is the proposed location of another 2 MG irrigation lake.

Similar to Area 4, Area 5 is six acres adjacent to and north of the existing 2 MG irrigation lake and east of a paved roadway at an elevation ranging from 400 to 440 feet. This area is the proposed location of a third 2 MG irrigation lake. Area 6 is a corridor for an 8-inch waterline that conforms to an existing service road leading from Areas 4 and 5 in a southerly direction to the Conservation/Agriculture District boundary. Area 7 is four acres for a proposed percolation pit adjacent to and south of Queen Ka'ahumanu Highway.

BACKGROUND

The lands of Ka'ūpūlehu, 22,545 acres, comprised a traditional seashore to mountain top *ahupua'a* up until the Mahele (the great land division) of 1848. The *ahupua'a* was part of the dry, arid Kona coast known as "*Kekaha wai 'ole o nā Kona,*" often shortened to Kekaha or Kaha.

The inhabitants of the coastal communities of Ka'ūpūlehu were related to people living *mauka* in the *ahupua'a* as well as to people in the neighboring *ahupua'a* to the north and south. The *kama'āina* of Kekaha were related in trade as well as blood. Trade was carried out *mauka-makai* within the *ahupua'a* and with relatives or trade partners in nearby *ahupua'a*. This trade network relied heavily on the inland and coastal trails, and on offshore canoe travel, all of which provided physical connections between settlement areas. The significance of these relationships and connections is patently demonstrated when reviewing the legendary, documentary, and oral-historical source materials of the region.

Legendary History

Ka'ūpūlehu and the nearby lands have a rich history of legendary events, many of which have been memorialized on the cultural landscape through the act of naming important places. In historic times *ali'i nui* were known to have lived at Ka'ūpūlehu, the historic ownership being traced in the Kamehameha family up to the current owners, Kamehameha Schools-Bishop Estate.

The legendary events of Ka'ūpūlehu date back to ancient times when the Hawaiian gods from whom the *ali'i nui* descended, walked the lands of Kekaha. Eliza D. Maguire, wife of John Maguire founder of Hu'ehu'e Ranch, first heard the stories of Ka'ūpūlehu from old *kama'āina* during the early 1900s. In 1923, Isaac Kihe, who had once been a school teacher at various schools the Kekaha region began writing these same tales and legends for "*Ka Hoku O Hawai'i,*" a Hawaiian language newspaper published in Hilo.

Having been told these stories and having the sites pointed out to her by elder *kama'āina*, Eliza Maguire translated portions of the Isaac Kihe stories into English for the future knowledge of the young people who may want to know the history of their own lands. Eliza Maguire was Hawaiian on her mother's side.

The legend of 'Akahipu'u accounts for the names given to three places of upper Ka'ūpūlehu: 'Akahipu'u (first hill of Hualālai), Pu'u Moanuiahea (the large chicken that calls; rooster), and Pāhulu,

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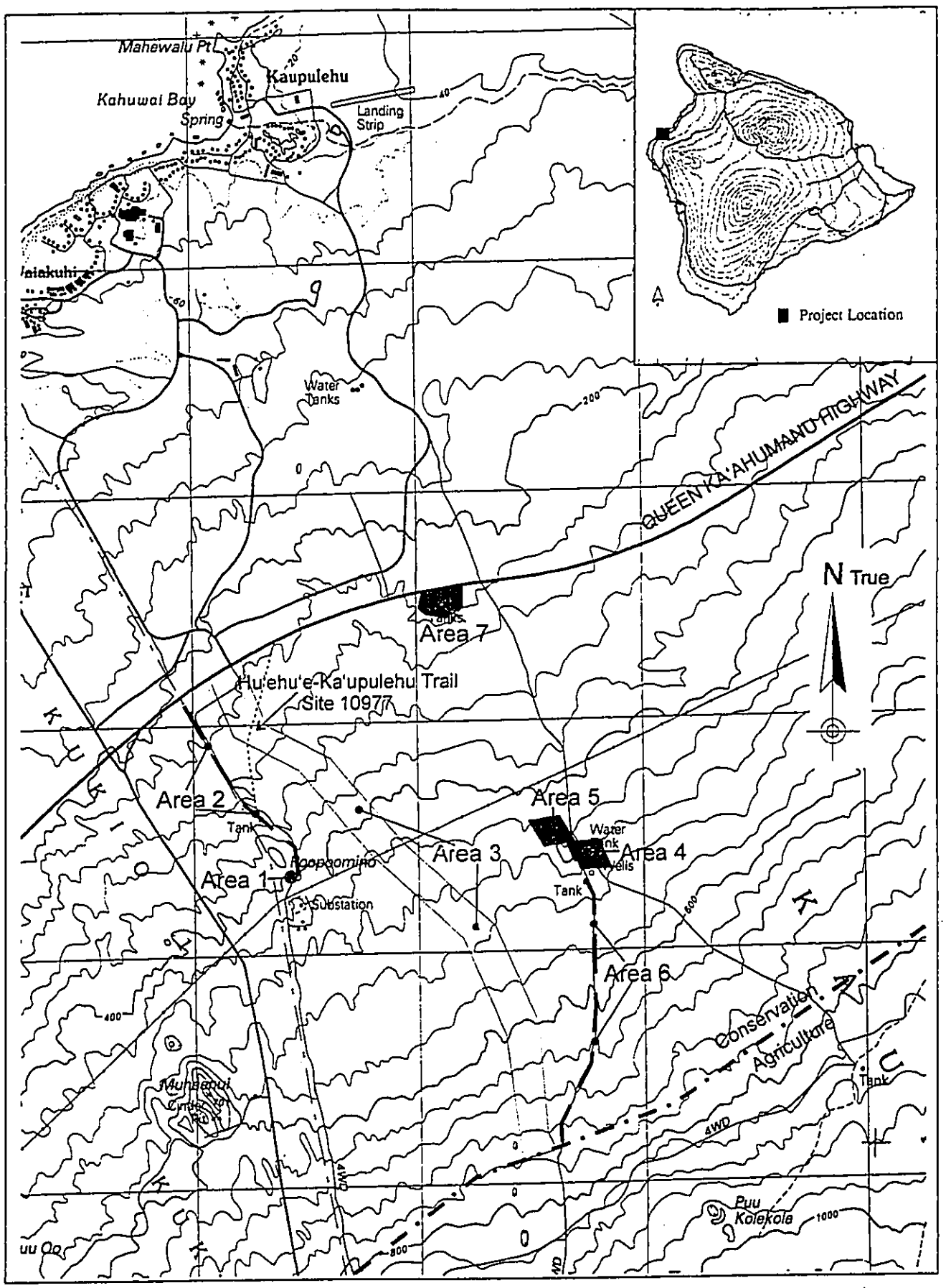

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(chief of the *menehune*). The story recounts the *menehune* who want to pry off the top of 'Akahipu'u and put it on the top of Kuili, a *pu'u* on the coast just south of Ka'ūpūlehu. Moanuiahea, the rooster, crows early each morning to stop the work, so the chief of the *menehune*, Pāhulu, is forced to forever abandon the work before it is completed.

The famous story of the two sisters, Pāhinahina and Kolomu'o, one of whom (Kolomu'o) denied Pele roasted breadfruit (*'ulu pūlehu*), when she appeared before them as a hungry old woman, is memorialized on the cultural landscape by the naming of the places (Pāhinahina, Kolomu'o, and Puhi a Pele) near the location where the story took place. Pele covered the house of Kolomu'o with lava and its said you can still see the legendary house site of Pāhinahina. There is a site on the coast of Ka'ūpūlehu also called Kolomu'o as well as an offshore fishing ground. It is said this lava flow erupted from Kawahaopele or Waha Pele (Pele's mouth). From this legend comes one of the versions of the naming of Ka'ūpūlehu, the roasting breadfruit Ka'ulupūlehu later shortened to Ka'ūpūlehu.

An alternative interpretation of the naming of Ka'ūpūlehu stems from the story of the waters of Kāne, a fresh water spring on the beach at Ka'ūpūlehu. The Hawaiian god, Kāne appeared before the residents of the region in a time of an extended draught and famine. Kāne had a large *imu* built, and went into the *imu* himself. When the *imu* was opened, all manner of food was inside to feed the people. Kāne then appeared just offshore, as a bubbling spring of fresh water. It is said that this legend provides an explanation for the naming of the coastal village and the *ahupua'a*, Ka'ūpūlehu shortened from "*Ka imu pūlehu ke akua*"; and the fresh water spring in the ocean, *Ka wai a Kāne*.

The legend of a young boy finding a secret water cave (rare for the Kekaha region), which helped his family farm prosper, and later winning a chief's beautiful daughter, gives name to the site Mākālei, above 'Akahipu'u and behind the Hu'ehu'e Ranch.

The legendary love triangle between the young man Uluweuweu who was to marry Manini'ōwali, and his other lover Kahawaliwali, the daughter of *ali'i nui* Po'opo'omino and Kaelewa'a, provides us with the names of Kua Bay, Manin'ōwali, Uluweuweu Bay, and Pu'u Po'opo'omino; the latter being a hill within the boundary of the current study area. The account of this story was given by Kihe from a series of articles printed in *Ka Hōkū o Hawai'i*; November 1923. The following is an English language version of the original story as translated by Maly (2000). Kihe begins the account with the following description:

> There is a stone on the beach dunes between Awake'e and Kūki'o 2. This is a stone in the form of a woman, she has a head, a nose, a mouth, breasts, and a large body laying in the sand to this day. It can be covered entirely with sand, and then when the high surfs come, the sand is dug away and the stone body is exposed. This stone is known by the name Manini'ōwali.

Maly summarizes the main part of the tradition:

> In ancient times, there were families living on these lands, and to them children were born. One family had a son, and he was given the name Uluweuweu. He was a good child, and he lived at Kūki'o with his parents and family. And so it was, there was another family, and to them, a daughter was born. She was very beautiful, and her name was Manini'ōwali. When these to children were young, the parents entered into a betrothal agreement (*ho'opalau*), so that when they grew up, they would marry (*ho'āo*).
>
> When the children grew up, preparations were made for their wedding feast. Just as all things were made ready, Uluweuweu, became ill. Manini'ōwali learned of this and the ceremony was postponed till a later time. Hearing that the marriage had been postponed, he became well, and went back to his favorite pastimes, leaping into the ocean (*lele kawa*) and surfing (*he'enalu*). Seeing that he was well, the families of Kūki'o made arrangements once again for the marriage, and once again, Uluweuweu became mysteriously ill. Because of this unusual illness, the family called a priest.

His name was Kikaua. When Kikaua arrived at the house, Uluweuweu was sitting up speaking with the people that had gathered there. Kikaua then asked, "Why have you come and gotten me?" She explained that her son had been ill, and they needed his help to discern the nature of the illness.

Kikaua told the parents that this was no real illness, but a result of the boy's love for another. He has been out in the night with a cherished garland (*ipo lei manu*), and has been ensnared in the nets of the bird catchers that are set in the mists... When Kikaua finished speaking, all those who had gathered together, began speaking among themselves, wondering who the woman could be. Well my companions in this pleasant passing of time, this royal *ʻōhai* blossom that adorns the breast *(pua lani uma a ʻōhai)* was the cherished daughter of Poʻopoʻomino (w) and Kaʻeleawaʻa (k), the *aliʻi ʻai ahupuaʻa* (chiefs who controlled the wealth of the land) of Kūkiʻo. She was a beautiful chiefess, and unknown to anyone, she had been meeting with Uluweuweu. At the time that this became known, some of the members of Manini'ōwali's family were present. There were relatives of Moana, Manini'ōwali's father, and relatives of Kauiha, her mother, at this gathering. Some of them went to Manini'ōwali and told her that Uluweuweu's sickness had not been a real one, and that the *kahuna* had told them of his relationship with Kahawaliwali.

Hearing of what had happened, Manini'ōwali's mother cancelled the wedding arrangements. Hearing all of this, Manini'ōwali quickly became ill and almost died. Kikaua was called again, and he discerned that it was no real illness, but one of love...Following consultation with the parents of Manini'ōwali, it was decided that Kikaua should pray the youths to death. Praying to his gods Kamohoali'i and Pele, the girls and the boy were turned to stone.

Uluweuweu was turned into a stone that stands in the water to this day. The amazing thing about this stone is that where it stands, it is securely imbedded, but it can rock back and forth when struck. Though it moves, the stone cannot be taken from its place. Kahawaliwali was turned into a long stone about thirty feet long and of like height. The stone extends out into the sea in two sections, which are said to be the thighs of Kahawaliwali, and into which the water rushes. This stone can be seen to this day as well. Because Manini'ōwali understood what was happening, she ran to the beach and laid on the sand. It was there that she was turned to a stone, which can still be seen today. When the tide comes in, she is covered with sand, and when it goes out, the sand is washed away.

One of the most unusual things about the ocean of this place is the movement of the *manini* (common reef surgeonfish) that are seen swimming across the bay. The *manini* twist and move as if on a rope, and roll about like big fish in the ocean. From afar, these *manini*, moving together can be mistaken for a shark. But when one moves closer, it is seen that they are *manini*, twisting and rolling very close together. The nights of Kū and the mornings of Lono and Mauli are good times to see this mysterious practice of the *manini*. It is said that these fish, the *manini aliʻi kākalaolua*, are the *manini* fish form of the girl Manini'ōwali, and that is why she was given her name. It is also the reason that the *manini* fish are seen twisting and turning in the waters there.

These accounts provide a glimpse into the richness of traditions that were passed from one generation to the next concerning the legendary history of Kaʻūpūlehu. It is with a knowledge and understanding of these traditions that Hawaiians were (and are) able to experience the physical world in a spiritual manner.

Documentary History

Researchers today believe that leeward bays along the Kekaha coastline, were originally settled between AD 1000-1300, and by AD 1300 selected upland areas were being cultivated. In the AD 1500-1700s a separation between *ali'i* and common people (*maka'āinana*) occurred, and land use was formalized. *Ali'i 'ai ahupua'a* controlled a particular *ahupua'a* and had a *konohiki* as a land manager. A series of coastal trails connected villages around the island for social and economic purposes. Each *ahupua'a* also had *mauka-makai* trails for internal exchange and visiting. The trail system connected people with each other and with various resources, and documents the relationship among the people and their land.

According to Kamakau (1961), for a time during the 1700s Hawai'i Island was controlled by Alapa'i nui. When he died in 1754, his son Keawe'ōpala became his successor. But Keawe'ōpala was soon killed by the opposing *ali'i nui*, Kalani'ōpu'u. Around 1780 Kalani'ōpu'u gave the land of Ka'ūpūlehu to the Kona chief Kame'eiamoku, and the land of Kīholo to Kamanawa, the twin brother of Kame'eiamoku.

While living at Ka'ūpūlehu in 1790, Kame'eiamoku captured the ship "Fair American," killed the crew except for Isaac Davis and secured firearms and a cannon "*lopaka*" for the armies of Kamehameha I. Isaac Davis became an important friend and military/economic advisor to Kamehameha who eventually conquered the Hawaiian Islands with the aide and military advice of Davis (and John Young). The twin chiefs, Kame'eiamoku and Kamanawa, the "Kona Uncles" of Kamehameha are pictured in the official seal of the State of Hawai'i.

When Kamehameha became paramount of all the Hawaiian Islands, Kame'eiamoku retained Ka'ūpūlehu until he died around 1803, his son Ulumaheihei Hoapili inherited Ka'ūpūlehu and his fathers' position as advisor to the King. Hoapili died in 1840, leaving Ka'ūpūlehu to his *hānai* (adopted) son, Kamehameha V.

As a result of the Māhele of 1848, Lot Kapuāiwa (Kamehameha V) received the *ahupua'a* of Ka'ūpūlehu as LCAw. 7715:10. Kamehameha V died in 1872, leaving Ka'ūpūlehu to his half-sister princess Ke'elikōlani. Upon Ke'elikōlani's death in 1883, Ka'ūpūlehu passed to her cousin Princess Bernice Pauahi Bishop, who died only a year and half later in 1884. All lands of the princess became part of the B. P. Bishop Estate, originally founded to support educating Hawaiian children. Today, Kamehameha Schools-Bishop Estate maintains ownership of the land of Ka'ūpūlehu.

Bishop Estate granted leases to goat and cattle ranchers in *mauka* Ka'ūpūlehu starting as early as 1873 with John Broad, and later in 1884 with Henry Greenwell. In 1885, Bishop Estate granted leases to eleven Hawaiian families living on the coast at Ka'ūpūlehu. John Maguire leased lands from Bishop Estate in *mauka* Ka'ūpūlehu for his Hu'ehu'e Ranch. Ranching in *mauka* Ka'ūpūlehu has continued to this day, with Hawaiian families working and living at the ranches. A few Hawaiian families remained living at coastal Ka'ūpūlehu into the early 1900s. But many Hawaiians have continued to use the coastal and *mauka-makai* trails to get to traditional fishing, shellfish, and salt harvesting resources. The salt works at Ka'ūpūlehu were actively maintained into the 1930s and certain *kama'āina* regularly collected salt into the 1970s and 1980s.

Summary of Previous Oral-Historical Research

From the extensive oral histories collected by Kepā Maly in the late 1990s with fifteen *kama'āina kanaka mauoli* to the Kekaha region, we learn of the local Hawaiian families' love for and connections to the lands, beaches, lava flows, oceans, and fishing grounds of Ka'ūpūlehu. We hear Hawaiians talk about using *mauka-makai* trails (including the one that passes through the current study area) to gather special dirt from Pu'u Mau'u and Pu'u Nāhāhā for *'ōpelu* fishing, the primary fishing activity on the Ka'ūpūlehu coast. It is also interesting to learn that during the many times of continued draught, *kama'āina* living in upland Ka'ūpūlehu would move to the shore (again using the *mauka-makai* trails) to access the brackish water sources available at the coastal springs. As Kihe (*Ka Hōkū o Hawai'i*, April 5, 1917) described:

> *'Oia ka wā e 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 ona, pūhe'e oho I kahakai kā wai e ola ai nā kānaka.* It was during the dry season, when the sun moved over Kona, drying and devouring the land, that the chiefs and people fled from the uplands to dwell along the shore where water could be found to give life to the people (Maly 1998:9)

Mauka-makai movement was also a seasonal event for residents of the Kekaha region; Kihe (*Ka Hōkū o Hawai'i*, February 21, 1928) presents us with a famous saying of the land that touches deep upon the human-environment relationship. This saying describes the seasonal residence pattern of upland habitation under the shelter of the *lehua* trees during the winter planting season, and then travel to the shore during the warm weather fishing season, where the fishing canoes could be seen floating on the sea like *lehua* blossoms:

> *Ola aku la ka 'āina kaha, ua pua ka lehua i ke kai.* The natives of the Kaha lands have life, the *lehua* blossoms are upon the sea! (Maly 1998:9).

An interviewee tells of when he was a small boy he would buy fish from fishermen in Kekaha and sell it to the store in Kawaihae on Fridays. Or, he would trade fish for *pa'i'ai* (hard poi), which he would sell back to the Kekaha fishermen upon his return to the Kona coast; all the time using the coastal trail (*ala loa*).

Other interviewees tell how women had the job of salting fish, often times cutting the fish open with their thumb nails rather that using a knife. Salt harvesting was done when the ocean was too rough for fishing. Salt was a valuable resource for preserving *'ōpelu* and other fish.

In the interviews of *kama'āina* we learn the endangered or nearly extinct native *loulu* (*Pritchardia sp.*) once grew at Kahuwai Bay. Women would weave fine, white hats from young *loulu* leaves. Some houses were thatched with dry *loulu* leaves in the old days and people ate the *loulu* nuts, called *hāwane*. Remarkably we are also informed that in more recent times *kama'āina* in Ka'ūpūlehu have pruned and even watered *kiawe* (*Prosopis pallida*) to ensure a valuable "shade" resource against the intense Kekaha sun.

People know of family burials in the coastal area. Sadly we hear from *kama'āina* of the destruction caused by the 1946 and 1960 tsunami. One *kama'āina tūtu wahine* was known to put rocks back in place when they had fallen from walls of old houses and features.

While it is true that the Hawaiian people (including those of Ka'ūpūlehu) suffered great losses following Western contact, and were overwhelmed by various foreign cultures, it must be stressed that native Hawaiian culture and the concept of *'ohana* (family) never went away, nor died out. Hawaiian culture has continued, and like all cultures, has changed with the times. Many *kama'āina* families of Ka'ūpūlehu endured on their homelands, continued to use fishing and salt gathering sites, and express the greatest *aloha* for their *'āina* and remaining sites of *ka po'e kahiko* (the ancient people), and *nā akua* (the gods).

NEW ORAL-HISTORICAL INTERVIEWS

As part of the current study, two new interviews were conducted. On November 1, 2000, the present authors interviewed Thomas (Kamaki) Lindsey Jr. at his home in Kaulana *mauka*; and on November 16, 2000, Hannah Kihalani Springer was interviewed at her family home, Kukui'ohiwai, on the western slope of Pu'u 'Alalauwā overlooking the Kekaha region. The interview questions were topically specific, primarily relating to the interviewees' experiences with and knowledge of traditional or otherwise significant places and traditional practices within the current study area.

Thomas (Kamaki) Lindsey Jr.

Born at Pu'u Wa'awa'a in 1932, the oldest of 5 brothers Kamaki spent his entire working life (from age 12) as a cowboy for Pu'uwa'awa'a Ranch, Parker Ranch, and Hu'ehu'e Ranch. His father, Kamaki Lindsey Sr. supervised Pu'uwa'awa'a Ranch operations for the Hinds. After Kamaki Sr. went to work at Hu'ehu'e Ranch, his son joined him in 1955. It was during his tenure at Hu'ehu'e Ranch that Kamaki Jr. gained extensive personal knowledge of the Ka'ūpūlehu area. He regularly traveled the *mauka/makai* trails, whether driving cattle to Kīholo, hunting goats and donkeys in *kula* sections of Ka'ūpūlehu, or going *holoholo* along the shore at Kūki'o and Ka'ūpūlehu. Kamaki's knowledge of the area was also garnered from the experiences and history shared by his late wife, Keala Haleamau-Lindsey. While growing up she spent much of her time with an elder aunt, Annie Punihaole Una Keala'ula, who was *kama'āina* to the Kekaha region.

Kamaki had no specific traditional knowledge about Pu'u Po'opo'omino, but a general awareness of the importance of the place. He did know the names Po'opo'omino and Ka'eleawa'a, but was not sure exactly who they were. When asked directly about his experiences at Pu'u Po'opo'omino, Kamaki discussed traveling on the Kūki'o Trail past the *pu'u* and the strange feelings he would get:

> *Kamaki Lindsey*: Somehow I get feelings over there when I pass through there too eh, even my horse get feelings, feels like somebody is around you; mean over there, Po'opo'o down there.

Historically, both the Kūki'o Trail and the Ka'ūpūlehu Trail were used primarily for recreational purposes, providing access to and from the coast. These were not working trails like the Kīholo-Hu'ehu'e Trail. Speaking of the main *mauka-makai* trails, Kamaki had this to say:

> *Robert Rechtman*: When you come down from the ranch would you come down on this trail (pointing to the *mauka* section of the Kūki'o Trail on a map)?
> *Kamaki Lindsey*: This same trail, we would go all the way down.
> *Robert Rechtman*: The Ka'ūpūlehu branch of the trail, what was it used for mostly?
> *Kamaki Lindsey*: For Hawaiians go fishing.
> *Robert Rechtman*: And in ranch days, what-.
> *Kamaki Lindsey*: Ranch days just our cowboys was using them, we take trail rides, tourists, all that.
> *Robert Rechtman*: So, just a way down to the beach?
> *Kamaki Lindsey*: Yeah, Yeah down to the beach, down to the (inaudible) to show them all those things.
> *Richard Rudolph*: Did you herd cows down?
> *Kamaki Lindsey*: Our days the cows went to Kiholo from Hu'ehu'e, Hu'ehu'e and Pu'uwa'awa'a go together.
> *Robert Rechtman*: And you run them down Kīholo and ship them out.
> *Kamaki Lindsey*: To Kawaihae, this is where the boats wait.

During an earlier interview recorded by Kepā Maly, Kamaki's sentiments about resource stewardship were summed up as follows: he believes that we should "share the history of the land with those who visit, or make it their home, so that they can help take care of it" (2000:A-127).

Hannah Kihalani Springer

A native resident of Ka'ūpūlehu *mauka*, Hannah Kihalani Springer was born in 1952. Her great grandfather was John Avery Maguire, founder of Hu'ehu'e Ranch; and her great grandmother was Maguire's first wife, Luka Hopulā'au. Luka Hopulā'au was a native of Kūki'o and Kaulana, with a genealogical tie to Kame'eiamoku, and thus was also connected to the land of Ka'ūpūlehu. Hannah considers herself "*'he kama o ka 'āina*," a child of the land, and has a corresponding love for the land that any child does of a parent. She attributes her emotional attachment to the land to her mother, granddaughter of Luka Hopulā'au.

From an earlier interview with Hannah, the following was summarized:

> She recalls that from an early age, looking from the heights of Kukui'ohiwai, down the lava plains to the shore and out to sea, she was filled with awe and respect for the land and who she is, as a result of her heritage. Hannah shares that the history and native accounts of the land embody the power of the creative forces of nature, and the place of these natural forces in the lives of the people of the land. (Maly 1998:257)

When speaking specifically of lava flows and landscapes, Maly summarized Hannah's sentiments thusly,

> In discussing the Ka'ūpūlehu lava flows that demarcate the region of Kalaemanō, Hannah shares that—All of the landscapes of the *pae 'āina Hawai'i nei* (the Hawaiian Archipelago) are cultural landscapes. The absence of our ancestor's signature upon the landscape speaks as clearly as the presence of their signature upon the land—thus likening the flows to a place of the gods. There may be different expressions of culture and greater or lesser values in those all encompassing landscapes, but that is an important thing to recognize. Not only landscapes, but seascapes as well; that the world view is all encompassing.
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> The *'a'ā* flow defines the area of Kalaemanō. *It remains profound to us. To get to* Kalaemanō, you walk through the *'a'ā* flow. To get to this resource [salt] that you are going to harvest, you pass through a zone of distinct transition, that doesn't have the signature of our ancestors upon it, except for that very narrow trail that winds its way through the lava. Even the bare lava flow is imbued with characteristics that are deserving of recognition. (1998:257-8)

During the current interview Hannah added the following relative to the lava flows within the current project area and the general landscape:

> *Hannah Springer*: . . . Now the lava which surrounds Po'opo'omino may be inter-fingerings of lava from Nāhāhā or 'Alalauwā, which is just behind of our home here at Kukui'ohiwai and I don't know stories associated with those lavas like we know stories associated with the Ka'ūpūlehu flow and the Puhiapele flow which in some interpretations may represent, in the case of Ka'ūpūlehu, Pele moving in that *kulipe'e* fashion, more slow and cumbersome movement like that of an old women, as compared to the Puhiapele flow which in its fluidity, may have been like a young women moving with graceful, hula motions across the landscape. I don't know those traditions of the lava surrounding Po'opo'omino but we can source them to particular geological events and they then have interpretive value for, by virtue of those unique sources of origin, and again that these were named places on the landscape and may themselves be *wahi pana*, or remarkable places.
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> . . . biological communities of resources . . . as well as geophysical features on the landscape all have value to me as a child of the land, in a sense that I guess they're my siblings, but they're clearly cultural resources as well whether we think of in that perhaps ill-defined time of traditional Hawaiian occupation where we know that the *'a'ali'i*, the *lama*, would have been useful for their material culture whether as sources of fuel or as building materials. So any work that may be done in the study area that might be reconstructive or mitigating the impacts of development. I would hope that they would, the developers, would look to the native plant palette and utilize those resources in whatever landscaping or other landscaping work that they have to do in that area. One of the things that we're becoming more comfortable with voicing desire of, is that the landscape that we grew up in, as mighty as the changes upon it might be, still retain some familiarity for us and some of that familiarity is best demonstrated by the view planes that we have across the landscape. So we look forward to development that doesn't obstruct the view either to or from a site like Po'opo'omino. But we understand certainly that there may be development that will obstruct the view to or from it from one angle, but we would always hope that there is a place that we can catch a glimpse of these components of the landscape, these landmarks of the landscape, that are so meaningful to us.

In discussing Pu'u Po'opo'omino itself, Hannah describes both some personal history and cultural activity:

Hannah Springer: My first trip to Kūki'o was in 1958 when we came in by boat and for the next several years that was our primary access to Kūki'o, which is of course adjacent to Ka'ūpūlehu. In the mid-sixties we began hiking into Kūki'o either from the then newly opened Kona Village Resort or from Kuili, the double humped cinder hill located in Awake'e. During those times mother would tell us of her family riding from Hu'ehu'e in the uplands to Kūki'o and she described very well their use of the *mauka/makai* trail from Kūki'o to Hu'ehu'e and traversing the various cinder hills. When I was in the ninth grade, or there about, a jeep road was built into Kūki'o and we began making overland access from the uplands to Kūki'o. I began hiking that area immediately. You know when you're a teenager and you're already out in the middle of, well, nowhere, and you still need to be alone, Po'opo'omino was the place I would often retreat to while the rest of the family were camping at Kūki'o proper. And to access Po'opo'omino I would use the trail from Kūki'o up to that site. In the 1980's we began hiking from Kikaua Point to Kūki'o to our home here at Kukui'ohiwai using to the extent that we were able to find it, and how well we were able to find the *mauka/makai* trail literally varied from day to day depending upon the angle of the sun, or just how patient we were with hacking our way through the fountain grass, but typically we would begin at Kikaua, enjoy a rest at Po'opo'omino, or there's a nice lava tube just above there that we'd get out of the sun in, and then continue on across Pu'uokai and on up to Nāhāhā, and above Nāhāhā we have not been able to find the trail, we've lost it in the fountain grass, and then use the old ranch and Kona Village roads to get back up here to Kukui'ohiwai. And we would have made this hike on a fairly regular basis.

Most recently, just earlier this year, we walked our children for the first time from here Kukui'ohiwai to Kakapa which is located in Kukio 2nd, and we used the ranch and development roads in the interior of the *ahupua'a* but once we got to Po'opo'omino we were able to take a break and recount Po'opo'omino as it relates to the *ali'i* mentioned in this story of Manini'ōwali and Kūki'o, and then continue on to Kakapa, the shoreline there. One of the things, as my mother did for me, we try to do for our children, is to visit the *wahi pana* to visit the storied or remarkable places in our homeland and recount the stories that have come to us through the elders. And so our family has a tremendous debt of gratitude tc Issac Kihe for his recordations in the *Hoku O Hawai'i*, to Steven Desha for publishing the paper and to my great-great-grandfather's second wife, Elisa Davis Low McGuire, for her translation and collection which is know as *Kona Legends*. So often times when we go out and about with the children on the land we take *Kona Legends* with us and read the excerpts as appropriate to the places that we are visiting. One of the things that we try to do as we're coming into this time of *mahakiki* now is to use this time, although we don't necessarily practice the old religion, we do try to use the *makahiki* time as a period when we are more attentive to those *mo'ōlelo* and to those places and so, also its better traveling weather because it's cooler now, so we try to get out onto the landscape and as I was describing tell those stories, use those trails, offer the reminiscences of my mother in particular. My mother's family, my mother is descended from Ha'ilau and Kinolau who are recorded as being amongst the early, as being amongst the residents of the Kaha lands at the turn of the 18th into the 19th century and through them comes the ancestor Luka Hopulā'au who was married to John Avery McGuire who started Hu'ehu'e Ranch, and through them comes my mother and then of course us. So, our perspective on the landscape was as both a landowner, and as I was describing earlier *kama'āina*.

When specifically discussing the view plane associated with Pu'u Po'opo'omino the dialogue went as follows:

Hannah Springer: Po'opo'omino is of course one of the landmarks on the Kūki'o/Ka'ūpūlehu boundary, and that boundary line takes on sort of the classical *ahupua'a*, as we stand at the edge of the sea where the *'a'ā* drops down to the white sand at the Kūki'o/Ka'ūpūlehu boundary, and then we looked at Po'opo'omino, we look upslope to Po'opo'omino where the boundary then

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

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In discussing Pu'u Po'opo'omino itself, Hannah describes both some personal history and cultural activity:

Hannah Springer: My first trip to Kūki'o was in 1958 when we came in by boat and for the next several years that was our primary access to Kūki'o, which is of course adjacent to Ka'ūpūlehu. In the mid-sixties we began hiking into Kūki'o either from the then newly opened Kona Village Resort or from Kuili, the double humped cinder hill located in Awake'e. During those times mother would tell us of her family riding from Hu'ehu'e in the uplands to Kūki'o and she described very well their use of the *mauka/makai* trail from Kūki'o to Hu'ehu'e and traversing the various cinder hills. When I was in the ninth grade, or there about, a jeep road was built into Kūki'o and we began making overland access from the uplands to Kūki'o. I began hiking that area immediately. You know when you're a teenager and you're already out in the middle of, well, nowhere, and you still need to be alone, Po'opo'omino was the place I would often retreat to while the rest of the family were camping at Kūki'o proper. And to access Po'opo'omino I would use the trail from Kūki'o up to that site. In the 1980's we began hiking from Kikaua Point to Kūki'o to our home here at Kukui'ohiwai using to the extent that we were able to find it, and how well we were able to find the *mauka/makai* trail literally varied from day to day depending upon the angle of the sun, or just how patient we were with hacking our way through the fountain grass, but typically we would begin at Kikaua, enjoy a rest at Po'opo'omino, or there's a nice lava tube just above there that we'd get out of the sun in, and then continue on across Pu'uokai and on up to Nāhāhā, and above Nāhāhā we have not been able to find the trail, we've lost it in the fountain grass, and then use the old ranch and Kona Village roads to get back up here to Kukui'ohiwai. And we would have made this hike on a fairly regular basis.

Most recently, just earlier this year, we walked our children for the first time from here Kukui'ohiwai to Kakapa which is located in Kukio 2nd, and we used the ranch and development roads in the interior of the *ahupua'a* but once we got to Po'opo'omino we were able to take a break and recount Po'opo'omino as it relates to the *ali'i* mentioned in this story of Manini'ōwali and Kūki'o, and then continue on to Kakapa, the shoreline there. One of the things, as my mother did for me, we try to do for our children, is to visit the *wahi pana* to visit the storied or remarkable places in our homeland and recount the stories that have come to us through the elders. And so our family has a tremendous debt of gratitude to Issac Kihe for his recordations in the *Hoku O Hawai'i*, to Steven Desha for publishing the paper and to my great-great-grandfather's second wife, Elisa Davis Low McGuire, for her translation and collection which is know as *Kona Legends*. So often times when we go out and about with the children on the land we take *Kona Legends* with us and read the excerpts as appropriate to the places that we are visiting. One of the things that we try to do as we're coming into this time of *mahakiki* now is to use this time, although we don't necessarily practice the old religion, we do try to use the *makahiki* time as a period when we are more attentive to those *mo'ōlelo* and to those places and so, also its better traveling weather because it's cooler now, so we try to get out onto the landscape and as I was describing tell those stories, use those trails, offer the reminiscences of my mother in particular. My mother's family, my mother is descended from Ha'ilau and Kinolau who are recorded as being amongst the early, as being amongst the residents of the Kaha lands at the turn of the 18th into the 19th century and through them comes the ancestor Luka Hopulā'au who was married to John Avery McGuire who started Hu'ehu'e Ranch, and through them comes my mother and then of course us. So, our perspective on the landscape was as both a landowner, and as I was describing earlier *kama'āina*.

When specifically discussing the view plane associated with Pu'u Po'opo'omino the dialogue went as follows:

Hannah Springer: Po'opo'omino is of course one of the landmarks on the Kūki'o/Ka'ūpūlehu boundary, and that boundary line takes on sort of the classical *ahupua'a*, as we stand at the edge of the sea where the *'a'ā* drops down to the white sand at the Kūki'o/Ka'ūpūlehu boundary, and then we looked at Po'opo'omino, we look upslope to Po'opo'omino where the boundary then

takes a dogleg up to Puhiapele, and there's another jog as it goes up to Moanuiahea and we can follow the course of the boundary line looking from hill to hill to hill. So that is something familiar to us in this landscape.

Robert Rechtman: So if I understand that correctly one of the more significant view planes associated with Po'opo'omino would have been from standing on the shore, looking back *mauka* at Po'opo'omino and seeing it in that direction.

Hannah Springer: Certainly. And similarly from Po'opo'omino looking on from there up to Puhiapele, and looking down to that whole expanse of Kūki'o, of Ka'ūpūlehu. And only a couple times have I, literally a couple of times, two times, hiked from Po'opo'omino into Ka'ūpūlehu on the trail that's mostly drawn out on this map [pointing to the Hu'ehu'e-Ka'ūpūlehu Trail] and that's just because of use and purpose; we walked those two times purely for, to explore and to say that we had walked that section of trail. We did not have a lot of activity that drew us into Ka'ūpūlehu, again as I described our family's closest association was with Kūki'o, but that I only wonder looking from Po'opo'omino down to shore and knowing what an easy walk it is, I wonder if that might have been a look-out place. Certainly in recent years we've use Kuili as a vantage point from which to observe and record the activities of whales in the waters off of the Kaha lands. Po'opo'omino certainly offers a fine vantage point to the shoreline and off of shoreline activities as well.

In summarizing her personal thoughts and attitude about the development of the Kaha lands, which she so clearly feels a kinship with, Hannah's explains that although:

> . . . the fit might not always be what we, we who are not necessarily, we who are *kama'āina*, would aspire to. But, what one of my aspirations is that there be as complete and accurate record of the landscape and of the people that the landscape supported. And the information-gathering phase of land use planning offers that opportunity for us to have another vehicle to record the lives and times of our people on this landscape

And from the earlier Maly interview, we can add Hannah's recommendation that we should "provide the people who will work on the development of the land, and those who will work and/or live within the completed project and community with orientation to the significance of the cultural landscape and history of the area" (1998:259).

IDENTIFICATION OF TRADITIONAL CULTURAL PROPERTIES

In the Hawai'i Revised Statutes–Chapter 6E, and in the draft Hawai'i Administrative Rules (draft HAR 13§13-275-2) that would govern the State Historic Preservation Division, a definition of Traditional Cultural Property is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of Traditional Cultural Property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable

place. Traditional Cultural Properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of Traditional Cultural Properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often times cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining Traditional Cultural Properties and assessing their validity. As the OEQC guidelines do not contain criteria for assessing the significance for Traditional Cultural Properties, this study will adopt the state criteria for evaluating the significance of Historic Properties. To be significant the potential Traditional Cultural Property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

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

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

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

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

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

Clearly, Traditional Cultural Properties will all be significant under Criteria E, but others may be significant under multiple criteria.

Two specific traditional cultural properties are identified within the project area as a result of the current study, Puʻu Poʻopoʻomino and the Huʻehuʻe–Kaʻūpūlehu Trail (SIHP Site 10977). Additionally, although not defined as a Traditional Cultural Property, as will be discussed below, the lava flows that make up the physical landscape within the study area should be considered important both in terms of their potential relationship with significant Hawaiian cosmological events; and as part of a newly emerging ideology associated with Hawaiian self-identity.

Puʻu Poʻopoʻomino

Puʻu Poʻopoʻomino is a storied landscape feature at the confluence of two culturally and historically significant trails. It also sits prominently at the *ahupuaʻa* boundary between Kaʻūpūlehu and Kūkiʻo. Clearly, the *puʻu* was and is a significant feature to the residents of both Kaʻūpūlehu and Kūkiʻo Ahupuaʻa, as well as to the overall Hawaiian community within Kekaha.

As a Traditional Cultural Property, Puʻu Poʻopoʻomino is evaluated as significant under Criteria A. B, and E: Criterion A for its association with legendary events that were and are orally transmitted from one generation to the next; Criterion B for its association with the legendary *aliʻi* of the same name, who perhaps still watches over her son, Uluweuweu, along the Kūkiʻo shore; and Criterion E for its cultural value.

Hu'ehu'e–Ka'ūpūlehu Trail

As described in this and other studies (Maly 1998; Maly and Rosendahl 1997; Rechtman 1999) Hawaiians originally used the Hu'ehu'e–Ka'ūpūlehu Trail to access traditional gathering places and resource extraction locales; and it functioned as the major *mauka/makai* transportation route with the *ahupua'a*. As such, this trail provided a physical linkage between all of the natural and cosmological elements and features of the *ahupua'a*. During historic times the trail continued to function as an important *mauka/makai* access route for members of the ranching community.

This property is evaluated as significant under Criterion E as it was an important aspect of the *ahupua'a* for undertaking traditionally mundane as well as sacred activities. The trail continued as an important feature during the Ranching Era, and it remains significant to members of the Hawaiian community.

General Lava Flow Landscape

The nature of the overall lava landscape, an unstoried boundless natural feature, within the current project area precludes it from being defined as a Traditional Cultural Property, and thus is not evaluated as such. However, it should be considered a significant cultural resource nonetheless. It is evident from the interview with Hannah Kihalani Springer that she considers herself a *kama* of the land, and by homology considers the landscape features to be siblings over whom she feels a great sense of sisterly stewardship.

Hannah's personal feelings and interpretations relative to the significance of the volcanic landscape, and her anthropomorphizing nature features, is not necessarily neo-traditional. Rather, cosmologic as well as documented antecedents can be found in the historical record. This is best illustrated when recounting stories about the two most significant events in the native history of the region: the volcanic eruptions and lava flows of 1800 and 1801. These flows covered vast sections of Ka'ūpūlehu and adjoining *ahupua'a* (to the east and north of the current study area) and had a significant impact on the residents of the Kekaha region. These events must also have seemed particularly ominous and troublesome to Kamehameha I as they represented a direct assault on his personal holdings by the Goddess Pele at a time when he was undertaking a great challenge in uniting the Hawaiian Islands. After the battle called Kaipalaoa, the following happened:

> Another important event which occurred in the fourth year of Kamehameha's rule, was the lava flow which started at Hu'ehu'e in North Kona and flowed to Mahai'ula, Ka'ūpūlehu, and Kiholo. The people believed that this earth-consuming flame came because of Pele's desire for *awa* fish from the fishponds of Kiholo and Ka'ūpūlehu and *aku* fish from Ka'elehuluhulu; or because of her jealousy of Kamehameha's assuming wealth and honor for himself and giving her only those things which were worthless; or because of his refusing her the tabu breadfruit of Kameha'ikana which grew in the uplands of Hu'ehu'e where the flow started . . . Kameharneha was in distress over the destruction of his land and the threatened wiping-out of his fishponds. None of the *kahuna*, orators, or diviners were able to check the fire with all their skill. Everything they did was in vain. Kamehameha finally sent for Pele's seer (*kaula*), named Kamakaokeakua, and asked what he must do to appease her anger. "You must offer the proper sacrifices." said the seer. "Take and offer them," replied the chief. "Not so! Troubles and afflictions which befall the nation require that the ruling chief himself offer the propitiatory sacrifice, not a seer or a *kahuna*." "But I am afraid lest Pele kill me." "You will not be killed," the seer promised. Kamehameha made ready the sacrifice and set sail for Kekaha at Mahai'ula.
>
> When Ka'ahumanu and Kaheiheimalie heard that the chief was going to appease Pele they resolved to accompany him and if necessary die with him. Ululani also went with them because some of the seers had said, "That consuming fire is a person; it is the child of Ululani, Keaweokahikona, who has caused the flow," and she was sent for to accompany them to Kekaha. Other chiefs also took the trip to see the flow extinguished. From Keahole Point the lava was to be seen flowing down like a river in a strewn of fire extending from the northern edge of Hualālai westward straight toward Ka'elehuluhulu and the sweet-tasting *aku* fish of Hale'ohi'u. There was

> one stream whose flames shot up the highest and which was the most brilliant in the bubbling mass as it ran from place to place. "Who is that brightest flame?" Asked Ululani of the seer. "That is your son," he answered. Then Ululani recited a love chant composed in honor of her first-born child as his form was seen to stand before her . . . The flow had been destroying houses, toppling over coconut trees, filling fishponds, and causing devastation everywhere. Upon the arrival of Kamehameha and the seer and their offering of sacrifices and gifts, the flow ceased; the goddess had accepted the offering. The reasons given for the flow may be summed up as: first, Pele's wanting the *aku* of Hale'ohi'u and the *'ahi* (Sic, *awa*) fish of Kiholo; second, her anger at being denied the breadfruit of Kameha'ikana in upper Hu'ehu'e; third, her wrath because Kamehameha was devoting himself to Kaheiheimaile and neglecting Ka'ahumanu. It is said that Pele herself was seen in the body of a woman leading a procession composed of a multitude of goddesses in human form dancing the hula and chanting. (Kamakau 1961:184-186)

In about 1812, John Papa I'i, a young boy and companion to the Kamehamehas, traveled by sailing vessel along the Kekaha coast and provided the following description of the then eleven-year-old lava flows. Looking shoreward from the ship the young I'i exclaimed, "How beautiful that flowing water is!" [To which the reply came] "That is not water, but *pāhoehoe*. When the sun strikes it, it glistens, and you mistake it for water" (I'i 1959:109). One cannot help but draw a cognitive link between Hannah's observations and those of I'i, which are separated by nearly 200 years.

IMPACTS TO IDENTIFIED RESOURCES

Pu'u Po'opo'omino

Given that the proposed potable water tank will be situated low on the southeast margin of the *pu'u*, its placement will not affect the view plane to this prominent landscape feature from either the *mauka/makai* Kūki'o Trail (SIHP Site 1193) or the shoreline. It is therefore concluded that the proposed development of the potable water tank will have no significant effect on the Traditional Cultural Property, Pu'u Po'opo'omino.

Hu'ehu'e–Ka'ūpūlehu Trail

The proposed access road to the Hualālai Links Golf Course will cross the Hu'ehu'e–Ka'ūpūlehu Trail, thereby impacting it. Potential new breaches will be limited to one, wide enough to accommodate the construction of a two-way traffic road. The finished roadway width will not be greater than 30 feet. The proposed 16-inch water line that emanates from the proposed 0.5 MG potable water tank at Pu'u Po'opo'omino and runs within the preexisting county and state approved utility corridor alongside the paved roadway to Queen Ka'ahumanu Highway will cross the trail through the existing previously approved breach.

General Lava Flow Landscape

As the overall lava flow landscape is not a precisely delimited cultural property, but rather a conceptual resource, it is difficult to assess the exact nature of any potential impacts. It is clear, however, that development of the area will add a visual impact to the starkness of lava flows, particularly the *'a'ā* flows, in the study area. As these flows hold potential cultural significance, and identified personal significance to at least one *kama'āina* family, it is recommended that recognition of this significance be incorporated into the interpretive effort associated with both the golf course development and the Hu'ehu'e–Ka'ūpūlehu Trail.

PROPOSED MITIGATION OF IMPACTS

Hu'ehu'e–Ka'ūpūlehu Trail (SIHP Site 10977)

The portion of Hu'ehu'e–Ka'ūpūlehu Trail that passes through the current study area, will be subject to the same preservation strategy that was employed for the *makai* portion of the trail that runs through the Hualālai at Historic Ka'ūpūlehu development area (Rechtman 1999). That is, both preservation as is and rehabilitation following localized development improvements. A buffer of 15 feet (measured from the centerline) on either side of the trail will be maintained with an additional structure setback of at least 30 feet. This preservation area will help ensure that view planes to and from the trail are not overly obscured. In the area of the breach, the feeling of the trail will be maintained by placing a pavement of *pāhoehoe* across the roadway corresponding to the trail right-of-way. Traffic safety signs will be placed on the roadside at the trail crossing and will contain the following cautionary language:

CAUTION PEDESTRIAN CROSSING
Hu'ehu'e–Ka'ūpūlehu Trail

In addition, interpretive signs will be placed along the trail at key locations (potential points of ingress) to provide educational information about the resource. The signs will read as follows:

Hu'ehu'e–Ka'ūpūlehu Trail
State Site 10977
Ka'ūpūlehu Ahupua'a

You are walking along the historic Hu'ehu'e-Ka'ūpūlehu Trail. This was the main *ahupua'a* upland/coastal transportation route. Used first before European contact by Hawaiians as a footpath and later during historic times by horse and cart, this trail provided coastal inhabitants access to upland agricultural and forest resources, and upland inhabitants access to the resources of the coast. Please take care not to move or rearrange rocks along this historic site.

This resource is protected under State Law, Chapter 6E-11 Hawai'i Revised Statutes

General Lava Flow Landscape

As consideration for affecting the general landscape of Ka'ūpūlehu, the golf course developers will provide interpretive information to potential end users (golfers and hikers) of the area. An interpretive display will be established in the clubhouse and signs will be placed along the Hu'ehu'e–Ka'ūpūlehu Trail informing visitors about the significance of the lava flows, other cultural sites, and the culturally significant flora and fauna of the region. The golf course developers will work with Hannah Kihalani Springer and other members of the community to develop the language to be used for the interpretive displays, which will be submitted to DLNR-SHPD for concurrence prior to finalization.

REFERENCES CITED

I'i, John Papa
1959 *Fragments of Hawaiian History*. Translated by Mary Kawena Pukui and edited by Dorothy B. Barrère. Bishop Museum Press, Honolulu.

Kamakau, S. M.
1961 *Ruling Chiefs of Hawaii*. Kamehameha Schools/Bishop Estate, Honolulu.

Maly, K.
1998 *Ka'ūpūlehu Ma Ka 'Āina Kaha*: A Report on Archival and Historical Documentary Research and Oral History Interviews, Ahupua'a of Ka'ūpūlehu, District of North Kona, Island of Hawai'i (2 Vols.). Kumu Pono Associates Report Hiku38b(030300). Prepared for Kaupulehu Developments, Honolulu.

2000 *Nā Kūki'o Ma Ka 'Āina Kaha*: A Collection of Traditional and Historical Accounts of Kūki'o at Kekaha, North Kona. Kumu Pono Associates Report Hiku38b(030300). Prepared for Steven S. C. Lim, Hilo.

Maly, K. and P. H. Rosendahl
1997 Identification of Traditional Cultural Properties, Beach Safety Improvements at Hualalai Resort, Land of Ka'ūpūlehu, North Kona District, Island of Hawai'i. Army Corps of Engineers Permit No. 950030004, Section 106 (NHPA 1966) Review. PHRI Report 1733-043097. Prepared for Hualālai Development Company, Kailua-Kona.

Rechtman, R. B.
1999 Historic Sites Preservation and Interpretation Plan, Hualālai at Historic Ka'ūpūlehu. Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. PHRI Report 1675-081299. Prepared for Hualālai Development Company, Kailua-Kona.

2000 Addendum Archaeological Inventory Survey for Selected Portions of the Ka'ūpūlehu Mauka Lands Project Area—Conservation District, Ka'ūpūlehu Ahupua'a, North Kona District, Island of Hawai'i. Report RC-0026. Prepared for Roger Harris, Lee Sichter, and Guy Lam, Kamuela, Honolulu, and Kailua-Kona.

Rechtman, R. B. and J. D. Henry
2000 Addendum to Archaeological Inventory Survey, Ka'ūpūlehu Mauka Lands Project Area, Land of Ka'ūpūlehu, North Kona District, Island of Hawai'i. PHRI Report 2038-030300. Prepared for Tyler Smith and Roger Harris, Kamuela.

Personal Release of Oral History Interview Records: Ka'ūpūlehu Mauka Lands, North Kona, Hawai'i

The interviews referenced below were conducted by Robert B. Rechtman, Ph.D. (Rechtman Consulting) as part of a Cultural Impact Assessment for a Conservation District Use Application in the land of Ka'ūpūlehu, North Kona, Hawai'i.

Date of Recorded Interview: November 1, 2000.

I, Thomas Kamaki Lindsey Jr., participated in the above referenced oral history interviews with Robert B. Rechtman, and hereby give permission to include the released interview transcripts in the studies he is preparing for the Ka'ūpūlehu Mauka project area. This permission is granted, subject to any restrictions listed below:

(a) Quotes from the interview may be used as a part of the final report on historic and cultural sites and practices in the study areas, or reference may be made to the information in the interview.

(Yes) or no: _____

(b) Copies of the interview records may be made available to appropriate review agencies as a part of the preservation and interpretive development program.

(Yes) or no: _____

(e) The released interview records may be housed in library and/or historical society collections for general public access.

(Yes) or no: _____

(d) The released interview records may be referenced by Robert B. Rechtman for scholarly publication.

(Yes) or no: _____

(e) Excerpts from the released interview may be used in the to be developed interpretive material associated with development in the study area.

(Yes) or no: _____

(f) Restrictions:

Thomas Kamaki Lindsey Jr. (Interviewee)

Address: 72-3890-B Hawaii Belt Road
Kailua-Kona, HI 96740-9101

Robert B. Rechtman (Interviewer)

Date of Release: January 4, 2001

Personal Release of Oral History Interview Records:
Ka'ūpūlehu Mauka Lands, North Kona, Hawai'i

The interviews referenced below were conducted by Robert B. Rechtman, Ph.D. (Rechtman Consulting) as part of a Cultural Impact Assessment for a Conservation District Use Application in the land of Ka'ūpūlehu, North Kona, Hawai'i.

Date of Recorded Interview: November 16, 2000.

I, Hannah Kihalani Springer., participated in the above referenced oral history interviews with Robert B. Rechtman, and hereby give permission to include the released interview transcripts in the studies he is preparing for the Ka'ūpūlehu Mauka project area. This permission is granted, subject to any restrictions listed below:

(a) Quotes from the interview may be used as a part of the final report on historic and cultural sites and practices in the study areas, or reference may be made to the information in the interview.

Yes or no: yes

(b) Copies of the interview records may be made available to appropriate review agencies as a part of the preservation and interpretive development program.

Yes or no: yes

(e) The released interview records may be housed in library and/or historical society collections for general public access.

Yes or no: yes

(d) The released interview records may be referenced by Robert B. Rechtman for scholarly publication.

Yes or no: yes w/notification

(e) Excerpts from the released interview may be used in the to be developed interpretive material associated with development in the study area.

Yes or no: yes

(f) Restrictions: see (d) above.

Hannah Kihalani Springer (Interviewee)

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Kailua-Kona, HI 96740

Robert B. Rechtman (Interviewer)

Date of Release: January 4, 2001

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
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Personal Release of Oral History Interview Records: Ka'ūpūlehu Mauka Lands, North Kona, Hawai'i

The interviews referenced below were conducted by Robert B. Rechtman, Ph.D. (Rechtman Consulting) as part of a Cultural Impact Assessment for a Conservation District Use Application in the land of Ka'ūpūlehu, North Kona, Hawai'i.

Date of Recorded Interview: November 16, 2000.

I, Hannah Kihalani Springer., participated in the above referenced oral history interviews with Robert B. Rechtman, and hereby give permission to include the released interview transcripts in the studies he is preparing for the Ka'ūpūlehu Mauka project area. This permission is granted, subject to any restrictions listed below:

(a) Quotes from the interview may be used as a part of the final report on historic and cultural sites and practices in the study areas, or reference may be made to the information in the interview.

Yes or no: yes

(b) Copies of the interview records may be made available to appropriate review agencies as a part of the preservation and interpretive development program.

Yes or no: yes

(e) The released interview records may be housed in library and/or historical society collections for general public access.

Yes or no: yes

(d) The released interview records may be referenced by Robert B. Rechtman for scholarly publication.

Yes or no: yes w/modifications

(e) Excerpts from the released interview may be used in the to be developed interpretive material associated with development in the study area.

Yes or no: yes

(f) Restrictions: see (d) above.

Hannah Kihalani Springer (Interviewee)

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Date of Release: January 4, 2001