1991-10-23-HI-FEA

ENVIRONMENTAL ASSESSMENT

FOR

MAUKA ACCESS ROAD, INTERSECTION, AND IRRIGATION LAKE

KA'UPULEHU RESORT

KA'UPULEHU, NORTH KONA, HAWAII

TAX MAP KEY: (3)7-2-003: PORTIONS OF :003

CONSERVATION DISTRICT SUB-ZONE: GENERAL

APPLICANT:

PIA Kona Limited Partnership

APPROVING AGENCY:

Board of Land and Natural Resources

September 1991

MEMO TO THE FILES

DATE: 10/16/91 TIME: _____

SUBJECT: Ka'upulehu mauka access road an irrigation lake and a grade-separated intersection

CONTACT: Name: Anne Mapes

Organization: Belt Collins + Assoc.

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COMMENTS: List of agencies contacted was missing from the E.A. Mark Willy called back listing the following agencies contacted:

1. DOT
2. BWS, Hawaii County
3. DPW - " -
4. Office of Planning - " -
5. DOH
6. DLNR

FOLLOW-UP REQUIRED: YES _____ NO _____

Date: _____ Time: _____

Individual Contacted: _____

Organization Contacted: _____

Phone: _____

COMMENTS: _____

Signature: Eric Robinson Tasaki

OEQC 07/87 (568A)

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1. INTRODUCTION

1.1 PURPOSE AND CONTENT OF THIS DOCUMENT

The Environmental Assessment (EA) has been prepared in support of a Conservation District Use Application by the applicant, PIA Kona Limited Partnership, for a proposed mauka access road, a portion of grade-separated (underpass) intersection, and an irrigation lake that would be located on Ka'upulehu lands on the mauka side of Queen Ka'ahumanu Highway in North Kona, Hawaii. The land on which the road, intersection, and irrigation lake would be established is identified as tax map key (TMK:) (3) 7-2-003:portions :003 (see Figure 1).

The proposed access road would run through the Conservation and Agricultural Districts, connecting Mamalahoa Highway at the mauka end and Queen Ka'ahumanu Highway on the makai end. The grade-separated (underpass) intersection would be at the point where the new road intersects Queen Ka'ahumanu Highway. Half of the intersection would be located in Conservation lands makai of Queen Ka'ahumanu Highway. The non-potable water irrigation lake would be placed adjacent to the existing utility corridor and attendant service road along the border of the Ka'upulehu mauka lands and Huehue Ranch at the approximately 490-foot elevation point.

The proposed infrastructure would serve planned resort and residential projects located within the Ka'upulehu lands in the State Urban District, makai of Queen Ka'ahumanu Highway (Ka'upulehu Resort) and the planned agricultural/residential projects within the Ka'upulehu lands in the State Agricultural District mauka of the Conservation District lands. The lands on which the entire access road, intersection, and the irrigation lake would be established are presently designated Agriculture (5,000 acres) and Conservation (3,164 acres) by the state. County zoning for the Agriculture District lands is "U," unplanned. County zoning for the Conservation District lands is Open. The Conservation sub-zone is General. A portion of the access road and the irrigation lake within the Conservation District is adjacent to the northern boundary of the Huehue Ranch Kuki'o Urban District lands. A portion of the access road and the intersection within the Conservation District is adjacent to the Ka'upulehu Resort Urban District Lands.

In 1989, the Board of Land and Natural Resources approved a utility corridor in the immediate vicinity of the proposed infrastructure improvements requested in this application. This utility corridor, as would the proposed action, serves the Ka'upulehu resort development. Since the granting of the Conservation District Use Permit for the adjoining utility corridor, two alterations have occurred following requirements from the Board of Water Supply (BWS). The

pressure release valves (PRV) located near the 440-foot elevation are to be replaced with a 0.1 million gallon tank at the 400-foot elevation. The 0.5 million gallon tank originally proposed at the 400-foot elevation is to be replaced with a 1.0 million gallon tank at the 292 foot elevation. These changes were made to provide more reliable service as per BWS instructions and requirements. In addition, Ka'upulehu has agreed to allow the adjacent land owner, Huehue Ranch Associates, to locate potable water lines in the Ka'upulehu utility corridor. Construction work in this corridor is underway in accordance with the 1989 Conservation District Use Permit, which approved water lines within the corridor.

A separate Conservation District Use Application was submitted by the Kona Village Resort and approved in July 1991 for the makai portion of the grade-separated intersection and the relocation of the entry road leading to both the Kona Village Resort and to the Ka'upulehu Resort.

This Environmental Assessment has been prepared in accordance with the provisions of Hawaii Revised Statutes (HRS) Chapter 343 and Title 11, Department of Health, Chapter 200, Environmental Impact Rules, Sections 11-200-9 through 11-200-13. A description of the affected environment, the alternatives considered to date, proposed mitigation measures, preliminary impact determinations based on the information contained herein and the reasons supporting those determinations are provided. The information contained in this environmental assessment has been developed from site visits, from studies undertaken specifically for the project, and from generally available information regarding the environmental characteristics of the project site and surrounding area.

1.2 REGIONAL SETTING

The Ka'upulehu lands are located in North Kona, Hawaii on the landward (mauka) and seaward (makai) side of Queen Ka'ahumanu Highway, approximately 13 miles north of Kailua-Kona and 17 miles south of Kawaihae on West Hawaii (see Figure 2). The property on which the access road, the intersection, and the irrigation lake would be located is presently vacant and is directly mauka of the Ka'upulehu lands that are planned and zoned for hotel/resort development. A complete description of the overall Ka'upulehu Resort project area makai of Queen Ka'ahumanu Highway is included in the approved and accepted Ka'upulehu Resort Final Environmental Impact Statement [Belt Collins & Associates (BCA), June 1986]. The land on which the road, the intersection, and the irrigation lake would be located is owned in fee by the Bernice Pauahi Bishop Estate and leased to PIA Kona Limited Partnership.

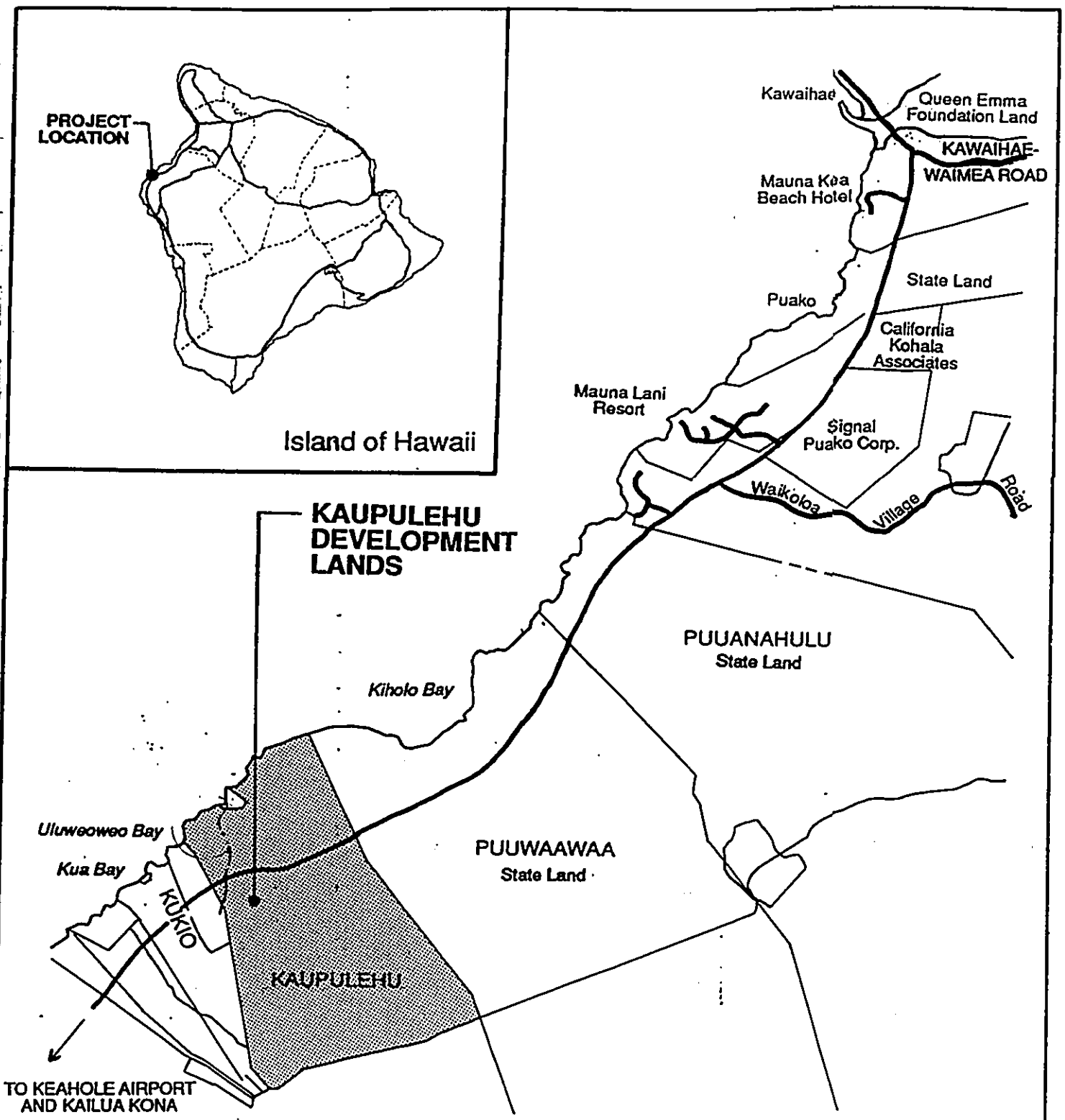
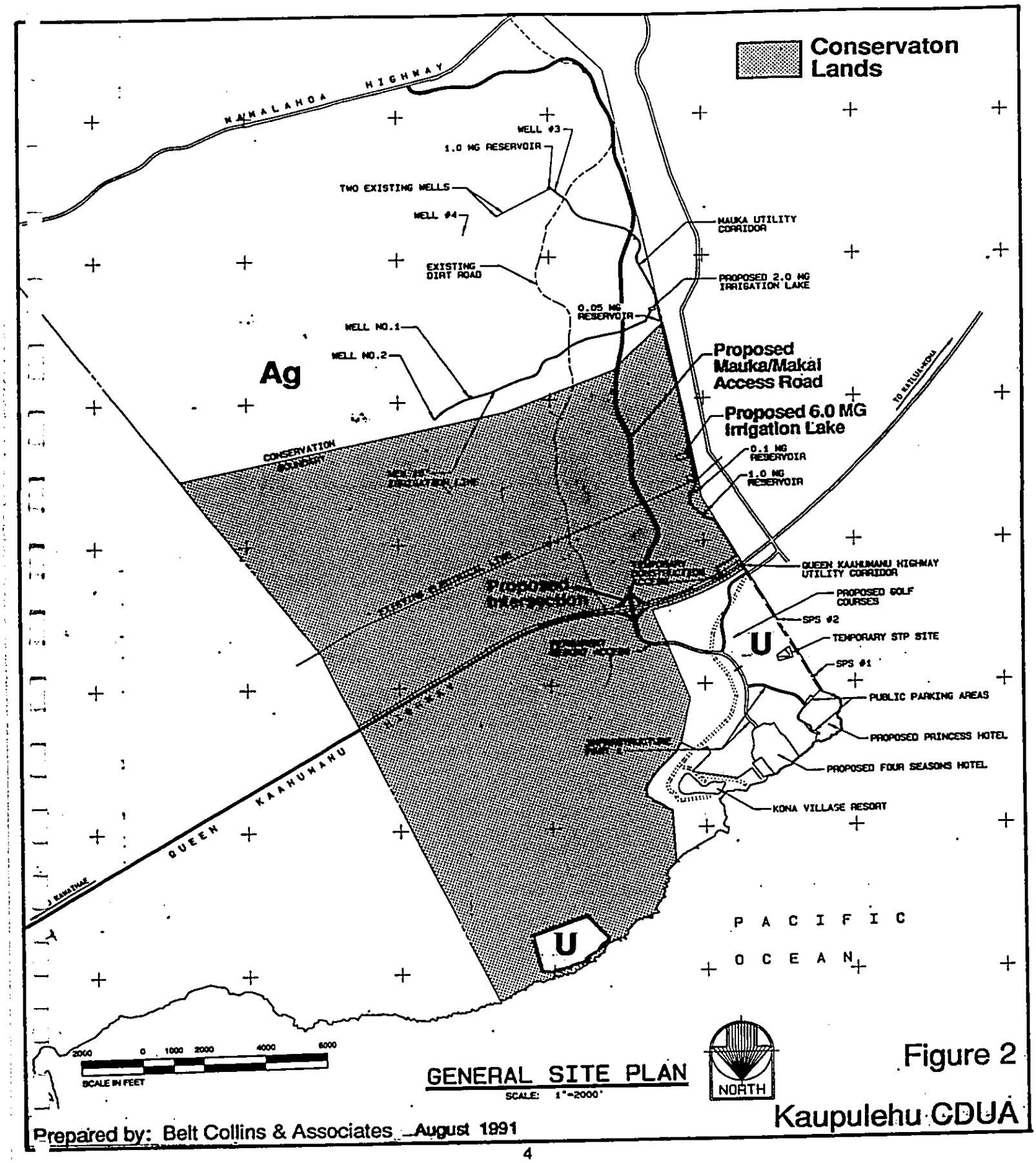


Figure 1
PROJECT SITE
Kaupulehu CDUA

Prepared by: Belt Collins & Associates August 1991



GENERAL SITE PLAN

SCALE: 1"=2000'

Figure 2

Kaupulehu CDUA

Prepared by: Belt Collins & Associates August 1991

1.3 REQUESTED GOVERNMENT ACTION

The requested government action is the issuance of a Conservation District Use Permit (CDUP) to allow for the construction of the road, the grade-separated intersection, and the irrigation lake within Conservation District lands.

1.4 DESCRIPTION AND PURPOSE OF PROPOSED ACTION

To provide access and water service to the planned Ka'upulehu Resort Four Seasons Hotel and associated residential units and recreational facilities (golf courses, tennis facilities and public restrooms and shower facilities), the applicant is proposing the development of a road, a grade-separated intersection, and an irrigation lake along the southwestern boundary of the mauka Ka'upulehu lands.

1.4.1 The Mauka Access Road to Ka'upulehu Mauka Lands

The access road within the Conservation District would be approximately two miles long and 24 feet wide within a 100-foot right-of-way. The road would connect the proposed intersection at Queen Ka'ahumanu Highway at the makai portion of the property with the planned mauka agricultural/residential community in the Agricultural District of the project. A portion of the road will extend makai of the Queen Ka'ahumanu Highway to provide vehicular access to the resort development. The section of the road within the Conservation District would begin at an elevation of about 800 feet and descend to an elevation of about 250 feet on the mauka boundary of the Queen Ka'ahumanu Highway right-of-way. The road will run with grades of between two to eight percent.

1.4.2 The Grade-Separated Intersection

Also proposed is a fully grade-separated intersection, consisting of an underpass beneath the Queen Ka'ahumanu Highway (see Figure 3). The long range plan calls for the construction of two to three additional lanes parallel to the existing roadway and separated by an approximately 30-foot median. The selection of either two or three lanes is currently under review by the State of Hawaii Department of Transportation. The proposed intersection would service both the Ka'upulehu Resort lands and the Kona Village Resort. A Conservation District Use Application covering the Kona Village and Ka'upulehu Resort access roads was approved in July 1991.

The intersection would consist of two 12-foot-wide off-ramps leading from Queen Ka'ahumanu Highway approximately 500 feet to the intersection with the access road to Ka'upulehu Resort. The deceleration lanes on Queen Ka'ahumanu Highway would be approximately 920 feet in length. Both on- and off-ramps for each side would meet at the Ka'upulehu Resort access road, forming four-way intersections controlled by stop signs.

The portion of Queen Ka'ahumanu Highway which would pass over the access road would be replaced with highway bridge structures. These structures would accommodate either two or three lanes and would contain 12-foot shoulders.

All design and construction would conform to current State of Hawaii, County of Hawaii, and American Association of State Highway and Transportation Official (AASHTO) standards.

The grade-separated intersection (underpass) will be constructed in a manner to minimize the traffic delays and disruptions along the Queen Ka'ahumanu Highway in the vicinity of the proposed resort development. The grade-separated intersection is being proposed in accordance with State Department of Transportation policies for Queen Ka'ahumanu Highway.

1.4.3 The Irrigation Lake

The irrigation lake and related improvements (transmission lines, valves and reservoir covered under the previous utility corridor CDUA) would service the transmission of the non-potable irrigation water to the resort area makai of the Queen Ka'ahumanu Highway (see Figures 4 and 5). This system provides for the the irrigation of the golf course and landscaping, and for other related needs of the overall development. The irrigation lake, situated at the approximate 490-foot elevation would have a capacity of approximately 6 million gallons. This lake would be situated next to the approved utility corridor near the southwestern boundary of the property. Water transmission lines to be utilized by Huehue Ranch will also be located within the existing Ka'upulehu utility corridor.

Water from two existing non-potable water wells, situated in the applicant's Agricultural District lands at the 800- and 900-foot elevation, will serve the non-potable water needs of the Ka'upulehu development. The water from the wells will run down the utility corridor into the proposed irrigation lake, located at the 490-foot elevation. From that level the water will again enter the gravity irrigation lines within the utility corridor.

Construction of the proposed irrigation lake would allow for the use of a gravity flow system without the requirement of mechanical pressure pumps, thus saving energy resources and costs. The construction of this system would also mean that scarce potable water would not need to be used for golf course irrigation. Approximately 68,000 cubic yards of soil would need to be excavated during construction of the lake, with clearing and grubbing occurring over approximately 4 acres. Soil removed from the excavation would be utilized in the construction of berms around the proposed irrigation lake.

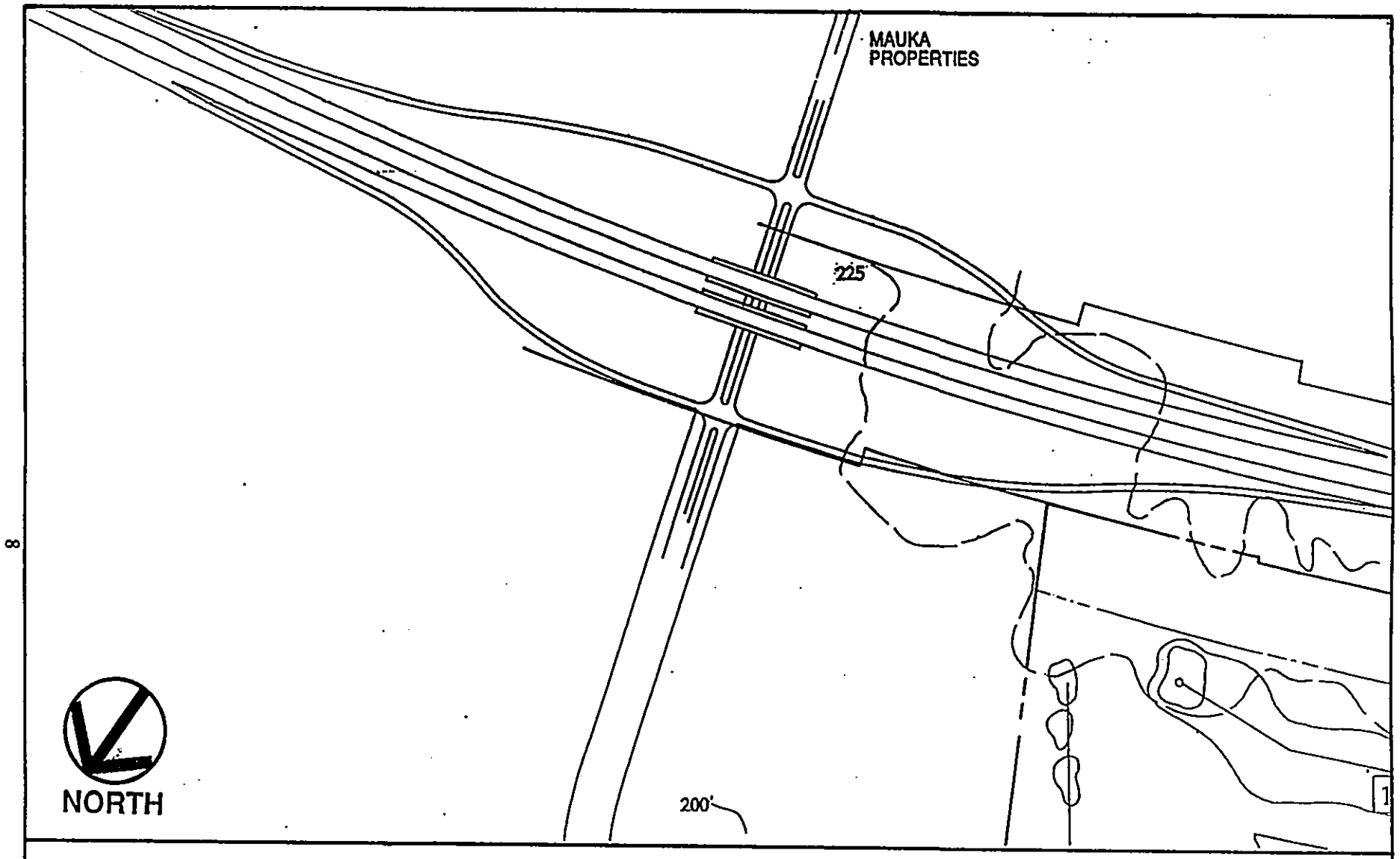


Figure 3
PROPOSED INTERSECTION LAYOUT
Kaupulehu CDUA

Prepared by: Belt Collins & Associates August 1991

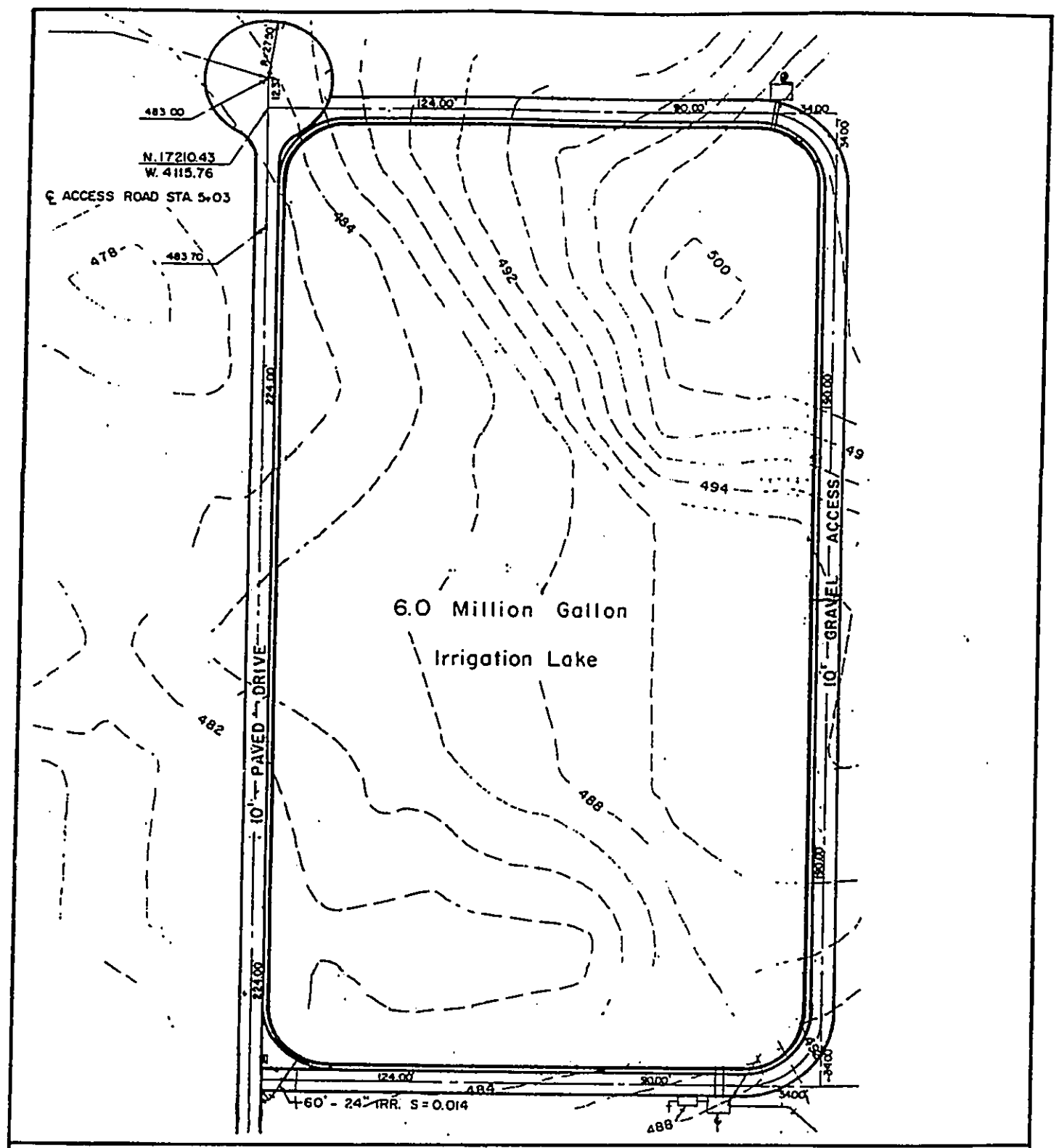
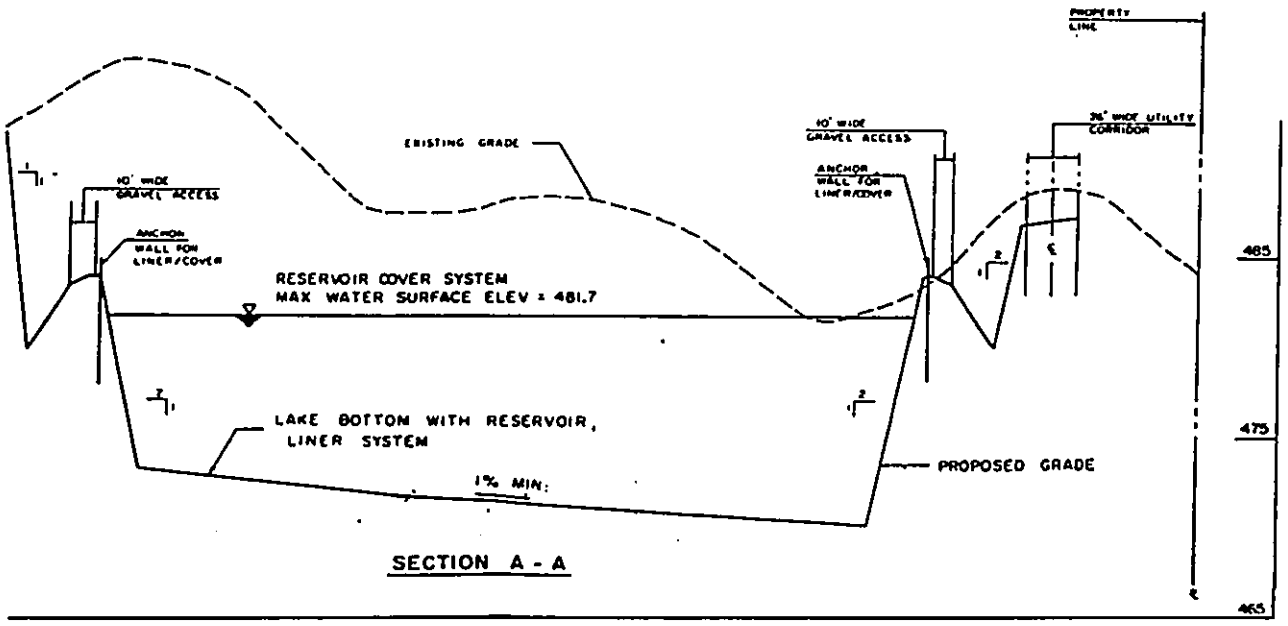


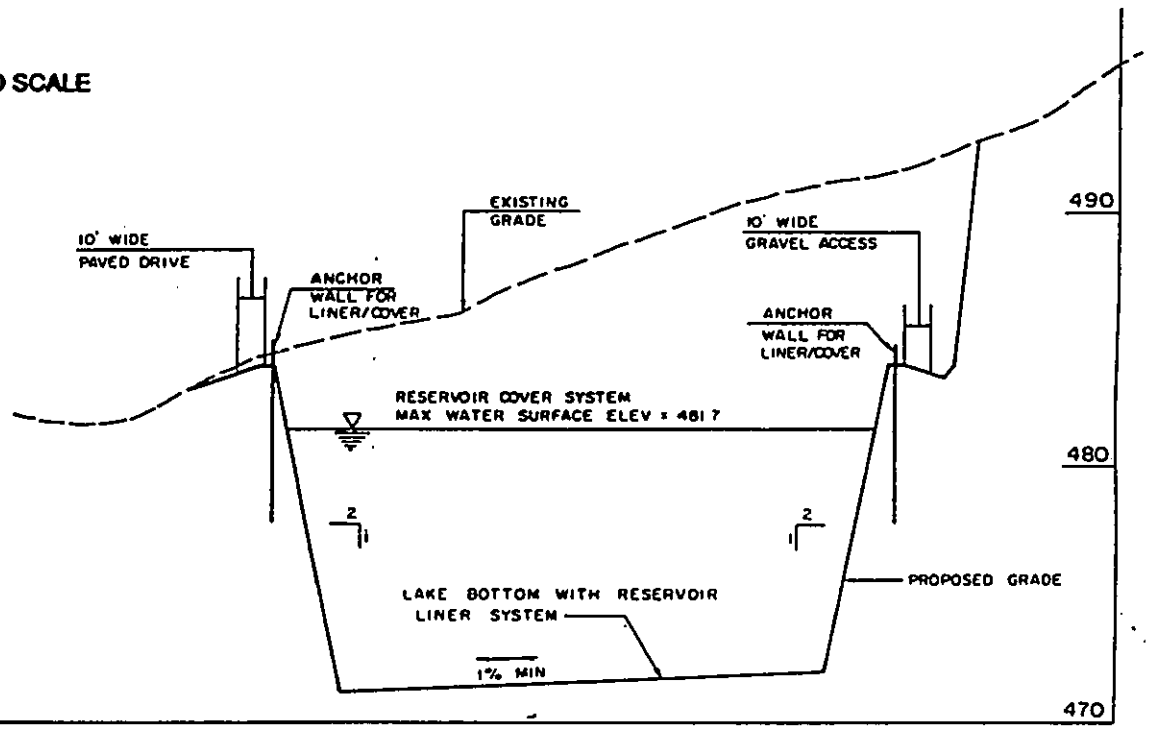
Figure 4
PROPOSED IRRIGATION
LAKE LAYOUT
Kaupulehu CDUA

Prepared by: Belt Collins & Associates August 1991



SECTION A - A

NOT TO SCALE



SECTION B - B

Figure 5
IRRIGATION LAKE PROFILE
Kaupulehu CDUA

Prepared by: Belt Collins & Associates August 1991

2. GENERAL DESCRIPTION OF THE PROPOSED ACTION'S TECHNICAL, SOCIAL, ECONOMIC AND ENVIRONMENTAL CHARACTERISTICS AND IMPACTS

2.1 DESCRIPTION OF THE SOCIAL AND ECONOMIC CHARACTERISTICS OF THE PROPOSED ACTION

2.1.1 Existing Conditions

The general social and economic characteristics of the Ka'upulehu area are provided in the Ka'upulehu Resort Final Environmental Impact Statement (BCA, 1986).

The project site is located in U.S. Census Tract 215, which includes the North Kona District of the Island of Hawaii. This census tract had an estimated resident population of 7,610 in 1989 (Hawaii, DBED, 1991). The 1990 U.S. Census results are not yet available.

2.1.2 Social and Economic Characteristics of the Proposed Action

The Ka'upulehu Resort area is currently designated on State and County plans as a resort area. The proposed road, intersection, and irrigation lake would aid in the realization of the planned Ka'upulehu Development facilities. In general, the social impacts associated with the overall development of the Ka'upulehu area are expected to be positive. For those elements that potentially might be disruptive to planned or present social conditions, appropriate mitigation measures have been formulated and would be put into effect as need warrants. The measures have been described in the Ka'upulehu Resort Final Environmental Impact Statement. The proposed road, intersection, and irrigation lake, in and of themselves, are not expected to significantly affect the social characteristics of the area.

Both employment and economic impacts directly and indirectly resulting from development of the proposed road, intersection, and irrigation lake, as part of the overall development of the Ka'upulehu Resorts, are expected to be positive in the short-and long-term. Development of the property will provide short-term construction employment, primarily for on-island workers and long-term employment during the operational phases of the resort facilities. Similarly, development of the property will increase both state and county tax revenues and require minimal public expenditures for public services. It is noted that the owners would be responsible for providing appropriate infrastructure components to serve the property development. These elements include the road, intersection, and irrigation lake.

Due to the expected positive benefits resulting from development of the proposed road, intersection, and irrigation lake, as well as from the continued development of the Ka'upulehu Resort, and the lack of expected adverse impacts to the economic characteristics of the region, county or state, mitigation measures to minimize potential adverse impacts are not anticipated.

2.2 DESCRIPTION OF THE ENVIRONMENTAL CHARACTERISTICS AND IMPACTS OF THE PROPOSED ACTION

2.2.1 Geology and Physiology

The general geology of the project site is dominated by the Ka'upulehu lava flows that emanated from Hualalai in 1800-1801. The 1800 flow entered the ocean at the northern boundary of the Ka'upulehu property and is characterized by numerous accretionary lava balls, a'a channels, lava stalactites and brown, red and black spattering bordering the channels. Both a'a and pahoehoe lavas are present, with little or no soil and only sparse ground cover. Slopes within the area range from two to eight percent.

The proposed road, intersection, and irrigation lake are located on older lava flows (1000+ years) and are not expected to significantly impact or be impacted by the geology or physiography of the project area. As such, measures to minimize potential adverse impacts, other than adherence to state and county building codes and standards, do not appear warranted.

2.2.2 Soils and Agricultural Potential

Four land types, as described below, have been identified on the Ka'upulehu mauka lands by the U.S. Department of Agriculture Soil Conservation Service (SCS) (December, 1973) in a comprehensive soil survey of the Island of Hawaii. None of the four are particularly 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 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 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.

Agriculturally, the Detailed Land Classification, Island of Hawaii, University of Hawaii, Land Study Bureau, 1972, classifies the Ka'upulehu mauka lands as E287, E319 and E324. These classifications indicate the soil's lack of suitability for agricultural purposes. None of the land within the area of the proposed infrastructure developments is classified in the Agricultural lands of Importance to the State of Hawaii (ALISH) system. However, the mauka terminus of the road would be located in lands that have been designated Agriculture by the Sate Land Use Commission for possible future agricultural subdivision. All of the land and soil types under the proposed road, intersection, and irrigation lake are excessively well drained.

Development of the proposed road, intersection, and irrigation lake is not expected to significantly impact or be impacted by the soils of the project site or area. At this time there are no known plans to utilize lands within the Conservation District for agricultural activities nor have the Conservation District lands been utilized for agricultural activities in the recent past. Similarly, it does not appear likely that future agricultural activities would be pursued on these lands.

Due to the lack of expected significant impacts to the soils or agricultural potential of the area or site, mitigation measures to minimize potential adverse impacts do not appear warranted.

2.2.3 Surface Water and Drainage

The Ka'upulehu lands, in the lee of Mauna Kea, Mauna Loa and Hualalai, are an area of low rainfall amounts and intensities. The land is comprised of porous and unweathered lavas and has sparse soil cover. As a consequence, there are no naturally occurring drainage ways and surface water runoff is virtually non-existent.

Because of the highly porous nature of the lavas underlying the proposed infrastructure, the proposed action is not expected to be significantly impacted by or to significantly impact the surface and drainage characteristics of the area. The proposed improvements will be designed in accordance with State and County drainage and runoff control standards.

2.2.4 Groundwater and *Hydrology*

In general, the Ka'upulehu lands can be conveniently divided into three hydrogeological sectors. The first sector falls between Queen Ka'ahumanu Highway and the coast. Highly permeable layered basalts contain basal groundwater, i.e., fresh-brackish water floating on sea water. Salinity of this water ranges from very brackish at the coast to moderately brackish near the highway. The second sector extends from Queen Ka'ahumanu Highway upward and inland to an indeterminate boundary lying in the rift zone between Pu'u Kolekole and Pu'u Nahaha. East of this rift zone, this sector extends all the way to Mamalahoa Highway. Groundwater is basal and quality is moderate to weakly brackish. At the farthest inland extent, the basal water may be marginally potable. The third sector is restricted to the vicinity of the rift zone where subsurface geological discontinuities occur. Groundwater is basal but the water table elevation above sea level (head) is abnormally high as a result of water accumulation behind leaky barriers. The groundwater is fresh because head is high enough to prevent sea water intrusion into the core of the lens. Two wells in upper Ka'upulehu (State Well Nos. 4658.01 and 4658-02) and three in the adjacent Huehue Ranch have proven the existence of this source.

The proposed irrigation lake will provide a facility for storing non-potable water and an efficient and secure means of transporting water via a gravity flow system from the source wells and reservoirs at the 800- and 900-foot elevation to the planned resort facilities. Adverse impacts to the groundwater resources and hydrologic characteristics of the area are not expected. Measures to minimize potential adverse impacts are not warranted.

2.2.5 Natural Hazards

Potential natural hazards to which the property could be subjected include earthquakes and volcanic eruptions. Because of the excessively well drained nature of the land and soil types, floods due to rainwater surface runoff are unlikely to occur.

Volcanic hazards in the area have been studied in detail (Mullineaux, et al., 1987). The last volcanic eruption at Hualalai that affected the Ka'upulehu lands occurred in 1800-1801. Lavas emerged from the northwest volcanic rift zone to create the Ka'upulehu Lava Flow. Mullineaux, et al., indicate that the Ka'upulehu lands are in lava flow hazard Zone 4. Less than 15 percent of the land in this zone has been covered with lava in the last 750 years. Although lava flows on Hualalai have typically covered large areas, the rift zones of the volcano do not seem to have a distinctly higher degree of hazard than do its flanks.

In addition to lava-flow hazard zones, hazard zones for tephra falls have also been defined for Hawaii (Mullineaux, et al, 1987). The Ka'upulehu lands are located in ashfall-hazard Zone 2A, which indicates a potential exists for burial by cinder cones and thinner, more widespread tephra 10 cm or more thick from infrequent eruptions of Hualalai.

Hazard zones are not designated on Hawaii in the Ka'upulehu area for pyroclastic surges. The single pyroclastic surge hazard zone on the island surrounds the Kilauea caldera and extends to a distance of 10 km from its center.

Hazard zones for volcanic gases are the same as hazard zones for tephra. The Ka'upulehu lands are outside hazard zones for ground fracture and subsidence. However, earthquakes, associated with volcanic events, primarily underground magmatic movement, of Hualalai have been reported. Based on historical data, earthquakes of a level of 6.4 Richter Scale Magnitude occur on an average of once every 62 years.

Because the proposed infrastructure could be affected by volcanic events, such as lava flows or earthquakes, appropriate design, engineering and construction measures would be taken to minimize potential risks due to volcanic activity. These measures would include adherence to engineering design standards in accordance with federal, state and county rules and regulations.

2.2.6 Climate and Meteorology

The Ka'upulehu lands lie within an area between Honokohau and Anaeho'omalu called Kekaha, meaning dry, sunbaked land. Rainfall at the coast averages only 7 to 8 inches per year. There is very little rainfall below the 1,000-foot elevation and only 25 to 30 inches annually at the 2,000-foot elevation. All of the proposed infrastructure would be located below the 1,000-foot elevation contour.

Mean annual temperature in the Ka'upulehu area is about 78 degrees F with relatively small daily and seasonal variations. Daytime temperatures above 88 degrees F or nighttime temperatures below 63 degrees F are rare.

Development of the proposed road, intersection, and irrigation lake is not expected to have any impact on the climate or meteorology of the project area or region. Structures would not be tall enough to significantly affect existing wind patterns; and any new landscaping that might be planted around future facilities is not expected to be great enough to significantly affect temperature or rainfall patterns. Due to the lack of expected significant impacts to the climate or meteorology of the property site or area, mitigation measures to minimize potential adverse impacts are not warranted.

2.2.7 Air and Noise Quality

The proposed infrastructure 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 mobile source, i.e., motor vehicle activity. The proposed action would also have off-site air quality effects due to increased demand for electrical energy, which must be met through the combustion of some type of fuel. There would be short-term impacts during construction due to vehicular movement, clearing and grading, and general dust-generating construction activities.

The existing noise quality of the subject property site is dominated by motor vehicle traffic movement along Queen Ka'ahumanu Highway and, to a limited degree, by natural factors including wind moving through vegetation and surf sounds makai of the mauka Ka'upulehu lands. Based on noise level measurements taken at other similar Hawaii and Oahu locations, it is presumed that existing noise levels are in the 30 to 50 dBA range, depending on the time of day and levels of traffic along Queen Ka'ahumanu Highway.

Impacts to the property area and regional air quality could be caused by increased vehicular activity in and around the property, electrical generation off-site and construction activities. The principal sources of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along Queen Ka'ahumanu Highway fronting the property site. Because of the moderate level of existing traffic volumes, the additional construction vehicle traffic should not cause state or federal air quality standards to be violated.

Site preparation work and earth moving would create particulate emissions as would building construction. Short-term construction impacts would be minimized by dust control measures (frequent watering) that would 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 would decrease.

Potential impacts on the noise quality of the site and area would be primarily limited to those that might be generated by an increased volume of traffic in the immediate vicinity of the property and, in the short-term, construction activity noise. Increased human noise generation is expected to occur on the road and in the immediate vicinity of the irrigation lake. However, these facilities are not near other human habitation locations.

Traffic generated noise levels both on-and off-site, are expected to be in the range of 40 to 50 Leq (energy equivalent sound level for a given time period) at 50 feet. Thus, traffic generated sound levels would be typical of a business/residential/resort condition. The lack of expected adverse impacts to the air and noise quality of the property site and area indicate that mitigation measures to minimize potential adverse impacts are not warranted.

2.2.8 Visual Attributes

The Conservation District Ka'upulehu lands on which the proposed infrastructure would be established range from an elevation of about 250 feet at Queen Ka'ahumanu Highway to about 900 feet at the mauka portion of the proposed road. The area is dominated by open space lava lands covered in grasslands with few trees.

The site features and attributes of the property area would be minimally changed from the present open space appearance by the development of the proposed road, intersection, and

irrigation lake. Portions of the highway intersection and the road would be visible from Queen Ka'ahumanu Highway. Similarly, it is likely that portions of the road would be visible from Mamalahoa Highway above the project area. To reduce visual intrusion, the road and the intersection will be landscaped in a manner compatible with the surrounding environment.

Although adverse impacts are not expected, some may view the road and intersection as an intrusion on the aesthetic character of the area. The use of the underpass configuration would minimize the visual impact at the highway intersection for the transient driver travelling beyond the Ka'upulehu development. For the Ka'upulehu project visitor and resident, the intersection provides for a minimized visual impact of the surrounding region.

2.2.9 Flora and Fauna

A botanical survey covering the area surrounding the proposed infrastructure was performed in February 1991 and is described in Appendix A. There have been three recent botanical surveys on portions of the project site or on areas adjacent to the site. The survey conducted for the Ka'upulehu resort lands makai of the highway (Char 1985) included the smaller parcel where the proposed intersection is planned. This area was described as primarily a'a lava which was largely barren. In 1988, Char conducted a survey of a water line and maintenance road corridor mauka of the highway and included entirely within the present study site. The corridor was approximately two miles long and varied from 100 to 200 feet wide. Vegetation consisted of fountain grassland on pahoehoe flows and mostly barren a'a flows. The adjacent Kuki'o lands, from along the coastline to about the 640-foot elevation, were also surveyed by Char in 1984. Vegetation consisted of fountain grass grassland with a few scattered lama trees. Closer to the highway, the grassland contained more shrubs and subshrubs as well as a few trees of kiawe. In all three studies no threatened and endangered plants were found on those portions currently within the project site. The two basic vegetation types recognized in the previous surveys also occur on the project site and are described in detail below.

Fountain Grass Grassland - Approximately half of the project site located above the highway is covered by pahoehoe flows; this is easily picked up on the USGS orthophotoquad as the lighter-colored areas and on the Soil Survey maps (Sato et al.1973) it is labeled "rLW". These flows are ancient and weathered. Instead of being glassy black like the more recent flows, the surface color is a reddish-brown. In places, the pahoehoe can change from rolling hummocky to rough and broken ("shelly pahoehoe"). A lava tube system, in places collapsed and with large caverns, can be found on the upper elevation portions of the site.

These weathered pahoehoe flows support a rather dense cover consisting of the introduced fountain grass (*Pennisetum setaceum*) with scattered shrubs and small trees of kiawe (*Prosopis pallida*). Fountain grass cover on the lower two thirds of the parcel varies from 50 to 60%; on the upper one third of the parcel the fountain grass becomes denser (60-80% cover). Common shrubs and smaller shrubs or subshrubs associated with this vegetation type are indigo (*Indigofera suffruticosa*), ʻuhaloa (*Waltheria indica*), and pluchea (*Pluchea symphytifolia*); of these three, only the ʻuhaloa is a common native. A few other natives which can be found in smaller numbers include nehe (*Lipochaeta lavarum*), koali (*Ipomoea indica*), ʻiwaʻiwa fern (*Doryopteris decipiens*), ʻilima (*Sida fallax*), and aʻaliʻi (*Dodonaea viscosa*). Locally common are patches of pili grass (*Heteropogon contortus*). From about the 600-foot elevation and to the upper boundary, native trees and shrubs as ʻohiʻa (*Metrosideros polymorpha*), lama (*Diospyros sandwicensis*), ʻakia (*Wikstroemia pulcherrima*), and naio (*Myoporum sandwicense*), along with the introduced silk oak tree (*Grevillea robusta*), are found.

Poʻopoʻomino cinder cone, although a different substrate type, supports somewhat similar vegetation and is included here within the fountain grass grassland. Around the base of the cinder cone is a ring of kiawe trees, 18 to 25 feet tall. Vegetation on the cinder cone is denser than on the pahoehoe substrate. Seasonally abundant on this area are the native poppy or pua kala (*Argemone glauca*) and kakonakona (*Panicum torridum*), an annual grass.

The grassland is used by feral donkeys and goats. During field studies a herd of 12 donkeys and two small groups of goats were observed .

AʻA Lava with Sparse Vegetation - Aʻa flows cover almost all of the smaller parcel makai of the Queen Kaʻahumanu Highway, although a few areas with pahoehoe lava and fountain grass grassland may be found. On the larger parcel mauka of the highway, the tumbled heaps of clinkery, sharp and scoriaceous aʻa covers about half of the parcel. Plant cover is very sparse, about 1 to 3%. Fountain grass and pluchea occur in small, scattered patches, usually in depressions. Where the 4-wheel drive road crosses the aʻa flow, there are more plants of Florida beggarweed (*Desmodium tortuosum*), indiga, fountain grass, and hairy spurge (*Chamaesyce hirta*), especially along the margins of the road where the aʻa has been crushed and compacted.

The proposed infrastructure would not have a significant negative impact on the botanical resources as the vegetation is dominated largely by introduced species as fountain grass. Additionally, the total area which would eventually be disturbed for the proposed intersection,

road, and water system is not large. Given the limited nature of the developments, no mitigation measures are necessary.

The fauna of the area was surveyed in connection with a 1989 CDUA for the adjoining utility corridor serving the Ka'upulehu project. No endemic birds were recorded during the course of the field survey. The short-eared owl or Pueo (*Asio flammeus sandwichensis*) is relatively common on Hawaii and could occur within the corridor. Of the migratory shorebirds that visit or reside in Hawaii, Pacific Golden Plover (*Pluvialis fulva*_) were seen flying over the corridor during the day and plover and Ruddy Turnstone (*Arenaria interpres*) were heard calling after dark from the corridor area. No resident indigenous seabirds were observed on the site. A total of ten species of exotic (introduced) birds were recorded in the project area during the field survey. The most abundant of these was the Japanese White-eye (*Zosterops japonicus*). No threatened or endangered species of birds were observed within the area.

The only evidence of feral mammals observed during the field survey were scats, tracks and skeletal remains of donkey (*Equus asinus*) and goats (*Capra hircus*). Five donkeys were seen, but evidence of their activity indicates that a sizeable herd of perhaps 20+ animals occurs in and around the Ka'upulehu lands. There is evidence that the donkeys have sleeping areas around Po'opo'omino Pu'u. No small Indian Mongoose (*Herpestes auropunctas*), rats, mice or cats were recorded but they most likely inhabit the area. Similarly, no individuals of the endemic and endangered Hawaiian Hoary Bat (*Lasirus cinerus semotus*) were observed during the field survey.

Development of the proposed infrastructure would result in the loss of some of the vegetation on the site. However, the majority of the vegetation within the corridor is found throughout most of the islands in similar environmental conditions. There are no endangered or threatened plants on the project site. The proposed project would not significantly affect the flora of the area and specific mitigation measures to minimize adverse impacts are not warranted.

Establishment of the proposed infrastructure could result in the loss of some wildlife habitat. It is expected that the overall project would result in negligible impacts on the bird life of the area. Feral donkey sleeping and resting areas are well outside the prect area.

2.2.10 Historical and Archaeological Resources

To determine impacts upon the archaeological and historical resources from of the proposed access road, intersection, and irrigation lake an archaeological inventory survey of the

mauka portion of the route was prepared in March 1991 by Paul H. Rosendahl, Inc. This is included as Appendix B.

Seventy-seven sites containing over 190 component features were identified within the project area. Seventeen of the sites had been previously identified, either by Sullivan and Rosendahl (1989) or by Walker and Rosendahl (1990). The identified sites range in condition from poor to good and consist of both single and multiple components. The sites comprise the following feature types: alignment (box C-shape, linear, and L-shape), cairn, cupboard, enclosure, lava tube (cave), modified outcrop, pahoehoe excavation, terrace, trail segment, and wall; and the following functional types: agriculture/animal husbandry, ceremonial marker, habitation (both semi-permanent and seasonal/temporary), indeterminate, marker, quarry, burial, recreation, transportation, and water catchment. All identified sites are summarized in terms of site number, formal/functional type, recommended field work tasks, and value assessments in Appendix B.

The current project assessment also included limited subsurface testing and collection of surface artifacts. The subsurface testing was conducted primarily in order to recover potential radiocarbon (c-14) dating samples. Carbon-14 samples were obtained from five features. Most sites identified during the survey appear to be prehistoric. Age determination results from the current project ranged from AD 1450 to AD 1955. Surface collection of artifacts took place at eight sites. Indigenous portable artifacts collected included a possible a'ulima, concretions, coral and scoriaceous abraders, a fishhook, and a possible octopus lure.

Of the 77 sites identified in the study, 25 sites assessed as significant for information content only were recommended for no further work. Sixteen sites assessed as significant for information content only were recommended for further data collection. Twelve sites assessed as significant for information content and as excellent examples of site types were recommended for further data collection and preservation with interpretive development. None of these 12 sites are within the Conservation District area to be affected by the development of the proposed infrastructure. The remaining sites had various assessments and recommendations. Detailed assessments and recommendations for all sites are presented in Table 8 of Appendix B.

Impacts to the archaeological and historical resources of the project area from development of the proposed infrastructure are expected to be minimal. The sections of trails that are found within the proposed project area would be preserved as required by appropriate state and county rules and regulations. However, the graded roadway would cross the trails in two locations.

Other archaeological resources will be addressed as recommended and required by the Department of Land and Natural Resources, State Historic Preservation Program Division and other public agencies.

2.2.11 Access

Access to the proposed mauka road and irrigation lake would be provided initially via a turnoff from Queen Ka'ahumanu Highway, within the highway right-of-way and ultimately with the construction of a grade separated (underpass) intersection. The project developers would coordinate development of the access and property with the County Department of Public Works and State Department of Transportation, Highways Division, to assure that traffic safety on Queen Ka'ahumanu Highway is maintained. The existing utility corridor service road will provide long-term access to the utilities and lake located along the corridor.

Vehicular access in and around the project area would be enhanced with the construction of the intersection and road. Present vehicular access to the property is via four-wheel drive vehicles on substandard roads. The proposed improvements would significantly upgrade this access with paved surface roadways and a grade-separated intersection.

The intersection underpass would enhance public safety by eliminating left-turn movements from and to the highway across traffic flows. These improvements would also increase the ease of access to the proposed Ka'upulehu development.

2.2.12 Wastewater Disposal

Wastewater treatment and disposal for the planned Ka'upulehu Resort are described in the Ka'upulehu Resort Final Environmental Impact Statement (BCA 1986). The proposed mauka access road, intersection and irrigation lake are not expected to contribute to the wastewater generation of the resort.

2.2.13 Solid Waste Disposal

Solid waste collection and disposal for the resort are also described in the Ka'upulehu Resort Final Environmental Impact Statement (BCA, 1986). The proposed infrastructure improvements are not expected to contribute to the solid wastes generated by the resort.

2.2.14 Electrical Power and Communications Systems

Electrical power to the proposed infrastructure would be provided by HELCO from their existing overhead 69 kv transmission lines located about 3,000 feet mauka of Queen Ka'ahumanu Highway. A drop to a pole transformer would be made and overhead distribution lines, on 30-foot poles, installed along a utility corridor to the non-potable water wells and reservoir and the resort facilities makai of the highway. Electrical power to the makai Ka'upulehu Resort would be provided via underground lines from the lower end of the utility corridor. Sufficient HELCO generating capacity exists to serve the planned facilities. As such, adverse impacts to the electrical system of the area are not expected to occur.

Communications (telephone service) to the subject property are provided by Hawaiian Telephone Company via existing pole lines on the mauka side of Queen Ka'ahumanu Highway. Hawaiian Telephone facilities are capable of serving the planned facilities and no adverse impacts to their system are expected by the development of the road, intersection, or irrigation lake.

2.2.15 Public Schools

The public schools serving the subject property area would be unaffected by the establishment of the proposed infrastructure. Therefore, no specific mitigation measures to minimize potentially adverse impacts are warranted.

2.2.16 Health Care Facilities

Existing and planned health care facilities in the vicinity of and/or serving the Ka'upulehu Resort are described in the Ka'upulehu Resort Final Environmental Impact Statement. Development of the proposed road, intersection, and irrigation lake is not expected to significantly add to the requirements for emergency or daily medical care facilities in the Ka'upulehu or West Hawaii area. As such, no additional burden on public or privately provided medical care and services is expected to result from the proposed project.

2.2.17 Police and Fire Protection Services

Police and fire protection services afforded the Ka'upulehu area are also described in the Ka'upulehu Resort Final Environmental Impact Statement. This project is not expected to negatively affect these services.

The proposed grade-separated intersection and access road would actually enhance the public safety concerns of the proposed Ka'upulehu development. The upgraded road system and grade-separated intersection would permit safer, faster, and more efficient access to the resort area for the public safety agencies.

The development of the proposed irrigation lake will help to increase water availability to Ka'upulehu Resort, thus increasing the fire protection capabilities at the area.

2.2.18 Recreational Resources

The existing and planned recreational resources serving the Ka'upulehu area have been described in detail in the Ka'upulehu Resort Final EIS. Development of the proposed infrastructure would be expected to positively affect the recreational resources of the area through the ability to efficiently provide water to those resources. Public shoreline access facilities at Ka'upulehu would also be serviced by these road and irrigation system improvements. Adverse effects are not expected and measures to minimize potential adverse impacts are not warranted.

Non-potable water would primarily be used to irrigate the recreational (golf) resources of the proposed Ka'upulehu resort project. Irrigation water and its transmission would be developed, in part, through the development of the irrigation lake and related improvements.

The development of a grade-separated intersection, with its accompanying access roads would allow for easy public access to the recreational facilities contained within the resort area.

3. IDENTIFICATION AND SUMMARY OF MAJOR IMPACTS AND ALTERNATIVES CONSIDERED

3.1 MAJOR IMPACTS

The major potential adverse impacts that could result from development of the subject property are potential loss of vegetation and wildlife habitat. In addition, short-term adverse impacts could result from increased localized noise levels during and after construction activities and decreased air quality during construction and in the immediate vicinity of the proposed intersection after construction due to increased vehicular traffic. Some people may also perceive the visual attributes of the proposed intersection to be adverse. This potential concern has been addressed with the proposed underpass which will minimize the visual impact.

3.2 ALTERNATIVES CONSIDERED

Known feasible alternatives to the proposed access road, intersection, and irrigation lake are limited to those that would allow the objectives of the proposed project to be met, while minimizing potential adverse environmental impacts. As noted in Section 1.4 above, the proposed project has been designed to provide an effective, efficient and environmentally acceptable means of providing both vehiclur access and non-potable water service to the planned Ka'upulehu 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.

3.2.1 Grade-Separated Intersection Alternatives

The intersection alternatives included:

1. The construction of a channelized at-grade intersection
2. The signalization at the highway intersection
3. The construction of a highway overpass intersection

These alternatives were rejected for a variety of reasons. The first alternative, which is prevalent along Queen Ka'ahumanu Highway, was rejected by the State Department of

Transportation. With traffic densities expected to increase dramatically over the course of the next few years, State policy is to prevent future conflicting left-turning movements across traffic. This policy is to facilitate traffic flow and safety.

The second alternative, which has not yet occurred along the section of Queen Ka'ahumanu Highway north of Kailua-Kona, but which does exist south of Kona, was also rejected. Channelization and signalization of the road would cause a decrease in traffic flows and an increase in traffic congestion. During peak periods, the demand volumes waiting to be processed through the signal are anticipated to be so large, long queues would develop, causing signal failure and adversely impacting the air quality of the area. This alternative also did not conform to State Department of Transportation policy for the area.

While an overpass alternative has the same positive impacts upon access and traffic flows, and is more economical than the preferred action, this alternative was also rejected. An overpass bridge structure across Queen Ka'ahumanu Highway would severely impact the visual character of the area and has the potential to draw opposition from some community groups and residents of the area.

3.2.2 Irrigation Lake Alternatives

The irrigation lake alternatives included:

1. No-build
2. Construction of above ground tanks

The first alternative was rejected due to the need to provide non-potable water to the resort development at the makai portion of the project. The second alternative was rejected due to the negative visual aspects that would be created from the multiple tank structures necessary to handle six million gallons of water.

3.2.3 The Access Road to Ka'upulehu Mauka Lands

The access road alternatives included:

1. No-build
2. Provide access only via the Mamalahoa Highway situated at the mauka boundary of the Ka'upulehu mauka lands

The first alternative was rejected due to the need to provide vehicular access to the proposed mauka agricultural/residential related development, linking this portion of the overall project with the makai resort development. The second alternative was rejected because it would limit access to the lower portions of the project. The proposed Ka'upulehu development is an integrated resort/residential/recreational project that is designed and will serve as an integrated development directly linked between the mauka and makai portions of the development.

3.2.4 Summary

The 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 vehicular access, and of storing and transporting non-potable water from upland wells to the planned Ka'upulehu Resort facilities; to minimize environmental impacts from the proposed project; and to be economically feasible.

Although the proposed intersection underpass represents the most expensive alternative, it was selected due to the mitigating effects it has on visual impacts and traffic circulation. In addition, the State Department of Transportation has indicated a preference for this intersection configuration, as have members of the community.

4. PROPOSED MITIGATION MEASURES

The mitigation measures proposed to ensure that potential adverse environmental impacts resulting from establishment of the proposed infrastructure projects are minimized include:

- limiting construction activities to daytime hours;
- adherence to all federal, state, and county environmental protection, health, safety and construction rules and regulations;
- coordination of development plans and activities with appropriate county agencies;
- landscaping the areas as appropriate and necessary; and,
- protection of wildlife habitat as required and preservation of archaeological and historical resources in accordance with appropriate federal, state, and county rules and regulations.

5. DETERMINATION

Based on the information available and the type of governmental action requested at present and to be requested in the future, it has been determined that development of the proposed mauka access road, the intersection, and the irrigation lake would result in positive social, economic impacts and would not have a significant impact on the environment. Thus, an environmental impact statement is not required for the proposed action. However, it is recognized that compliance with the environmental disclosure process, as defined in HRS Chapter 343 and Chapter 200, Department of Health Environmental Impact Statement Rules, is required and is one of the primary reasons that this EA has been prepared.

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 phase of the proposed action, 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:

1. The proposed action does not involve an irrevocable commitment to loss or destruction of any significant natural or cultural resource.

2. The proposed action increases the range of beneficial uses of the environment.

3. Adoption of the requested Conservation District Use Permit would result in the proposed action being in concert with the County's long-term environmental and land use policies, goals and guidelines as expressed in the Hawaii County General Plan.

4. The proposed action does not adversely affect the economic or social welfare of the community or state.

5. The proposed action does not involve substantial secondary impacts, such as population changes or effects on public facilities that are not already contemplated.

6. The proposed action does not substantially affect public health.

7. The proposed action does not involve substantial degradation of environmental quality.

8. The proposed action does not substantially affect rare, threatened or endangered species or habitats.

9. The proposed action does not detrimentally affect air or water quality or ambient noise levels.

10. 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;

11. The proposed action is individually limited and cumulatively does not have a considerable effect upon the environment or involve a larger commitment for larger actions.

12. The proposed action will promote highway safety and ease of access by eliminating left turn lanes and decreasing causes for traffic congestion at the intersection and in the region.

Further, it appears that the proposed action is compatible with the locality and surrounding project area and appropriate to the physical conditions and capabilities of the area to be served; the existing physical and environmental aspects of the subject area will be preserved; the proposed action will not result in any significant adverse effects to the environment; and the proposed action is in keeping with the objectives and purposes of the project site area, including State mandated policies regarding highway access. The applicant will be responsible for, and comply with, all applicable statutes, ordinances and rules of the federal, state, and county governments.

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APPENDIX A

Botanical Survey

BOTANICAL SURVEY
KA'UPULEHU RESORT CDUAS
TEMPORARY SUBSTATION, WATER RESERVOIR, AND SEWAGE TREATMENT PLANT
KA'UPULEHU, NORTH KONA, ISLAND OF HAWAI'I

by

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Honolulu, Hawai'i

Prepared for: BELT COLLINS & ASSOCIATES

February 1991

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TEMPORARY SUBSTATION, WATER RESERVOIR, AND SEWAGE TREATMENT PLANT
KA'UPULEHU, NORTH KONA, ISLAND OF HAWAI'I

INTRODUCTION

The project site consists of approximately 500 acres of land located mauka of the Ka'upulehu resort area. The Queen Ka'ahumanu Highway crosses the lower portion of the project site dividing it into two. The larger parcel mauka of the highway extends upslope to about the 800 ft. elevation level. The smaller parcel makai of the highway extends downslope to about the 160 ft. contour. An intersection, a temporary electrical substation, a sewage treatment plant, and a water reservoir are planned for the site.

Roughly one-half of the upper parcel and almost all of the smaller, lower parcel are covered by 'a'a lava flows. These are sparsely vegetated. The remainder of the property is covered by very weathered pahoehoe flows which support a dense cover of fountain grass with scattered shrubs and a few trees. Nearer the 800 ft. contour, a few dry forest species are encountered.

Field studies to assess the botanical resources on the project site were conducted on 19 January 1991. The primary objectives of the studies were to 1) describe the major vegetation type on the site; 2) inventory the flora; and 3) search for threatened and endangered plants protected by Federal and State laws. A total of three botanists were used to gather the technical data contained in this report.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the

pertinent literature to familiarize the principal investigator with other studies conducted in the general area. A USGS orthophotoquad and topograhic maps were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries and reference points.

Both parcels were accessed off the Queen Ka'ahumanu Highway. The larger parcel is bound by a gravel road on the Kuki'o side and on the northeast side by a 4-wheel drive road which services a water tank and wells.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, topography, exposure, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium (University of Hawai'i, Manoa) and for comparison with the recent taxonomic literature.

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

DESCRIPTION OF THE VEGETATION

There have been three recent botanical surveys on portions of the project site or on areas adjacent to the site. The survey conducted for the Ka'upulehu resort lands makai of the highway (Char 1985) included the smaller parcel where the proposed intersection is planned. This area was describe as primarily 'a'a lava which was largely barren. In 1988, Char conducted a survey of a water line and maintenance road corridor mauka of the highway and included entirely within the present study site. The corridor was approximately two miles long and varied from 100 to 200 ft. wide. Vegetation consisted of fountain grass grassland on pahoehoe

flows and mostly barren 'a'a flows. The adjacent Kuki'o lands, from along the coastline to about the 640 ft. elevation, were also surveyed by Char in 1984. Vegetation consisted of fountain grass grassland with a few scattered lama trees near the Muhe'enui cinder cone. Closer to the highway, the grassland contained more shrubs and subshrubs as well as a few trees of kiawe. In all three studies no threatened and endangered plants were found on those portions currently within the project site.

The two basic vegetation types recognized in the previous surveys also occur on the project site and are described in detail below.

Fountain Grass Grassland

Approximately half of the project site located above the highway is covered by pahoehoe flows; this is easily picked up on the USGS orthophotoquad as the lighter-colored areas and on the Soil Survey maps (Sato et al. 1973) it is labeled "rLW". These flows are ancient and weathered. Instead of being glassy black like the more recent flows, the surface color is a reddish-brown. In places, the pahoehoe can change from rolling hummocky to rough and broken ("shelly pahoehoe"). A lava tube system, in places collapsed and with large caverns, can be found on the upper elevation portions of the site.

These weathered pahoehoe flows support a rather dense cover consisting of the introduced fountain grass (Pennisetum setaceum) with scattered shrubs and small trees of kiawe (Prosopis pallida). Fountain grass cover on the lower two-thirds of the parcel varies from 50 to 60%; on the upper one-third of the parcel the fountain grass becomes denser with cover 60 to 80%. Common shrubs and smaller shrubs or subshrubs associated with this vegetation type are indigo (Indigofera suffruticosa), 'uhaloa (Waltheria indica), and pluchea (Pluchea symphytifolia); of these three, only the 'uhaloa is a common native. A few other natives which can be

found in smaller numbers include nehe (Lipochaeta lavarum), koali (Ipomoea indica), 'iwa'iwa fern (Doryopteris decipiens), 'ilima (Sida fallax), and a'ali'i (Dodonaea viscosa). Locally common are patches of pili grass (Heteropogon contortus). From about the 600 ft. elevation and to the upper boundary, native trees and shrubs as 'ohi'a (Metrosideros polymorpha), lama (Diospyros sandwicensis), 'akia (Wikstroemia pulcherrima), and naio (Myoporum sandwicense) along with the introduced silk oak tree (Grevillea robusta) are found.

Po'opo'omino cinder cone, although a different substrate type, supports somewhat similar vegetation and is included here within the fountain grass grassland. Around the base of the cinder cone is a ring of kiawe trees, 18 to 25 ft. tall. Vegetation on the cinder cone is denser than on the pahoehoe substrate. Seasonally abundant on this area are the native poppy or pua kala (Argemone glauca) and kakonakona (Panicum torridum), an annual grass.

The grassland is used by feral donkeys and goats. During our field studies we observed a herd of 12 donkeys and two small groups of goats, totaling about seven individuals.

'A'A Lava with Sparse Vegetation

'A'a flows cover almost all of the smaller parcel makai of the highway although a few areas with pahoehoe lava and fountain grass grassland may be found. On the larger parcel mauka of the highway, the tumbled heaps of clinkery, sharp and scoriaceous 'a'a covers about half of the parcel. Plant cover is very sparse, about 1 to 3 %. Fountain grass and pluchea occur in small, scattered patches, usually in depressions. Where the 4-wheel drive road crosses the 'a'a flow, there are more plants of Florida beggarweed (Desmodium tortuosum), indigo, fountain grass, and hairy spurge (Chamaesyce hirta) especially along the margins of the road where the 'a'a has been crushed and compacted.

DISCUSSION AND RECOMMENDATIONS

About one-half of the larger, mauka parcel and almost all of the smaller, makai parcel are covered by 'a'a lava flows which support very sparse vegetation, usually the introduced fountain grass. On the weathered, reddish-brown colored pahoehoe flows fountain grass is dense and shrubs as pluchea, 'uhaloa and indigo are occasionally found. Scattered native trees and shrubs such as 'ilima, 'ohi'a, lama, naio, and a'ali'i can be found on the upper elevation portions of the project site. Kiawe trees occur as scattered individuals throughout the property except at the base of Po'opo'omino cinder cone where the plants form a somewhat dense ring of trees. Locally abundant on the cinder cone are plants of the native poppy or pua kala and the native kakonakona grass.

Of the 43 plant species found on the site, 28 (65%) are introduced or alien; 9 (21%) are endemic, i.e. native only to the Hawaiian Islands; 5 (12%) are indigenous, i.e. native to the islands and elsewhere; and 1 (2%) is originally of Polynesian introduction. None of the native plants inventoried on the project site are officially listed as endangered or threatened; nor are any proposed or candidate for such status (U. S. Fish and Wildlife Service 1989, 1990). All the native species are found in similar environmental habitats throughout the islands.

The proposed infrastructures are not expected to have a significant negative impact on the botanical resources as the vegetation is dominated largely by introduced species as fountain grass. Additionally, the total area which will eventually be disturbed for the proposed intersection, sewage treatment plant, water reservoir, and substation is not large. Given the limited nature of the developments, no recommendations are offered at this time.

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PLANT SPECIES CHECKLIST -- Ka'upulehu Resort CDUAs

A checklist of all those vascular plants inventoried on the ±500-acre Ka'upulehu parcel during the field studies is presented below. The plants are divided into three groups: Ferns, Monocots and Dicots. The taxonomy and nomenclature of the Ferns follow Lamoureux (1984) while the flowering plants, Monocots and Dicots, are in accordance with Wagner et al. (1990). For the most part, common English names follow St. John (1973); Hawaiian names follow St. John (1973) or Porter (1972).

The following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian names, when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands
   - I = indigenous = native to the islands and also to one or more other geographic area(s)
   - P = Polynesian = plants of Polynesian introduction prior to Western contact (1778); not native
   - X = introduced or alien = all those plants introduced intentionally or accidentally by humans after Western contact; not native.

SCIENTIFIC NAME	COMMON NAME	STATUS
FERNS		
NEPHROLEPIDACEAE (Sword Fern Family)		
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy sword fern	X
SINOPTERIDACEAE (Cliffbreak Fern Family)		
Doryopteris decipiens (Hook.) J. Sm.	'iwa'iwa, kumu niu	E
MONOCOTS		
POACEAE (Grass Family)		
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	lovegrass	X
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili, pili grass	I?
Panicum torridum Gaud.	kakonakona	E
Pennisetum setaceum (Forsk.) Chiov.	fountain grass	X
DICOTS		
ASTERACEAE (Daisy Family)		
Ageratum conyzoides L.	maile hohono	X
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X
Emilia fosbergii Nicol.	red pua-lele	X
Gnaphalium purpureum L.	purple cudweed	X
Lipochaeta lavarum (Gaud.) DC.	nehe	E
Pluchea symphytifolia (Mill.) Gillis	pluchea	X
Sonchus oleraceus L.	sow thistle, pua-lele	X
Tridax procumbens L.	coat buttons	X
CAMPANULACEAE (Bellflower Family)		
Wahlenbergia gracilis (G. Forster) A. DC.	wahlenbergia	X
CAPPARACEAE (Caper Family)		
Capparis sandwichiana DC.	puapilo, maiapilo	E
CHENOPODIACEAE (Goosefoot Family)		
Chenopodium carinatum R. Br.	keeled goosefoot	X
Chenopodium murale L.	nettle-leaved goose-foot	X
CONVOLVULACEAE (Morning Glory Family)		
Ipomoea indica (J. Burm.) Merr.	koali	I

SCIENTIFIC NAME	COMMON NAME	STATUS
CUCURBITACEAE (Squash Family)		
Cucumis dipsaceus Ehrenb. ex Spach	wild cucumber	X
Momordica charantia L.	wild bittermelon	X
EBENACEAE (Persimmon Family)		
Diospyros sandwicensis (A. DC.) Fosb.	lama	E
EUPHORBIACEAE (Spurge Family)		
Chamaesyce hirta (L.) Millsp.	hairy spurge	X
FABACEAE (Pea Family)		
Acacia farnesiana (L.) Willd.	klu	X
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X
Indigofera suffruticosa Mill.	indigo, 'iniko	X
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X
GENTIANACEAE (Gentian Family)		
Centaurium erythraea Raf.	bitter herb	X
LAMIACEAE (Mint Family)		
Hyptis pectinata (L.) Poit.	comb hyptis	X
Hyptis suaveolens (L.) Poit.	hyptis	X
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	E
MYRTACEAE (Myrtle Family)		
Metrosideros polymorpha Gaud.	'ohi'a, 'ohi'a-lehua	E
PAPAVERACEAE (Poppy Family)		
Argemone glauca (Nutt. ex Prain) Pope	pua kala, native poppy	E
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	common purslane	X
Portulaca pilosa L.	'ihi	X

SCIENTIFIC NAME	COMMON NAME	STATUS
PROTEACEAE (Protea Family) Grevillea robusta A. Cunn. ex R. Br.	silk oak	X
RUBIACEAE (Coffee Family) Morinda citrifolia L.	noni	P
SAPINDACEAE (Soapberry Family) Dodonaea viscosa Jacq.	a'ali'i	I
STERCULIACEAE (Cocoa Family) Waltheria indica L.	'uhaloa, hi'aloa	I?
THYMELAEACEAE (Akia Family) Wikstroemia pulcherrima Skottsb.	akia	E
VERBENACEAE (Verbena Family) Lantana camara L.	lantana, lakana	X

APPENDIX B

Archaeological Survey

Report 897-030691

Archaeological Inventory Survey
Kaupulehu Mauka Lands Project Area

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

by

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Supervisory Field Archaeologist

Susan T. Goodfellow, Ph.D.
Laboratory Director

and

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Principal Archaeologist

Prepared for

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Western Division, Hawaii Office
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March 1991

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SUMMARY

Between October 12-December 11, 1990, Paul H. Rosendahl, Ph.D., Inc., (PHRI) conducted an archaeological inventory survey at the Kaupulehu Mauka Lands project area, in the upland portion of the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK: 3-7-2-03:3). During the survey, 77 sites (190 component features) were located. Of the 77 sites, 17 had been previously located (but not recorded); 60 sites were newly identified. The sites included the following formal feature types: alignment, C-shape, lava tube cave, cairn, clear 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.

The data from the current project indicates the project area was occupied both historically and prehistorically, potentially as early as 1450 AD. The occupation was most likely temporary.

Of the 77 sites identified in the project area, 25 sites assessed as significant for information content only are recommended for no further work. Sixteen sites assessed as significant for information content only are recommended for further data collection. Twelve sites assessed as significant for information content and as excellent examples of site types are recommended for further data collection and preservation with interpretive development. The remaining sites have various assessments and recommendations. Detailed assessments and recommendations for all sites are presented in the Conclusion section.

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INTRODUCTION

BACKGROUND

At the request of Mr. Roger Harris of Potomac Investment Associates (PIA), Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the approximately 2,288-ac Kaupulehu Mauka Lands project area, located in the Land of Kaupulehu, North Kona District, Island of Hawaii (TMK:3-7-2-03). The primary objective of the survey was to provide information sufficient for (a) the refinement of a current master plan, (b) preparation and submission of various state and county permit applications, and (c) satisfaction of all historic preservation inventory *requirements* of the Hawaii County Planning Department (HCPD) and the Department of Land and Natural Resources-State Historic Preservation Office (DLNR-HPP/SHPO).

The field work for the project was conducted October 12-December 11, 1990 under the supervision of Supervisory Archaeologist James A. Head, B.A., and under the overall direction of Principal Archaeologist Dr. Paul H. Rosendahl. Field inspections were made by Supervisory Archaeologist Alan T. Walker, B.A., on October 12 and November 16, 1990. Approximately 1,080 man-hours of labor were expended in conducting the field work.

SCOPE OF WORK

The basic purpose of the inventory survey was to identify all sites and features of potential archaeological significance within the 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; 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 current survey were fourfold: (a) to identify (find and locate) all sites and site complexes present within the project area; (b) to evaluate the potential general significance of all identified cultural 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 mitigation work that might be necessary or appropriate.

Based on a review of readily available background literature, the findings of an archaeological resources assessment study of the Kaupulehu Phase II Master Plan project area (Walker and Rosendahl 1990), familiarity with the current requirements of pertinent review authorities, information provided by Mr. Harris of PIA, and discussions with DLNR-HPP/SHPO staff archaeologists, the following specific tasks were determined to constitute an appropriate scope of work for the present project:

1. Review of archaeological and historical literature relevant to the project area, and conduct limited historical documentary research (emphasis on readily available literature and documentary sources);

2. Conduct 100% coverage, low-level (c. 30-50 ft) altitude aerial survey (helicopter) of the entire c. 1,300-ac project area, with special emphasis on identifying and plotting on aerial photographs and/or maps (a) sites observed (both previously known and newly encountered), (b) areas believed likely to contain new (previously not known) sites, and (c) areas devoid of sites (e.g., relatively recently and/or extensively eroded lands, mechanically altered lands);

3. Conduct (a) 100% coverage, variable-intensity surface survey of the high sensitivity (c. 200 ac), and (b) sample coverage (c. 375 ac, c. 50% sample), variable-intensity surface survey of selected parts of the moderate sensitivity portion of the project area;

4. Conduct limited subsurface testing (by hand-tool excavations) of selected sites and features identified within the project area (a) to determine the presence or absence of potentially significant buried cultural features or deposits, and (b) to obtain suitable samples for age determination analyses; and

5. Analyze background and field data, and prepare appropriate reports.

The inventory survey was carried out in accordance with the standards for inventory-level survey recommended by the DLNR-HPP/SHPO. The significance of any 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), (b) the criteria for evaluation of traditional cultural values prepared by the National Advisory Council on Historic Preservation, and (c) PHRI Cultural Resource Management (CRM) value modes. All of the above criteria are discussed in detail in the Conclusion section.

PROJECT AREA DESCRIPTION

The project area is bordered on the northwest by Queen Kaahumanu Highway and on a portion of the northeast boundary by the Conservation District Boundary. The eastern limits of the area are generally drawn by Kiholo-Kaupulehu Trail (Site 1319), and the western limits is the western boundary of Kaupulehu Ahupua'a. The southern boundary of the project area is the Hawaii Belt Highway (Mamalahoa Highway)(*Figures 1 and 2*).

The project area terrain ranges in elevation from c. 200 ft AMSL (above mean sea level) (61 m) to c. 2,140 ft (653 m) 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. In addition to cinder cones (including Poopoomino and Puu Mau) and volcanic vents (including Puhi-a-Pele, Puu Nahaha, and Puu Kolokole), both aa and pahoehoe 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 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, five are within the current project area (Aa Lava Flows [includes historic aa flows], Pahoehoe Lava Flows, Cinder Land, Kaimu Extremely Stony Peat, and Punaluu Extremely Rocky Peat). These five types are shown on *Figure 3* and are discussed further below:

Aa Lava Flows - Comprises c. 740 acres of the project area. This soil/terrain type includes the historic flow from Puhi-a-Pele (AD 1801) in the southwest portion of the project area. 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" (1973:34).

Pahoehoe Lava Flows - Comprises c. 932 acres 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 ohia trees, ohelo berry, and aalii have gained a foothold in cracks and crevices" (1973:34).

Cinder Land - Consists of c. 38 acres of the project area. This type is limited to the volcanic cinder cones such as Poopoomino and Puu Mau located in the Kaupulehu Mauka area. According to Sato et al., cinder land consists "of bedded cinders, pumice, and ash...[t]he 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 pastureland because of its loose consistency and poor trafficability" (1973:14).

Kaimu Extremely Stony Peat - Comprises c. 527 acres of the project area. This soil/terrain type is present in inland sections of the project area above c. 1,300 ft AMSL. According to Sato et al., "[t]he

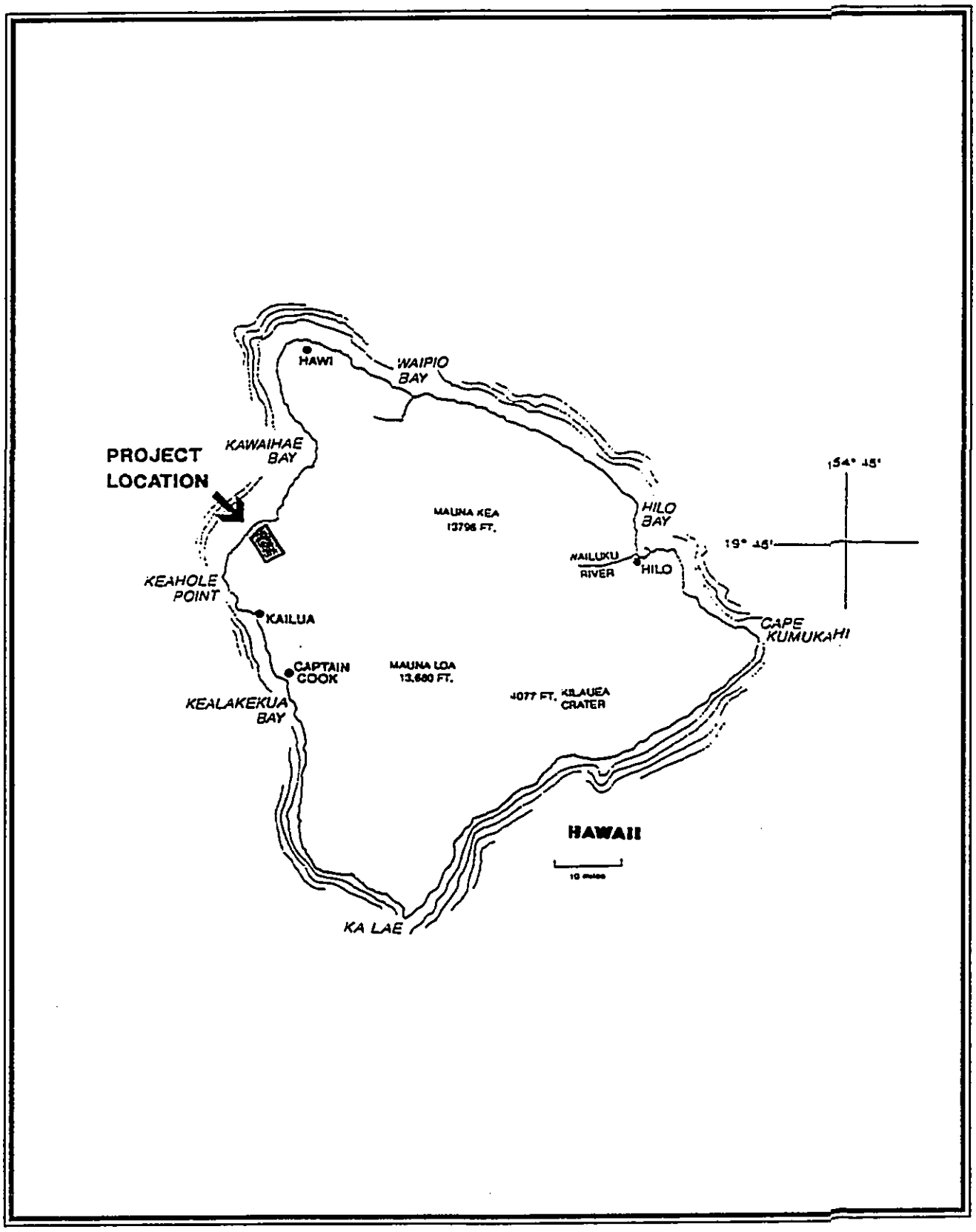
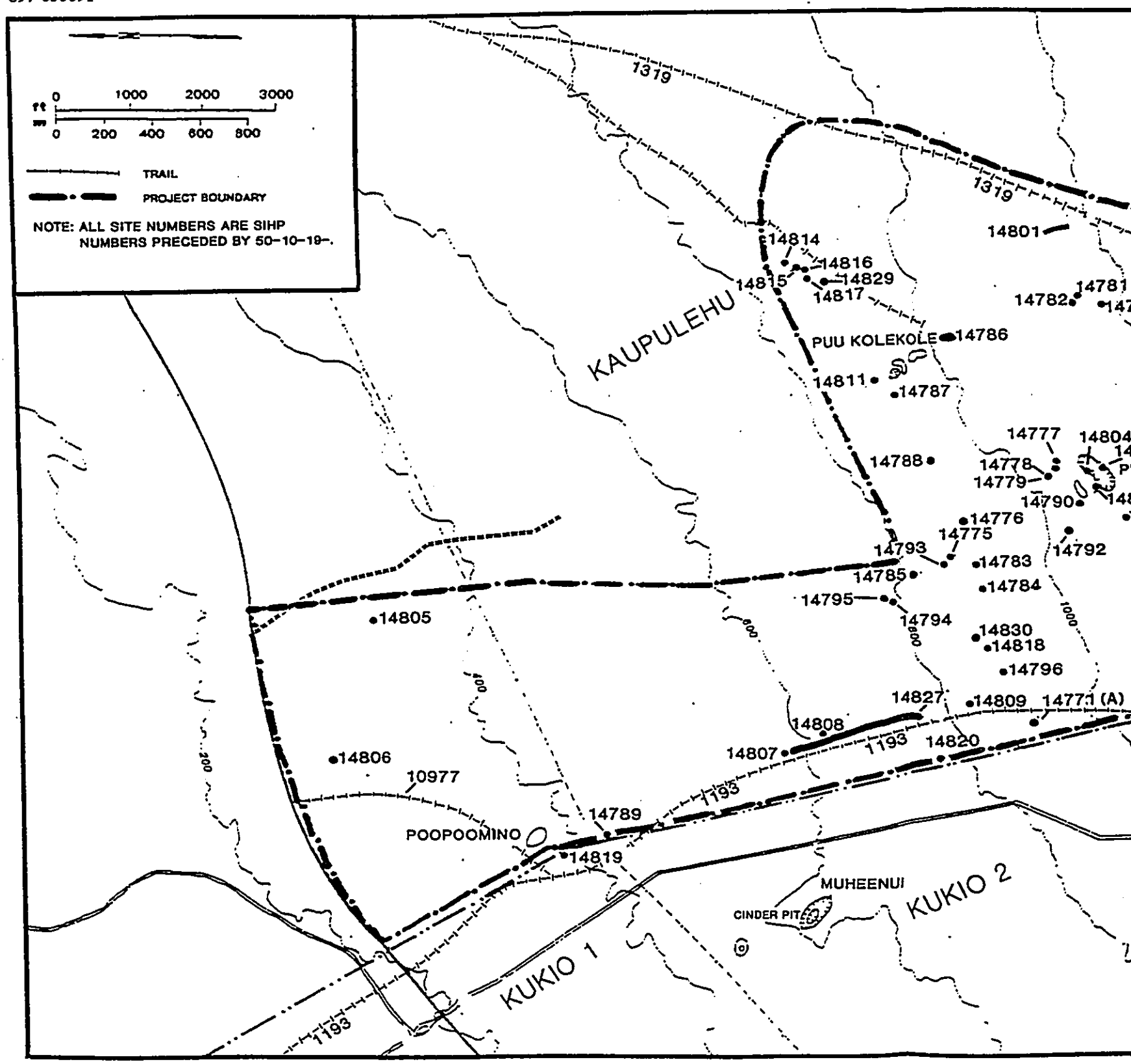


Figure 1. Project Area Location Map


0 1000 2000 3000
ft
m
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TRAIL
PROJECT BOUNDARY
NOTE: ALL SITE NUMBERS ARE SIHP NUMBERS PRECEDED BY 50-10-19-.
1319
1319
14801
14814
14816
14829
14815
14817
14782
14781
KAUPULEHU
PUU KOLEKOLE
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14811
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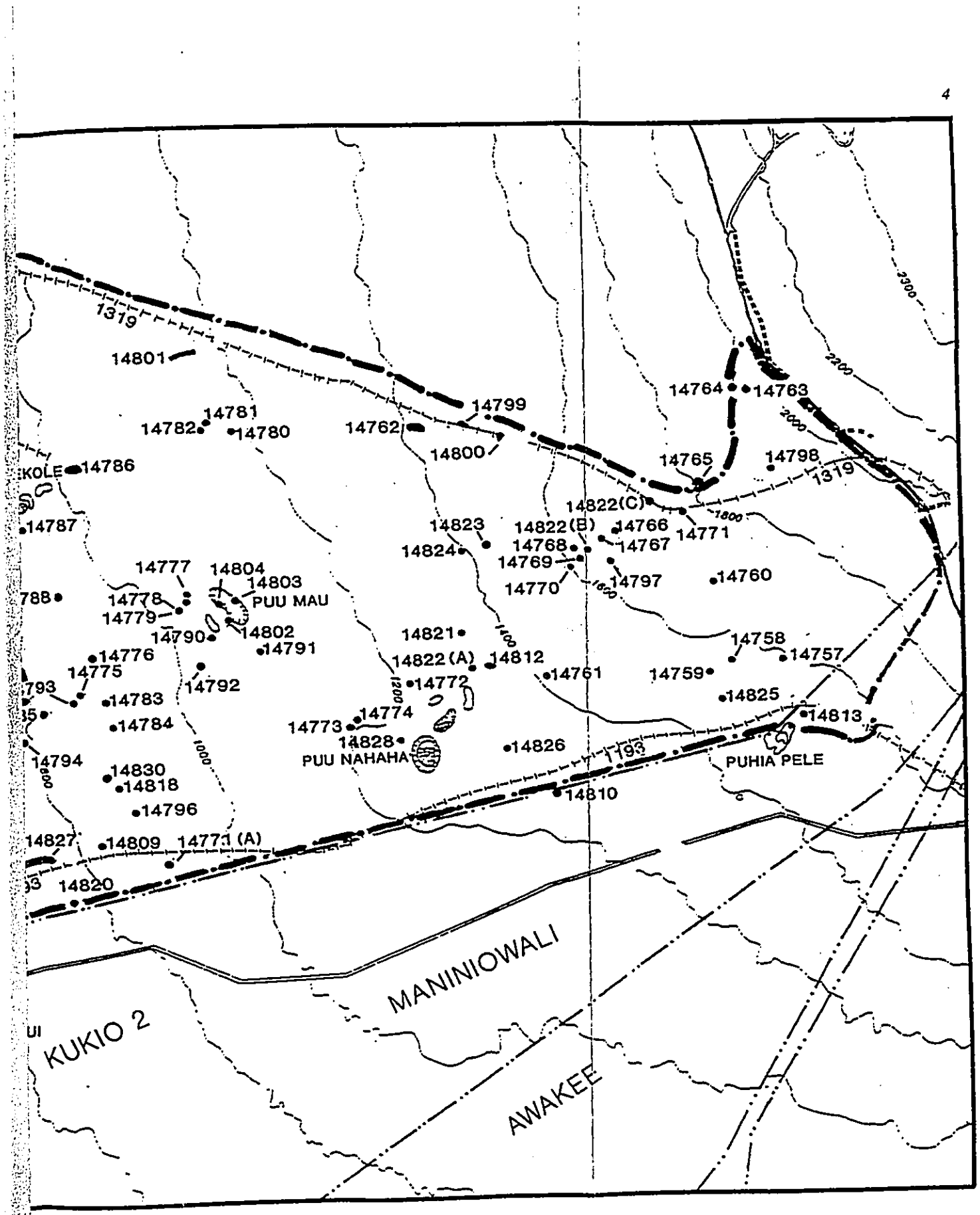
MUHEENUI
CINDER PIT
KUKIO 2
KUKIO 1
1193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14822(C)
14823
14822(B)
14766
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14824
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14797
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14804
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PUU MAU
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14822 (A)
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14784
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PUU NAHAHA
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1193
PUHIA PELE
14794
14830
14818
14810
14796
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14809
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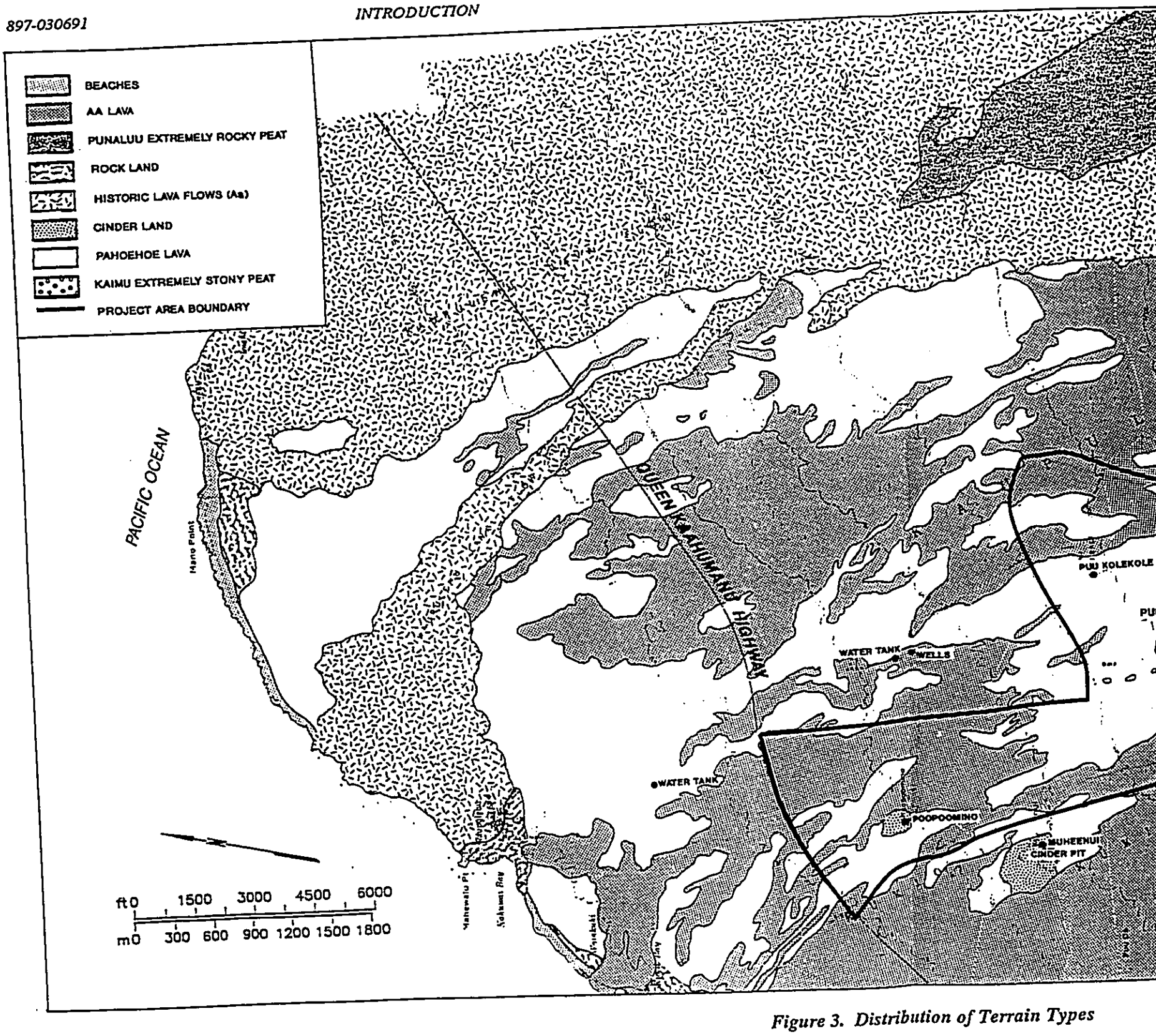
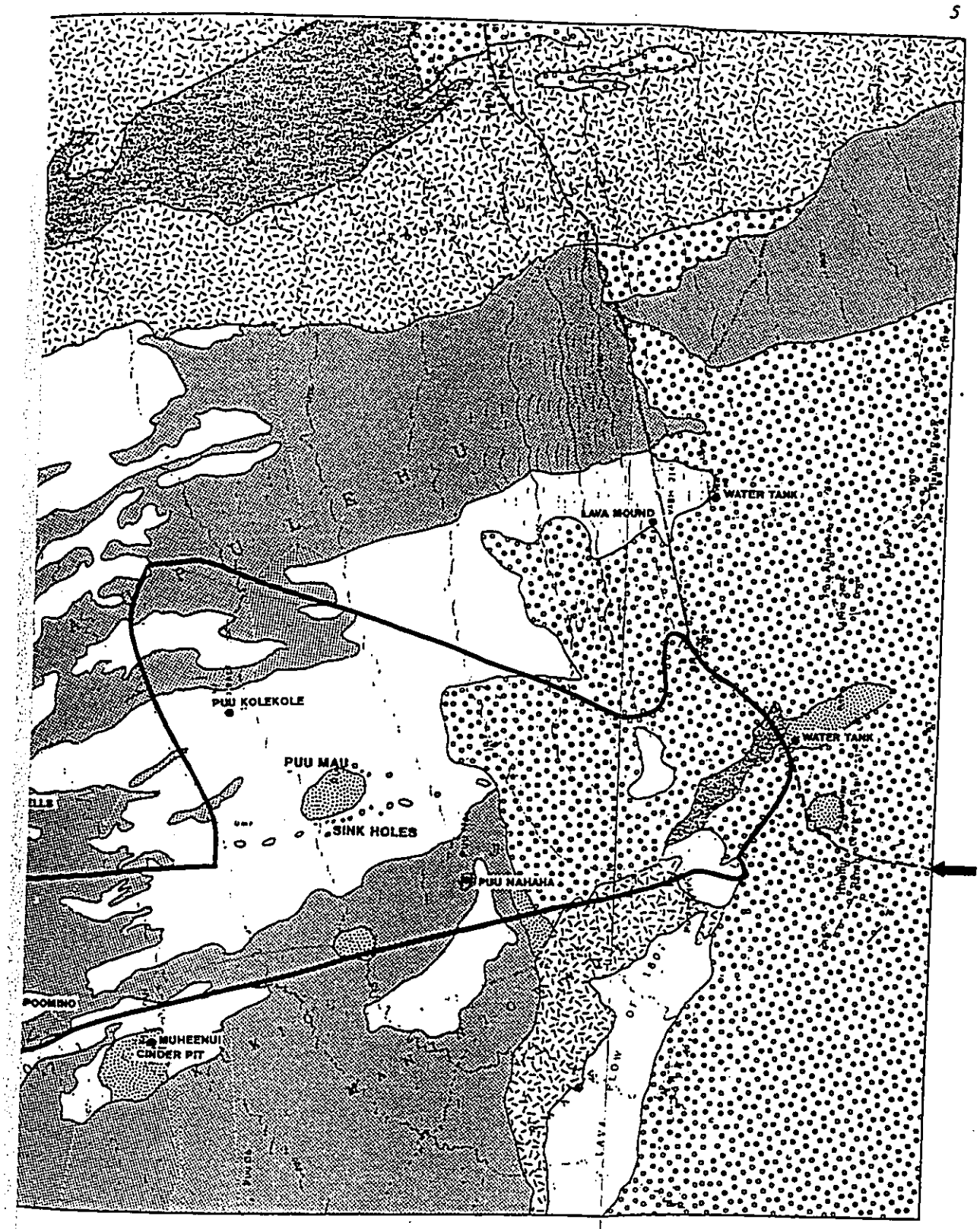


Figure 3. Distribution of Terrain Types



ɔn of Terrain Types

Kaimu series consists of well-drained, thin organic soils over Aa lava...[i]n a representative profile the surface layer is very dark brown extremely stony peat about three inches [0.08 m] thick. It is underlain by fragmental Aa lava...[t]his soil is not suitable for cultivation. Most of it is in native woodland" (1973:22).

Punaluu Extremely Rocky Peat - Comprises c. 34 acres in the project area. This soil/terrain type is present in a southwestern, inland section of the project area, above c. 940 ft AMSL. According to Sato et al., "[t]he Punaluu series consists of well-drained, thin organic soils over pahoehoe lava bedrock...[r]ock outcrops occupy 40 to 50 percent of the surface. In a representative profile the surface layer is black peat about 4 inches [0.1 m] thick. It is underlain by pahoehoe lava bedrock" (1973:48).

Annual rainfall in the general vicinity of the project area is an estimated 10-20 inches (Armstrong 1983). Vegetation in the project area is diverse. Introduced fountain grass (*Pennisetum setaceum* [Forsk.] Chiev.) is present in the lower and intermediate elevations. Also present are the native *pili* grass (*Heterpogon contortus* [L.]), and scattered native and exotic shrubs including *'ilima* (*Sida cordifolia* L.), indigo (*Indigofera suffruticosa* [Mill.]), *kiawe* (*Prosopis pallida* [Humb. and Bonpl. ex Willd.] HBK), and *lama* (*Diospyros ferra* var. *sandwicensis* [A.DC.] Fosb.). In the highest elevations of the intermediate zone are silver oak (*Grevillea robusta* [A.Cumm.]) and occasional *'ohi'a-lehua* (*Metrosideros polymorpha* [Gaud.] Rock).

In the upper elevations, the grasslands give way to areas of mixed and secondary forests, and in the extreme southeast portion of the project area is a small native forest. The uplands are home to a variety of species. On the bare upland lava flows are a rare *'ohi'a-lehua* and fountain grass; vegetation on older flows is dense and diverse. The more mature forests have a groundcover dominated by fountain grass, and commonly include lantana (*Lantana camara* L.), guava (*Psidium guajava* L.), *'ohi'a-lehua*, air plant (*Kalanchoe pinnata* Lamm.), *pa-nini* (*Opuntia megacantha* Salm-Dyck), balloon plant (*Gomphocarpus physocarpus* E. Meyer), Christmas-berry (*Schinus terebinthifolius* Reddi), *hala-pepe* (*Pleomele aurea* Mann [N.E.Br.]), and *kukui* (*Aleurites moluccana* [L.] Willd.), et al.

For a more detailed list of vegetation in the project area refer to Camara (1989).

A vegetation map initially presented in Walker and Rosendahl (1990) has been modified to show the bounds of the present project area *(Figure 4)*. 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, 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 infrared (1979 and 1989, 1"=1600' scale approx.) aerial photographs, and (c) field observations made during previous surveys and the Phase II assessment. The vegetation map should be considered as generalized and subject to modification.

There are seven major vegetation types in the project area:

1. **Barren Lava with 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 solitary specimens of *'ohia* (*Metrosideros collina* [Forst.] Gray subsp. *polymorpha* [Gaud.] Rock), *kiawe*, and *lama*;

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*, and *'ilima*. Solitary *pua-pilo* (*Capparis sandwichiana* DC.), indigo, *lama*, and *kiawe* may also be present;

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.);

4. **Scrub Grassland** - At lower elevations, this type includes sparsely distributed grasses, *'uhaloa*,

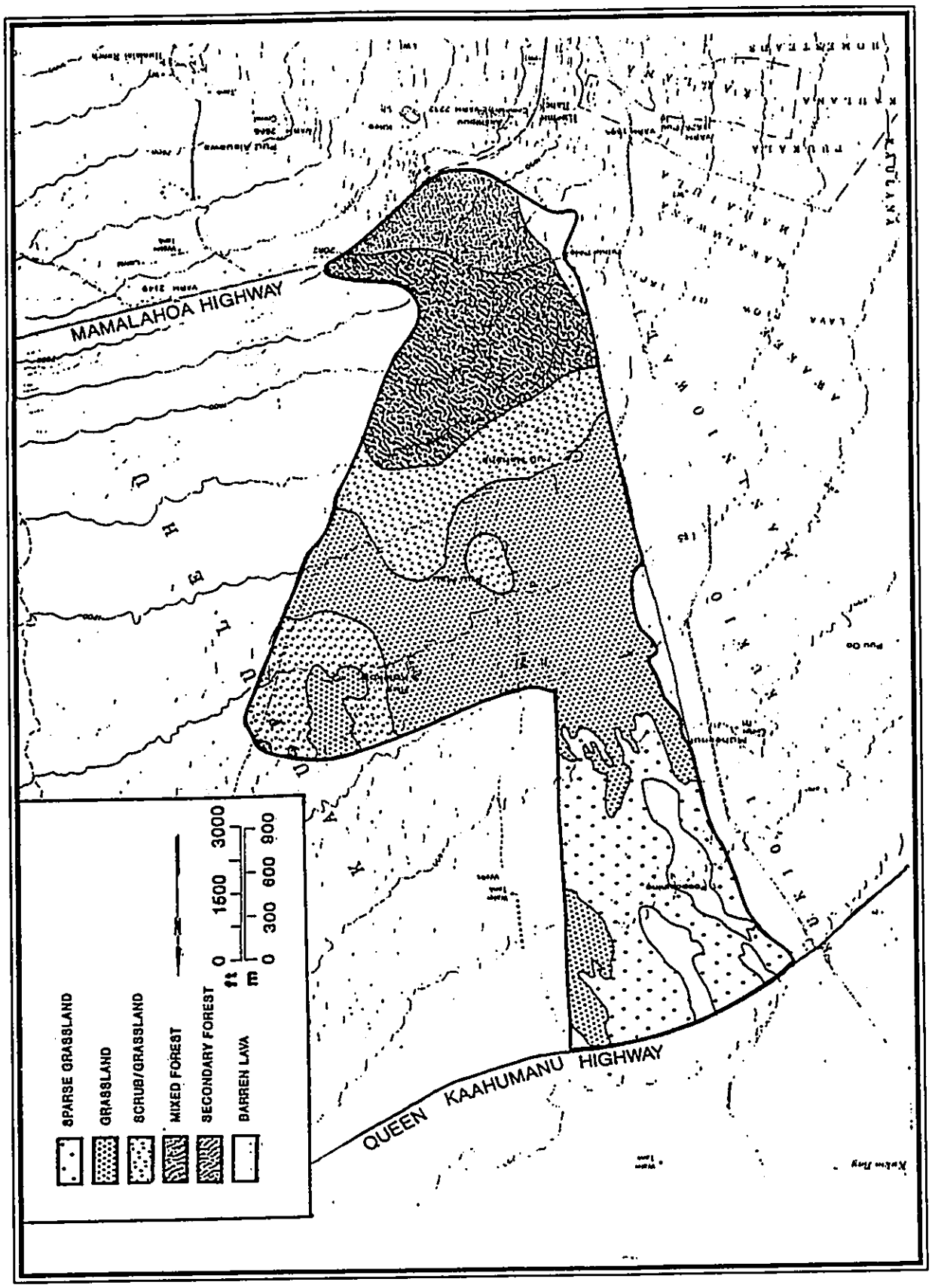


Figure 4. Distribution of Vegetation Types

'ilima, and scattered *kiawe*. At higher elevations, covering a large part of the land between c. 500-1,700 ft AMSL, the type also includes occasional solitary trees such as silver oak, *lama*, and *'ohia*;

5. **Dryland Native Forest** - Between c. 1,300-2,100 ft AMSL. One area of predominately dryland native forest is found within the current project area. This is located in the extreme southeast corner and possesses an understory comprised largely of various grasses. In addition to *lama* and *'ohia*, this zone includes *hala-pepe*, *'uhi'uhi* (*Mezoneuron kauaiense* [Mann] Bbd.), *koki'o* (*Kokia drynarioides*), *'ohe makai* (*Reynoldsia huehuensis*), and *kauila* (*Colubrina oppositifolia* Brongn.);

6. **Secondary Forest and Scrub** - This zone is present in inland portions of the project area between 1,525-2,050 ft AMSL. The zone includes several vegetation communities of predominately introduced species. Silver oak, Christmas-berry, and lantana are common components of this zone. Occasional native trees (including *lama* and *'ohia*) are also present; and

7. **Mixed Forest and Scrub** - This zone is present in inland portions of the project area between 1,300-2,100 ft AMSL. The zone lies between and consists of a mix of the Dryland Native Forest zone and the Secondary Forest and Scrub zone. This zone contains greater numbers of native species than the Secondary Forest and Scrub zones, and contains more introduced species than the Dryland Native Forest zone. This zone could be considered Dryland Native Forest in poor condition.

Most of the southwest corner of the project area (consisting of Kaimu Extremely Stony Peat terrain and either Mixed Forest or Secondary Forest vegetation) has been recently used as cattle pasture. Major portions of this area may have been modified recently by chaining or bulldozer grubbing to improve pastureland. Based on the appearance and on the vegetation distribution pattern, the modifications may extend down to 1,200-1,300 ft AMSL. The Dryland Native Forest zones in the southeast portion of the project area appears to have been largely unused during recent times.

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.

Over the years there have been a number of archaeological studies conducted within Kaupulehu *ahupua'a* (*Figure 5*). 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). 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

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* *B.P. Bishop Museum site designation system: all one-, two-, and three-digit site numbers are prefixed by 50-Ha-D22- (50=State of Hawaii, Ha=Island of Hawaii, D=North Kona District, 22=Land of Kaupulehu).*

\+ *State Inventory of Historic Places (SIHP) site designation system: all four- and five-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"]).*

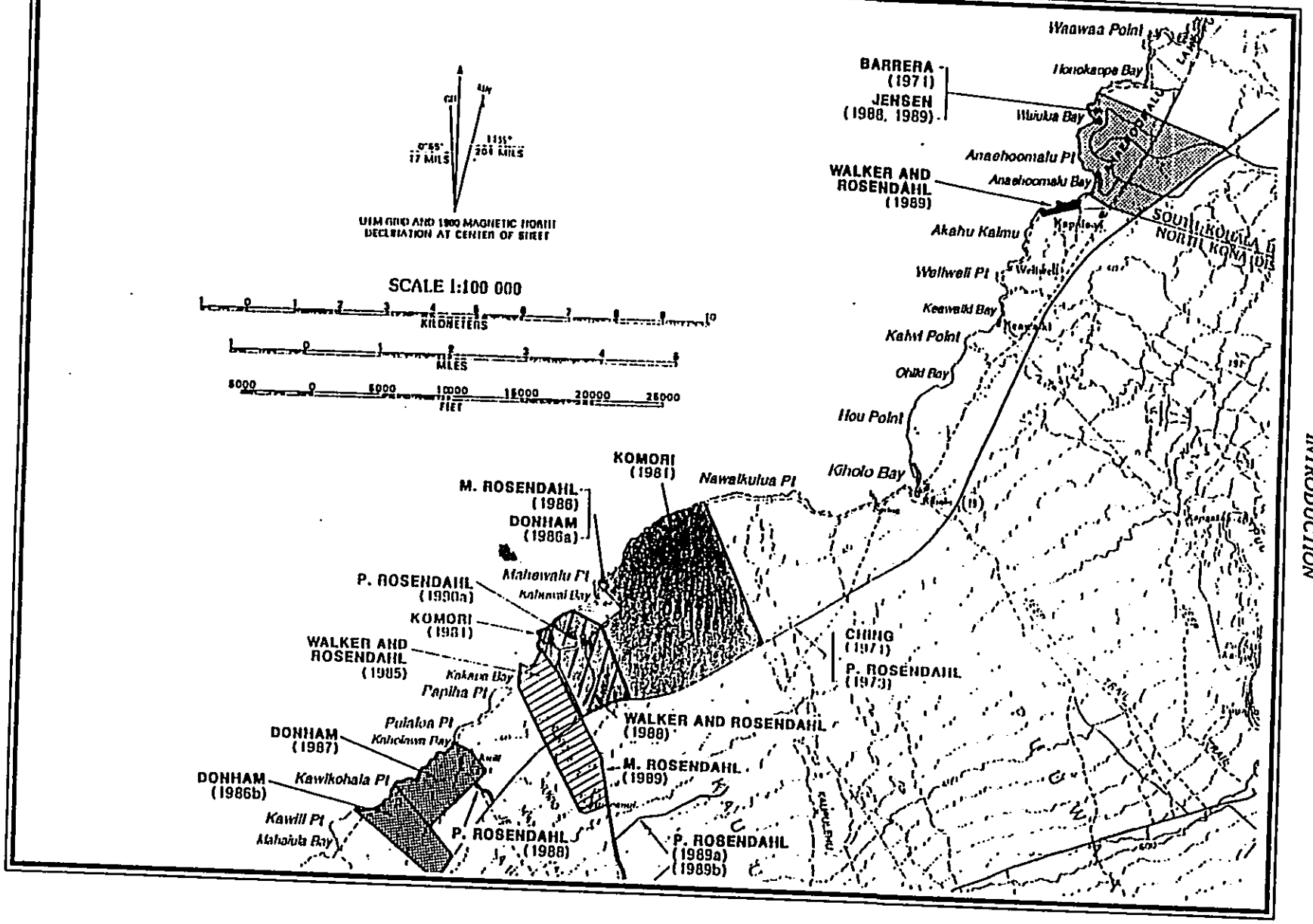

Figure 5. Previous Archaeological Work Location Map

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.

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. Subsequently, an archaeological mitigation plan for data recovery, interim site preservation, and burial treatment was prepared (Jensen and Rosendahl 1989) and the archaeological mitigation field work has been implemented. At present, only an interim report summarizing the mitigation field work has been completed (Sullivan and Rosendahl 1989) and the final report is forthcoming.

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.

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).

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) was 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). During the current project a sample of the sites identified during this Phase I survey was recorded to inventory-level standards. The sample included three temporary habitation caves, pahoehoe excavations, and an enclosure.

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 ara. 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. During the current project, a sample of the five sites (the two trail sections) is addressed.

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 is elevation from c. 850-1,350 ft AMSL. The proposed reservoir site consists of c. 2.1 ac 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. During the current survey, both sites were relocated.

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. No further work was recommended for three of the four sites. The last site (Temp. No. 1008-1), was given a provisional value pending radiocarbon analysis results. It was recommended that development work avoid the site until the analysis could be obtained (P.H. Rosendahl 1991:3).

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.

SUMMARY OF HISTORICAL DOCUMENTARY RESEARCH

The *ahupua'a* of Kaupulehu, in North Kona District of the Big Island has a rich and well-documented history. The name Kaupulehu probably derives from Hawaiian words related to legendary events that are said to have occurred there. The stories generally concern visits by the gods Pele or Kane, and involve cooking in an *imu* or sharing food, especially breadfruit. In one legend, Pele punishes a young girl who is selfish. In the legends concerning Kane, the god ends a drought and famine in the area, and creates a fresh water spring at the coast.

There was frequent contact between early western explorers and the native people in the Kaupulehu area. Archibald Menzies, traveling with Vancouver in 1792, was the first foreigner to describe the area. He characterized it as bleak, barren, and rugged, and suggested that the natives could only survive by fishing. King Kamehameha himself enjoyed fishing in the area in his later years and in 1810 had large fish ponds constructed at Kiholo. The ponds were destroyed by the lava flow of 1859.

When the American Captain Simon Metcalf visited Kaupulehu in his ship *Eleanor*, his crew roughly handled one of the Hawaiian chiefs, Kame'eiamoku. The chief vowed to capture the next ship to visit. Ironically the next western ship turned out to be the *Fair American*, captained by Metcalf's son Thomas. The Hawaiians slaughtered the crew, except for Isaac Davis, upon whom they took pity and nursed back to health. Davis and another Englishman, John Young, became advisors to King Kamehameha.

In 1823, the English missionary William Ellis traveled around the entire Island of Hawaii. He traveled by canoe from Kawaihae to Kailua, and along the way he noted villages, an abandoned *heiau*, and a large, well-stocked fishpond. Unfortunately it was late in the evening when he arrived in Kaupulehu. The villagers were already asleep, and Ellis recorded nothing about the village itself.

There is evidence that the Hawaiian inhabitants of Kaupelehu also manufactured salt, harvested seaweed, and practiced some agriculture. They were probably able to raise sweet potatoes and bananas (traditional crops) and melons and pineapples (introduced from the west). In addition they may have tended upland garden plots and gathered other upland resources. In the early 19th century, at the orders of their chiefs, many of the Hawaiians abandoned their crops to harvest sandalwood for the lucrative trade with China. In many areas this resulted in famine.

At the time of the Great Mahele, when the traditional Hawaiian landholding system was replaced with a western system based on private ownership, Kaupulehu was awarded to Lot Kamehameha. He chose this land because of the valuable fish ponds it included. Fishing remained the dominant economic activity in the *ahupua'a* until ranching overtook it in the mid-19th century. As in other parts of Hawaii, the native population of Kaupelehu dwindled as ranching increased in the area. 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.

FIELD METHODS AND PROCEDURES

On October 12, 1990, PHRI Supervisory Archaeologists Alan T. Walker, B.A., and James Head, B.A., accompanied by Field Archaeologist Michel Fager conducted aerial survey of the project area using a helicopter piloted by Mr. Kaohu Sproat of Mauna Kea Helicopters, Inc. The archaeologists began the helicopter survey in the *makai* portion of the project area (Queen Kaahumanu Highway). Using a series of overlapping sweeps oriented approximately east/northeast-west/southwest, all of the originally designated project area and all identified trails were inspected *(Figure 6)*. The extreme northeast portion of the current area was not subjected to aerial reconnaissance, since it was added on at a later date. Aerial sweeps varied between 15-30 m above ground level, depending on the terrain and vegetation. Visibility within the pahoehoe and aa lava flows was good, except in areas of low grass or other vegetation. As the survey progressed upslope, to about 1,300 ft AMSL, visibility became moderate due to forested areas and heavier grass. The extreme southwest corner of the project area (1,600-2,000 ft AMSL) had such dense forests that aerial survey of this region was not productive. All visible trails were followed out and were plotted from the air, and all previously located sites were viewed from the air.

The aerial reconnaissance identified 36 sites (two previously identified sites, four previously located sites that had not been previously recorded, and 30 newly identified sites). The two previously identified sites were Site 1193, Kukio-Huehue Trail, and Site 1319, Kiholo-Kaupulehu Trail. The four sites that had not been previously recorded were PHRI Temporary Sites 642-1, 642-2, 642-3 (Walker & Rosendahl 1990); and PHRI Temporary Site 851-1 (Rosendahl 1990c). The newly identified sites (30) were assigned sequential numbers prefixed by "AS-" and were recorded in a field notebook during the flight. Lengths of pink flagging tape (with the site designation written on them) were tied to weights and dropped from the helicopter onto the site. The sites were later reassigned PHRI temporary numbers prefixed by "897-" (e.g., 897-1). As sites were identified from the air, they were plotted onto a 1"=750' scale photocopy of aerial photographs provided by Potomac Investment Associates.

The ground survey covered 100% of the project area. High sensitivity areas, as outlined in Walker and Rosendahl (1990), were covered by way of pedestrian transects spaced

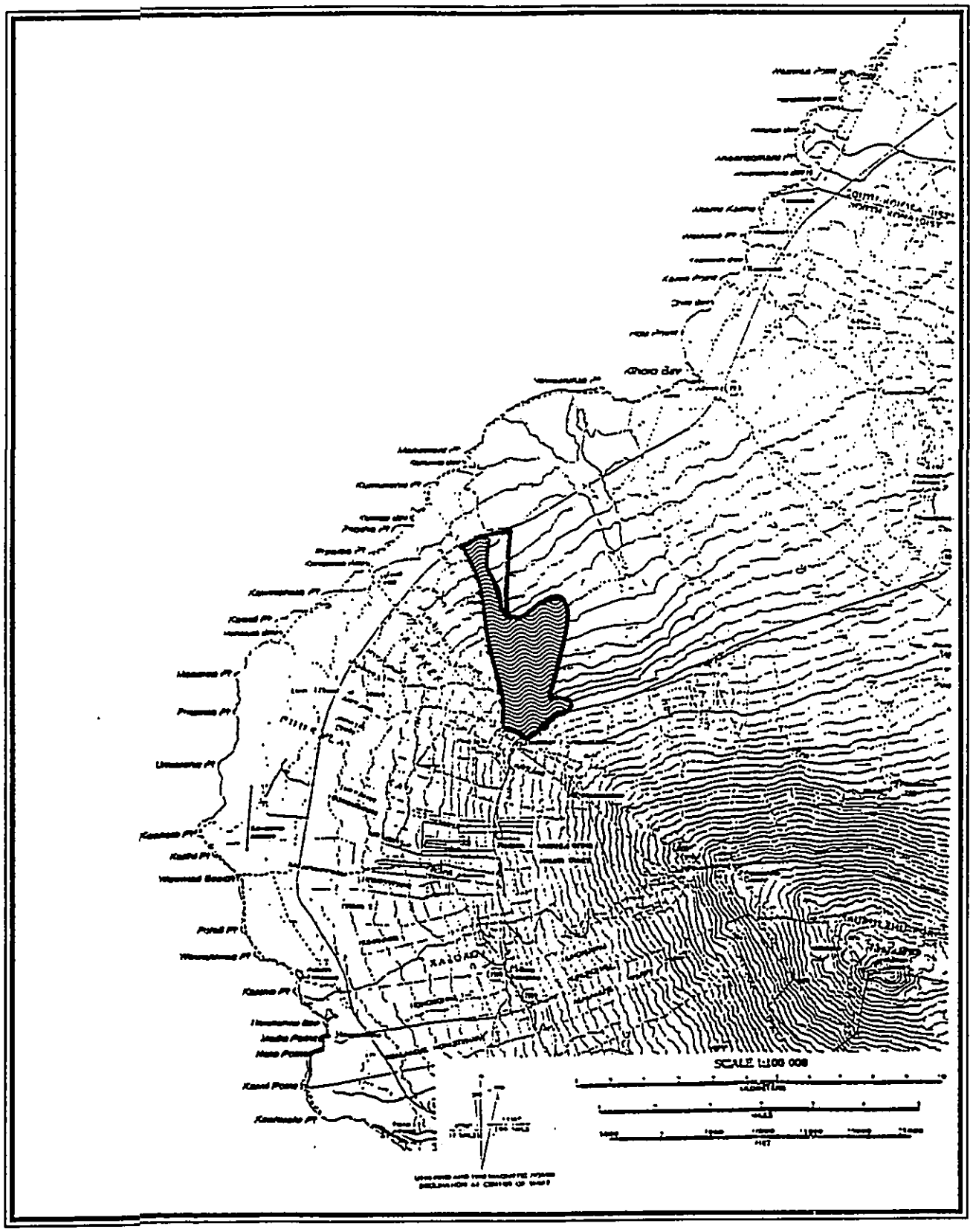

Figure 6. Aerial Survey Coverage Map

at intervals of ten meters or less. The remainder of the project area was covered using transects intervals of 20-30 m *(Figures 7 and 8)*. The methodology employed for the ground survey was somewhat unique. A survey area such as the present, is usually examined by way of a series of overlapping pedestrian transects. Because of the unique topography of the project area, however, this methodology was abandoned for one more appropriate. Present in the project area is a major *mauka/makai* lava tube system that extends from Mamalahoa Highway north through the project area, most likely to Queen Kaahumanu Highway and perhaps to the Pacific Ocean. This tube system has collapsed in places, with sinkholes resulting. Many of the tubes are accessible. It was determined that the most productive method of survey would be to traverse as many of the tubes as possible. In other words, rather that executing the standard overlapping transects, the priority would be to first follow out the tube system noting cultural manifestations as they were encountered. Subsequent to this, the areas between the tubes would be examined with a diminished intensity (intervals of 20-30 m). Using this survey design, the major tube line was examined, as were several other large tube systems in the uplands and the midlands around Puu Mau and around Puu Kolekole.

All known trails were subjected to 100% high intensity coverage, and features and sites associated with the trails were noted. Walker and Rosendahl (1990) notes that the trails (1193 and variants; 1319 and variants within the project area) are archaeologically sensitive.

All sites were described on standard PHRI site survey record forms and were photographed using 35 mm black-and-white film (PHRI Roll Nos. 1587-1593 and 1598-1600). Detailed recording of sites included written descriptions, measurements, and plan maps. Each site, or the primary feature within the site complex, was marked with pink and blue flagging tape, and with an aluminum tag bearing the temporary site number, date, initials of recorder, the letters "PHRI," and the PHRI project number (90-897). This aluminum tag was usually tied to a small stone, then the stone was wrapped in pink/blue flagging tape (with the same information written on it) and was placed in a prominent area of the site. Previously recorded sites were labeled with the appropriate site number; all newly identified sites were assigned one- or two-digit PHRI temporary field numbers prefixed with "897-," beginning with "897-1." All sites were subsequently assigned permanent State Inventory of Historic Places (SIHP) site numbers *(Table 1)*.

During the recording of the sites, all possible diagnostic artifacts and potential radiocarbon samples were collected.

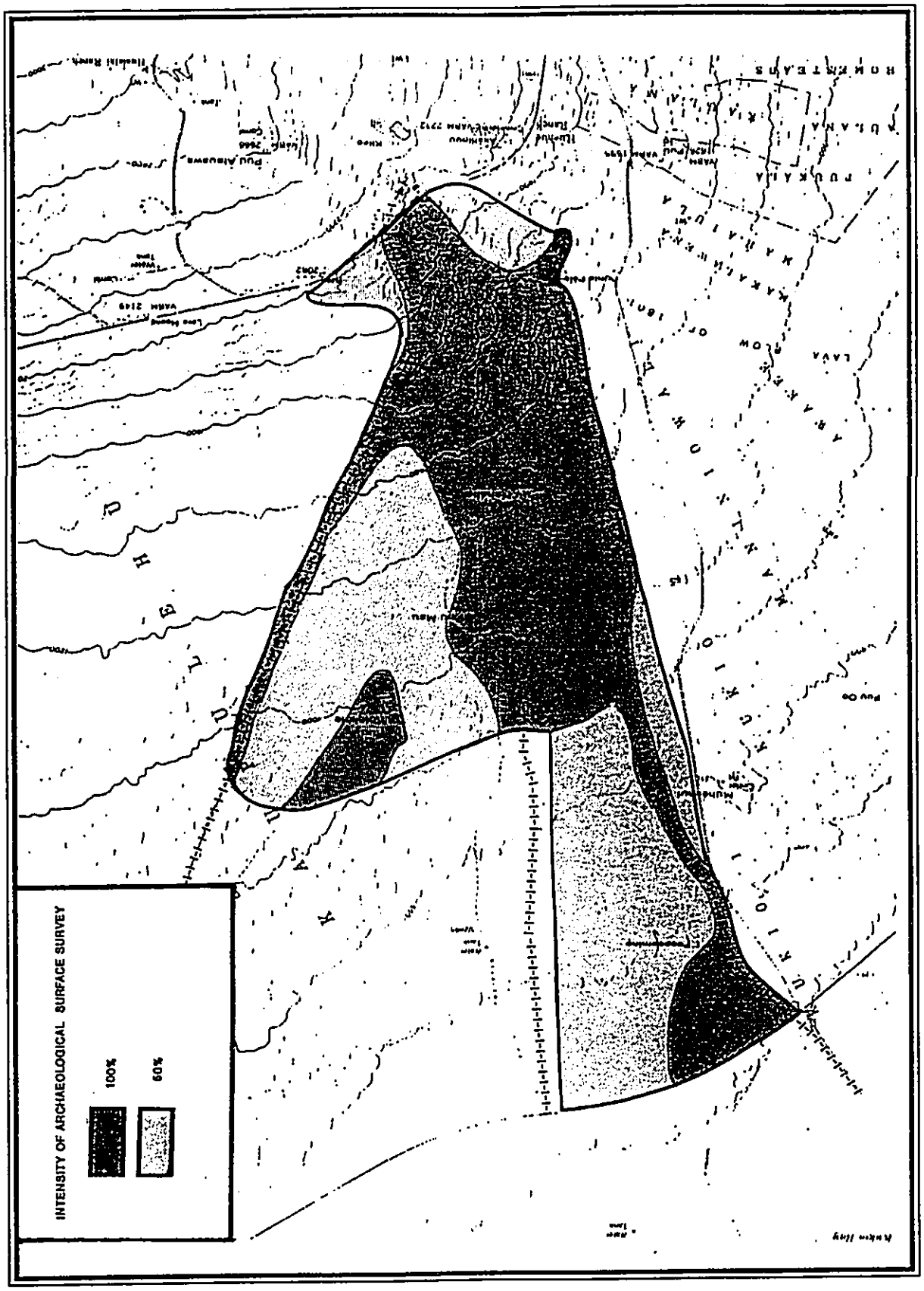

Figure 7. Intensity of Archaeological Surface Survey Coverage

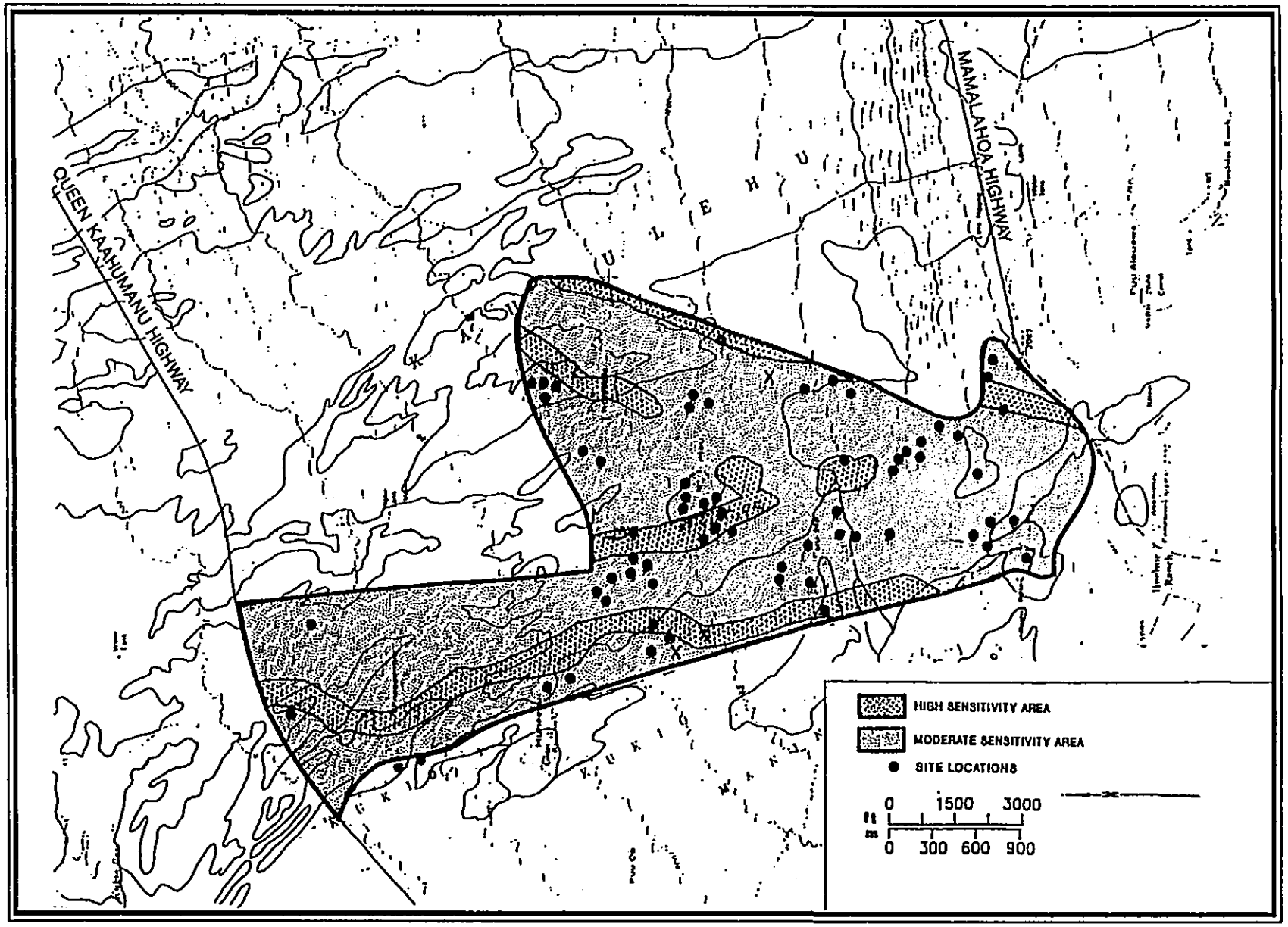

Figure 8. Areas of Moderate and High Sensitivity

Table 1.

CORRELATION OF SITE NUMBERS

*SIHP	#OTHER	PHRI	SIHP	OTHER	PHRI
14757	-	1	14794	-	38
14758	-	2	14795	-	39
14759	-	3	14796	-	40
14760	-	4	14797	-	41
14761	-	5	14798	-	42
14762	-	6	14799	-	43
14763	-	7	14800	-	44
14764	-	8	14801	-	45
14765	-	9	14802	-	46
14766	-	10	14803	-	47
14767	-	11	14804	-	48
14768	-	12	14805	-	49
14769	-	13	14806	1158,1160	50
14770	-	14	14807	-	51
14771	-	15	14808	-	52
14772	-	16	14809	-	53
14773	-	17	14810	851-1	54
14774	-	18	14811	720-6	55
14775	-	19	14812	-	56
14776	-	20	14813	642-3	57
14777	-	21	14814	720-11	58
14778	-	22	14815	720-9	59
14779	-	23	14816	720-10	60
14780	-	24	14817	720-8	61
14781	-	25	14818	720-16	62
14782	-	26	14819	-	63
14783	-	27	14820	-	64
14784	-	28	14821	720-20	65
14785	-	29	14822	-	66
14786	-	30	14823	-	67
14787	-	31	14824	-	68
14788	-	32	14825	-	69
14789	-	33	14826	-	70
14790	-	34	14827	-	71
14791	-	35	14828	-	72
14792	-	36	14829	720-7	73
14793	-	37	14830	720-14	74
			10977	-	-
			1193	-	-
			1319	-	-

* *State Inventory of Historic Places (SIHP) numbers. SIHP numbers are five- digit numbers prefixed by 50-10-19 (50=State of Hawaii; 10=Island of Hawaii; 19=USGS 7.5' series quad map ["Kiholo, Hawaii"]).*

1158 and 1160 = Rosendahl, P.H. (1973)
1319 and 1193 = Ching (1971)
720-# = Rosendahl, P.H. (1989a,b)
851-1 = Rosendahl (1990)
642-# = Walker and Rosendaul 1990)

FINDINGS

Seventy-seven sites (190+ component features) were identified in the project area. Of this number, 17 sites had been previously identified. Site locations are shown on *Figure 2*. *Table 2* summarizes the sites in terms of component features, formal and functional types, PHRI Cultural Resource Management (CRM) value mode assessments, and recommended field work tasks. Appendix A provides detailed descriptions for each site.

The sites comprise 32 complexes (multiple-feature sites) and 45 single-feature sites, and include the following formal types: alignment, C-shape, lava tube cave, cairn, clear 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 *(Table 3)*.

The most common feature type in the project area is lava tube cave (38 examples). Other common types include cairn, enclosure, terrace, wall, C-shape, and pahoehoe excavation.

Probable functional interpretations were determined for most recorded features. Functional types included: 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 *(Table 4)*.

The most common functional types encountered in the project area are habitation, both temporary and possibly longer term (45 examples). Other common feature types inventoried include agriculture/animal husbandry, agriculture, and indeterminate.

In general, the sites comprise two concentrations. The first consists of about 20 sites associated with the major *mauka/makai* tube system and its branches. This system runs north-south through the middle of the project area. The second concentration, consisting of about 14 sites, is associated with the c. 900 ft contour line *(Figure 9)*. Several other patterns are noted here: (a) burials/possible burials are located in all elevational zones, although 75% are above 1,400 ft AMSL; (b) the majority of sites in the intermediate zone are associated either with habitation (most probably temporary) or transportation routes; (c) all of the agriculture/animal husbandry sites are probably historic and could be associated with ranching (such as at Huehue Ranch, which is still in operation). The sites are in an area good for ranching. The terrain consists mainly of older aa and pahoehoe covered in many intermediate and upland areas by dense grass.

Table 2.

SUMMARY OF IDENTIFIED SITES AND FEATURES

*SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess. R	I	C	+Field Work Tasks DR	SC	EX
10977	Trail	Transportation	M	M	H	+	-	-
14757 A B	Complex (2)** Platform C-shape	Indeterminate/ habitation/agriculture	L	L	L	-	-	-
14758 -	Enclosure -	Habitation/ possible burial	M	L	L/H	+	-	+
14759 A B	Complex (2) Lava tube cave Enclosure	Habitation	H	H	M	+	-	+
14760 A B	Complex (2) Terrace Wall	Agriculture	L	L	L	-	-	-
14761 A B	Complex (2) Wall Terrace	Agriculture	L	L	L	-	-	-

* State Inventory of Historic Places (SIHP) numbers. SIHP numbers are five-digit numbers prefixed by 50-10-19- (50=State of Hawaii; 10=Island of Hawaii; 19=USGS 7.5' series quad map ["Kiholo, Hawaii"]).

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

\+ Recommended Field Work Tasks:
DR = detailed recording (scaled drawings, photographs, and written descriptions),
SC = surface collections,
EX = test excavations.

**Number of component features within complex.

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14762	Complex (6)	Transportation/ habitation/marker	M	M	M	+	-	-
A	Cairn							
B	Cairn							
C	Lava tube cave							
D	Trail							
E	Cairn							
F	Cairn							
14763	Complex (2)	Temporary habitation	L/M	L/M	L/M	-	-	-
A	Pahoehoe excavation							
-								
B	Hearth							
14764	Terrace	Temporary habitation	L	L	L	-	-	-
-	-							
14765	Complex (4)	Temporary habitation	H	M	M	+	-	+
A-C	Terrace							
D	Modified outcrop							
14766	Complex (4)	Temporary habitation	M	M	L/M	+	-	+
A	C-shape							
B	Cupboard							
C	Wall							
D	Cairn							
14767	Complex (11)	Temporary habitation	M	M	M	+	-	-
A	Upright							
B	Platform							
C	Alignment							
D-G	Alignment							
H	Modified depression							
I	Filled crack							
J	Lava tube cave							
K	Alignment							
14768	Complex (5)	Habitation	H	H	M	+	-	+
A-C	Terrace							
D	Ramp							
E	Hearth							
14769	Complex (2)	Habitation	H	H	M	+	+	+
A	Terrace							
B	Enclosure							

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14770	Complex (3)	Temporary habitation	H	H	M	+	-	-
A	Terrace							
B	Terrace/cupboard							
C	Terrace							
14771	Complex (2)	Temporary habitation	L/M	L	L	-	-	-
A	Terrace							
B	Cupboard							
14772	Complex (2)	Temporary habitation	M	L	L	+	+	+
A	C-shape							
B	Hearth							
14773	Complex (2)	Marker	L	L	L	-	-	-
A	Cairn							
B	Cairn							
14774	Complex (2)	Temporary habitation	M	L/M	L/M	+	-	-
A	Lava tube cave							
B	Alignment							
14775	Lava tube cave	Temporary habitation	M	L/M	L	+	+	-
-	-							
14776	C-shape	Temporary habitation	L/M	L/M	L	-	-	-
-	-							
14777	Complex (4)	Habitation	M	M	L/M	+	+	-
A	Mound							
B	L-shape							
C	Upright							
D	Cupboard							
14778	Complex (5)	Habitation	M	L/M	M	+	-	-
A	Cupboard							
B	Alignment							
C	Wall							
D	Wall							
E	Mound							
14779	Complex (3)	Habitation	M	L/M	L/M	+	-	+
A	Wall							
B	Wall							
C	Alignment							

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14780 -	Lava tube cave -	Temporary habitation	M	L/H	L/H	+	+	+
14781 -	Lava tube cave -	Temporary habitation	L	L	L	-	-	-
14782 -	Lava tube cave -	Temporary habitation	L	L	L	-	-	-
14783	Trail	Transportation	M	H	M	+	-	-
14784 -	Lave tube cave -	Temporary habitation	H	L/M	M	+	+	-
14785 -	Terrace -	Temporary habitation	M	L	M	+	-	+
14786	Complex (13)	Habitation	M	H	M	+	+	-
A-C	Enclosure (3)							
D-F	C-shape (3)							
G	Pahoehoe excavation							
H	Enclosure							
I	Enclosure							
J	Cairn							
K	Cairn							
L	Petroglyph							
M	Enclosure							
14787	Lava tube cave	Habitation	L/M	L	L/M		+	- +
14788 -	Alignment -	Temporary habitation	L/M	L/M	L/M		-	- -
14789 -	Lava tube cave -	Temporary habitation	L/M	L/M	L/M	+	-	-
14790	Enclosure	Indeterminate	M	M/H	L	+	-	+
14791	Cairn	Marker	M	L	L/H	-	-	+
14792 -	Lava tube cave -	Temporary habitation	M/H	M/H	L/M	+	-	+
14793 -	Lava tube cave -	Temporary habitation	H	M	M	+	+	+

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14794	Enclosure	Temporary habitation	M	M	L/M	+	-	-
-	-							
14795	Complex (2)	Temporary habitation	M/H	M	M	+	+	+
A	Lava tube cave							
B	Lava tube cave							
14796	Complex (2)	Habitation	H	M	M	+	-	-
A	Lava tube cave							
B	Lava tube cave							
14797	Enclosure	Temporary habitation	M	M	L/M	+	-	+
-	-							
14798	Lava tube cave	Burial	L/M	L/M	H	+	-	-
14799	Enclosure	Agriculture/ animal husbandry	L/M	M	L/M	+	-	-
-	-							
14800	Sink	Temporary habitation	H	M	M	+	+	+
-	-							
14801	Wall	Agriculture/ animal husbandry	M	H	M	+	-	-
-	-							
14802	Hearth	Temporary habitation	H	H	M	+	+	+
-	-							
14803	Wall	Agriculture/ animal husbandry	L/M	M	L/M	-	-	-
-	-							
14804	Petroglyph	Recreation	M	H	H	+	-	-
14805	Complex (4)	Temporary habitation	L/M	L/M	L/M	-	-	-
A	Lava tube cave							
B	Lava tube cave							
C	Modified sink							
D	Cairn							
14806	Complex (20)	Habitation	H	H	H	+	+	+
A-C	Lava tube cave (3)							
D	Terrace							
E	Terrace							
F	Overhang							
G	Cairn							
H	Modified blister							
I	Enclosure							

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14806 (cont.)								
J	Modified outcrop							
K	C-shape							
L	Lava tube cave							
M	Terrace							
N	Terrace							
O	Lava tube cave							
P	*Cupboard (3)*							
Q	Terrace							
R	Cupboard							
S	Lava tube cave							
T	Trail							
14807 -	Pahoehoe excavation	Agriculture	L/M	L/M	M	-	-	-
14808	Complex (2)	Temporary habitation	H	M	H	+	+	+
A	Lava tube cave							
B	Lava tube cave							
14809	Alignment	Indeterminate	L/M	L	L/M	-	-	-
14810	Terrace	Agriculture	L	L	L	-	-	-
14811	Complex (2)	Agriculture/ animal husbandry	L/M	M	M	+	-	-
A	Enclosure							
B	Alignment							
14812	Complex (3)	Agriculture/ animal husbandry	L/M	M	M	+	-	-
A-C	Enclosure							
14813 -	Enclosure -	Agriculture/ animal husbandry	L/M	L/M	L/M	-	-	-
14814 -	Lava tube cave -	Temporary habitation	L/M	L	L/M	-	-	-
14815 -	Lava tube cave -	Temporary habitation	L/M	L	L/M	-	-	-
14816 -	Lava tube cave -	Temporary habitation	L/M	L	L/M	-	-	-
14817	Complex (2)	Temporary habitation	L/M	L	L/M	-	-	-
A	Lava tube cave							
B	Lava tube cave							

Table 2. (cont.)

SIHP Site No. 50-10-19-	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
14818 A B C	Complex (3) Lava tube cave Cairn Pahoehoe excavation	Temporary habitation	L/M	L/M	L/M	-	-	-
14819 -	Lava tube cave -	Temporary habitation	M	L/M	M	+	-	+
14820 -	C-shape -	Temporary habitation	L/M	L	L/M	-	-	-
14821 A B C	Complex (3) Lava tube cave Hearth Alignment	Temporary habitation	H	M	M	+	-	+
14822	Wall	Boundary	L/M	L/M	L/M	+	-	-
14823	Lava tube cave	Burial	M	L/M	H	+	-	+
14824 -	Lava tube cave -	Temporary habitation	H	M	H	+	+	+
14825 -	Enclosure -	Agriculture/ animal husbandry	L/M	L/M	L/M	-	-	-
14826	Wall	Indeterminate	L	L	L	-	-	-
14827	Cairn (18)	Marker	M	M	L/M	-	-	-
14828	Cairn	Indeterminate	L	L	L	-	-	-
14829 A-C	Complex (3) Pahoehoe excavation	Quarry	L	L	L	-	-	-
14830 A B C	Complex (3) Cairn Pahoehoe excavation Pahoehoe excavation	Quarry/marker	L	L	L	-	-	-
1193	Trail	Transportation	M	M	L/M	-	-	-
1319	Trail	Transportation	M	M	L/M	-	-	-

Table 3.

FREQUENCIES OF FORMAL FEATURE TYPES

Formal Type	Number	%
Lava tube cave	38	20.14
Cairn	33	17.49
Enclosure	20	10.60
Terrace	20	10.60
Alignment	13	6.89
Wall	11	5.83
C-shape	9	4.77
Pahoehoe excavation	7	4.24
Cupboard	8	3.71
Hearth	5	2.65
Trail	3	1.65
Modified outcrop	2	1.06
Mound	2	1.06
Petroglyph	2	1.06
Platform	2	1.06
Upright	2	1.06
Cleared area	2	1.06
Filled crack	1	0.53
L-shape	1	0.53
Modified depression	1	0.53
Modified blister	1	0.53
Modified sink	1	0.53
Overhang	1	0.53
Ramp	1	0.53
Sink	1	0.53
Terrace/cupboard	1	0.53
TOTAL	190	100.70

Table 4.

FREQUENCIES OF FUNCTIONAL FEATURE TYPES

Function Type	Number	%
Temporary habitation	49	25.97
Habitation	35	18.55
Marker	33	17.49
Indeterminate	14	7.42
Agriculture/animal husbandry	10	5.30
Agriculture	8	4.24
Storage	8	4.24
Water catchment	6	3.18
Quarry	6	3.18
Burial	3	1.59
Habitation/possible burial	3	1.59
Transportation	3	1.59
Animal husbandry	2	1.06
Boundary	2	1.06
Ceremonial/marker	2	1.06
Cermonial/storage	1	0.53
Habitation/burial	1	0.53
Habitation/transportation	1	0.53
Recreation	1	0.53
TOTAL	190	99.64

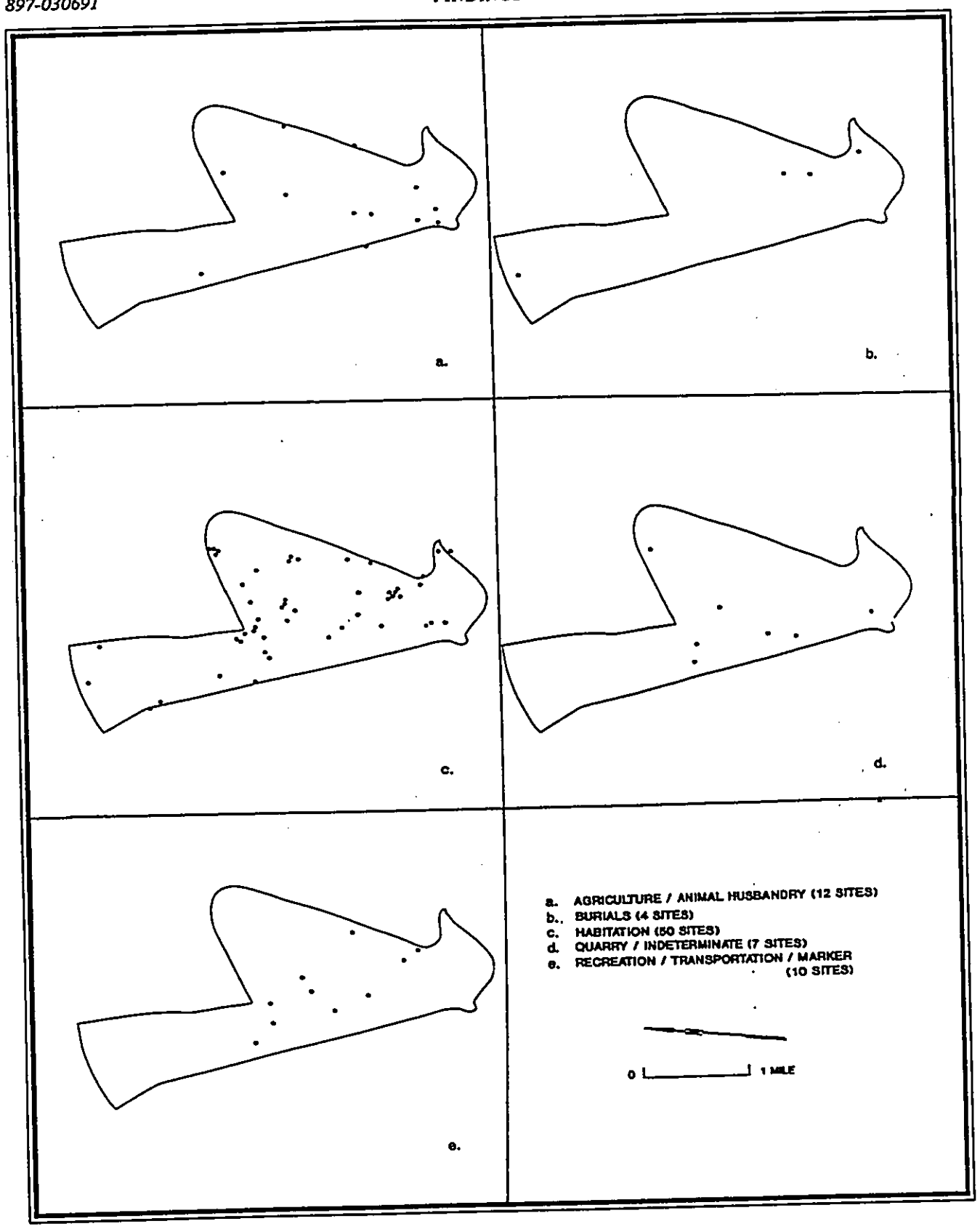

Figure 9. Functional Distribution of Sites

DATA ANALYSES

by Susan T. Goodfellow, Ph.D.

AGE DETERMINATIONS

Objectives and Methods

The purpose of age determination analysis is to provide initial chronological data to aid in assessing the relative significance of sites in the project area. Three samples of charcoal were chosen from discrete cultural deposits for age determination using radiocarbon analysis. Samples were selected based on the amount and nature of datable material present, stratigraphic context, and overall distribution within the project area. The three samples were submitted for radiocarbon analysis to Beta Analytic, Inc. of Coral Gables, Florida.

Using standard procedures, the samples were pretreated with an acid, alkali, acid series of soakings to remove carbonates and humic acids. The samples were combusted to form carbon dioxide gas, were combined with lithium to separate the carbon, and were hydrolized for conversion to liquid form. The liquid was then catalyzed to form benzene and was placed in a liquid scintillation counter to determine the amounts of carbon-13 and carbon-12. The isotope values obtained during the counting process were then used to calculate the carbon-13 carbon-12 ratio for the sample, with the final result being determined relative to international standards in order to reduce errors produced by carbon isotope fractionation. Processing of the samples proceeded normally.

Results

The results of the radiocarbon age determination analysis are presented in *Table 5*. The age for each sample is reported as a range corresponding to the calendric age +/- two standard deviations. Ages were calibrated using the tables provided in Stuiver and Pearson (1986), which correct for variations in atmospheric carbon over time.

As can be seen in *Table 5*, two of the samples, RC-922 and RC-923, yielded multiple age ranges. Multiple ranges are caused by "flat" regions in the calibration curve, which correspond to periods when atmospheric carbon decreased at a rate greater than 1.2 ppm/10 years, resulting in more than one possible fit of a sample to the calibration curve. While multiple age ranges are more difficult to interpret archaeologically, detailed examination of the sample curves, combined with evidence from artifactual material and feature stratigraphy, generally provides a means of selecting one age range as more probable than the others. Based on these criteria, the most probable age range for sample RC-922 is 1630-1955 AD, while sample RC-923 has an age range of 1450-1700 AD.

The results of the age determination analysis indicate that the project area was occupied during prehistoric times, potentially as early as 1450 AD at Site 14821 (897-65). The samples from Sites 14768 (RC-922) and 14824 (RC-924) yielded age ranges which span both prehistoric and historic times. Both age ranges overlap the results from Sample 14821, suggesting that all three sites may have been occupied contemporaneously. No artifacts were associated with the dating samples.

PORTABLE ARTIFACTS

Ten artifacts were recovered from the project area—seven indigenous and two non-indigenous. Indigenous artifacts are those fabricated using traditional Hawaiian manufacturing techniques and local raw materials, and range in type from fishing gear and tools to various decorative or religious items. The inventory of indigenous artifacts from the current project area is fairly narrow in content, and consists of fishing gear, tools, and a number of artifacts of uncertain function. The inventory of non-indigenous artifacts consists of glass fragments and a wooden artifact of uncertain function. A detailed tabulation of artifacts by deposit area is presented in Table 6. The results of the artifactual analysis are discussed below.

Fishing Gear

Two specimens of indigenous fishing gear were recovered from the project area. One specimen, a complete fishhook, is from Site 14793, and the other specimen, an octopus lure, constitutes Isolated Find B.

Fishhook - The complete fish hook derives from the surface of Site 14793 and is manufactured from animal bone. Based on the revised Coding System for Hawaiian Fishhooks devised by Sinoto (in Kirch 1979:231-233), the specimen is classified as a one-piece jabbing hook. One-piece fish hooks were fashioned as either jabbing or rotating hooks depending on the fisherman's intended catch strategy (Johannes

Table 5.

SUMMARY OF RADIOCARBON AGE DETERMINATIONS

PHRI Lab.No. RC-	Lab. No. BETA-	Provenience	C-14 Age Yrs. B.P. (one sigma)	C-13/ C-12 Ratio	C-13 Adjusted C-14 Age Yrs. B.P.	*Calendric Range Yrs. AD
SITE 14768						
922	42510	Fea.E, Surface	150+80	-24.9	150+80	1527-1556 1630-1955#
SITE 14821						
923	42511	Fea.B, Surface	260+80	-24.2	270+80	1450-1700 1720-1820 1831-1879 1916-1954
SITE 14824						
924	42512	Surface	140+50	-24.4	150+50	1650-1950

* *Calibrated according to Stuiver and Pearson (1986). Range at two sigmas.*
\# *Denotes influence of bomb C-14.*

1981:113). Jabbing hooks are those in which the point is straight or slightly outcurved or incurved, so that if extended, the point would intersect the shank between the head and upper third portion of the shank. Rotating hooks are hooks in which the point is incurved such that its extension would intersect the shank in the lower two-thirds of the shank. Morphologically, the hook specimen has a tipped-out point, a characteristic "V"-shaped bend, and no barb. The shank head is sloped upward with a notch on the outer side, just below the top (HT1d).

Octopus Lure - The octopus lure was encountered as an isolated find on the surface of the project area (IF-B). It consists of a cowrie shell (Cypraeidae) which has been perforated on the dorsal surface immediately above the lip. One side of the ventral lip has been cut, probably to allow access for the toggle assembly. The lure is extremely bleached, and measures 65 mm by 45 mm by 32 mm. Octopus lure hooks are composite hooks which consist of a point and shank which are generally manufactured from wood. The point and shank are lashed together at the base and attach to a hackle. A perforated cowrie shell, or octopus lure, is tied to one side of the toggle assembly, while a basalt sinker is attached to the opposing side of the toggle. According to Buck (1957:359), the cowrie lure assemblage was generally used to catch squid in water 80 to 120 fathoms deep, but was also used by aristocrats to catch squid for sport in more shallow waters.

Tools

Four tools were encountered in the project area during the current investigation. The assemblage derives from Sites 14769 (897-13), 14806 (897-50), and 14808 (897-52); and consists entirely of abraders.

Abraders - A total of three abraders, two manufactured from coral and one manufactured from scoria (highly vesicular

Table 6.

DETAILED DISTRIBUTION OF PORTABLE ARTIFACTS

CATEGORY	897-13 FEA.B SURF.	897-14 FEA.A SURF.	897-37 C-604 SURF.	897-40 FEA.A SURF.	897-44 CAVE-2 SURF.	897-49 FEA.C SURF.	897-50 FEA.F SURF.	897-52 FEA.A SURF.	IF-B SURF.	GRAND TOTAL
INDIGENOUS										
FISHING GEAR										
Bone										
Fishhook	-	-	1	-	-	-	-	-	-	1
Shell										
Octopus lure	-	-	-	-	-	-	-	-	1	1
SUBTOTAL FISHING GEAR	0	0	1	0	0	0	0	0	1	2
TOOLS										
Abrader										
Coral	1	-	-	-	-	-	1	1	-	3
Scoria	-	1	-	-	-	-	-	-	-	1
SUBTOTAL TOOLS	1	1	0	0	0	0	1	1	0	4
UNCERTAIN FUNCTION										
Basalt										
Manuport	-	-	-	2	-	-	-	-	-	2
SUBTOTAL UNCERTAIN FUNCTION	0	0	0	2	0	0	0	0	0	2
TOTAL INDIGENOUS	1	1	1	2	0	0	1	1	1	8
NON-INDIGENOUS										
MISCELLANEOUS										
Bottle										
Fragment	-	-	-	-	1	-	-	-	-	1
Wood										
Unidentified	-	-	-	-	-	1	-	-	-	1
TOTAL NON-INDIGENOUS	0	0	0	0	1	1	0	0	0	2
TOTAL	1	1	1	2	1	1	1	1	1	10

basalt), were encountered in the project area. Coral and scoria abraders are evaluated according to their overall shape in plan view, following the classification system and nomenclature set forth by Suggs (1961) to describe coral abraders found at Nuku Hiva in the Marquesas Islands, French Polynesia. In this system, abraders are either informal, meaning that the shape of the raw material is dominant; or formal, indicating that the characteristics of the raw material have been extensively modified by use. Cross-sections are generally taken perpendicular to the tip and butt of the abrader, while the number of abrasion faces is indicative of preferential abrasion on a given surface.

Two of the three coral abraders are partial specimens and are formal in description. The third is informal, and appears to be complete. One of the partial abraders has five faces of abrasion, and measures 62 mm by 48 mm by 32 mm. It is indeterminate in plan view and cross section. The second partial specimen has two faces of abrasion, and measures 20 mm by 12 mm by 5 mm. It is elliptical in cross section, and wedge-shaped in plan view. The complete specimen has three faces of abrasion and measures 51 mm by 41 mm by 33 mm. It is irregular in plan view and in cross section.

The scoria abrader is a complete specimen and is formal in description. It has six faces of abrasion, and measures 85 mm by 43 mm by 10 mm. It is convex-lateral in cross section and blunt-shaped in plan view.

Coral artifacts apparently served multiple purposes prehistorically, ranging from "rubbers" used to finish canoes and wooden bowls (Buck 1964), to saws or files used in the manufacture of bone and shell fishhooks (Emory, Bonk, and Sinoto 1968; Suggs 1961). The variety of shapes, edges and worn surfaces represented by the abraders in the assemblage suggest that the abraders served as multi-purpose tools. Use of a particular surface over a period of time might generate a sawing or filing edge, which in turn would wear down during use to a new shape which could serve a new purpose. Scoria abraders may have been used in the same manner as coral abraders, but given their greater resistance and coarser texture, would most likely have been used during the early stages of a task, or to shape materials which were themselves resistant to abrasion.

Uncertain Function

Two artifacts of uncertain function were encountered on the surface of Feature A, Site 14796 (897-40). Both of the artifacts are classified as manuports, indicating that they are natural, unmodified materials which have been transported out of their normal context by human action. The artifacts are basalt in composition, and are concretions created by the heating of the lava tube ceiling by the still-flowing lava. The ceiling, although remaining solid, appears to become almost viscous above the lava and "drips." Several of these concretions, each broken at one end, were encountered piled on the surface of Feature A. The function of these artifacts is unknown.

Non-Indigenous Artifacts

Two non-indigenous artifacts were encountered in the project area. The artifacts, one bottle fragment and one wood item of uncertain function, derive from Sites 14800 (897-44) and 14805 (897-49), respectively. The artifacts are described in detail below.

Glassware - The bottle fragment derives from the surface of Cave #2 at Site 14800. The specimen is manufactured from dark green glass, and consists of the mouth, neck, and shoulder portions of a medium to large bottle. The neck finish of the specimen indicates that the bottle was used to store wine or brandy (Fike 1987:8). Half of the cork remains in the mouth and neck of the fragment. The mouth and neck of the bottle have an irregular appearance, suggesting that these portions were hand-tooled.

Uncertain Function - A single artifact of uncertain function, manufactured from wood, was encountered on the surface of Feature C at Site 14805. It resembles a pole or stake, and measures 51.8 cm long by 15 mm in diameter. Comparison of the artifact with wooden artifacts in Buck (1957), suggests that the specimen may have been used as an *'au lima*, a stick which was held in the hand and rubbed in a fire-plow to produce fire by friction. The artifact is fairly unmodified, however, and may have had another function.

Summary

In general, the artifact assemblage suggests that prehistoric activities in the project area may have included fishing, indicated by the hook and octopus lure, as well as wood-working or domestic activities which required the use of coral or scoria abraders. The bottle fragment encountered at Site 14800 was most likely discarded as refuse, and does not suggest extended occupation of the site during recent or historic times.

MIDDEN

Objectives and Methods

Midden deposits are archaeologically significant on a number of levels, as the variety and content of food remains contained within a given midden deposit provide useful information concerning prehistoric diet and resource utilization patterns. The analysis of midden remains for inventory survey projects have two primary objectives:

1. To determine midden content, in particular the variety and distribution of the remains for each cultural deposit encountered within the project area;

2. To provide an indication of dietary and resource exploitation patterns for each site, and for the project area as a whole;

All midden remains recovered from the various test units underwent detailed analysis in the laboratory. The analysis involved splitting the sample into two size classes by passing each sample through 1/4-in and 1/8-in screens. One hundred percent of the material retained in the 1/4-in screen was completely sorted to the lowest taxonomic level possible, while the material retained in the 1/8-in screen was inspected both for artifactual material and for taxa not encountered in the larger portion of the sample. Marine shell identifications were verified and augmented using Kay (1979).

The sampling design outlined above is adapted from Kirch (1979); the design is based on a series of experiments measuring the relative distribution of molluscan and bone material retained on screens with various mesh sizes. Kirch concluded that pre-sorting midden with 1/4- and 1/8-in screens increased the speed of the sorting process without decreasing either the accuracy or statistical validity of the overall analysis. As a result of his experiments, the taxonomic distribution and weight of material retained on the 1/4-in screen is generally considered to be representative of the variety and relative percentages of each taxon present in the entire sample.

Results

Midden remains were encountered in the deposits at Sites 14760 and 14764. The range of taxa present in the midden is summarized in *Table 7*. Total weights for each taxon (in grams) are tabulated by site, with subtotals indicating the combined weight per site for each larger material class (e.g., gastropods). The total weight of each taxon in the project area is provided in the final column of the table, while the grand total represents the combined weight of all the midden derived from the project area.

In general, the taxa in the midden are common inhabitants of the shorelines, shallow-water areas, solution benches, and fringing reefs of the windward islands of the Hawaiian chain. By weight, 6.2% of the 109.18 grams of midden recovered from the project area is contributed by marine gastropods, 7.9% by bivalves, 84.1% by other invertebrates (echinoids), 0.44% by bone material, and 1.37% by vegetal material. Taxonomically, the marine gastropods are a mixture of *Cypraeidae* and *Thaididae*, while *Isognomonidae* and *Echinoidea* are the only taxa represented within the other bivalves and invertebrates categories, respectively. The bone material is contributed entirely by bird taxa. Vegetal material consists of *Aluerites moluccana* (*kukui*) and charcoal.

The relative distribution of midden by site differs from the relative distribution of midden for the overall project area. The midden from Site 14760 lacks bivalves, and has correspondingly higher percentages of the other invertebrates and marine gastropods. In contrast, the midden from Site 14764 is composed entirely of bivalves.

The results of the midden analysis indicate that subsistence patterns in the project area included the collection and consumption of a limited variety of shell fish, ranging from two taxa of marine gastropods to bivalves and echinoids. The presence of bird taxa in the midden deposit at Site 14760 indicates that exploitation of terrestrial vertebrates may have formed a second component of the local subsistence base. Finally, the presence of vegetal remains indicates that plants were included as part of the terrestrial component of the subsistence activities practiced in the project area.

Table 7.

DISTRIBUTION OF MIDDEN

MATERIAL	T-4 SURFACE	T-8 FEA.B, TU-1 HF-4 ALL	GRAND TOTAL
MOLLUSCA			
GASTROPODA			
CYPRAEIDAE	5.87	-	5.87
THAIDIDAE	0.90	-	0.90
SUBTOTAL GASTROPODA	6.77	0.00	6.77
BIVALVES			
ISOGNOMONIDAE	-	8.60	8.60
SUBTOTAL BIVALVES	0.00	8.60	8.60
OTHER INVERTEBRATES			
ECHINOIDEA	91.83	-	91.83
SUBTOTAL OTHER	91.83	0.00	91.83
TOTAL INVERTEBRATES	98.60	8.60	107.20
VERTEBRATES			
BONE	0.48	-	0.48
SUBTOTAL VERTEBRATES	0.48	0.00	0.48
VEGETAL REMAINS			
ALUERITES MOLUCCANA	1.23	-	1.23
Charcoal	0.27	-	0.27
SUBTOTAL VEGETAL REMAINS	1.50	0.00	1.50
TOTAL	100.58	8.60	109.18

CONCLUSION

EVALUATION OF SURVEY METHODOLOGY

The aerial survey covered c. 85% of the total project area. All of the project area was not surveyed, as an area in the *makai* portion was added after the survey had been completed. The aerial survey was conducted using an average 30 m interval spacing between E-W sweeps; the sweeps were flown at an average height of c. 15-30 m. This methodology was deemed appropriate, as surface visibility was excellent in all portions of the project area except in a portion of the southwest corner, which was covered with dense vegetation. The chosen *methodology was very* effective: tubes and trails were conspicuous from the air. Except for petroglyphs, all feature types, including small sites such as cairns, were visible.

The primary goals of the ground survey were (a) to conduct a 100% coverage, variable-intensity surface survey of the high sensitivity areas (c. 200 ac), (b) to conduct a sample coverage (c. 375 ac, c. 50% sample), variable-intensity survey of selected moderate sensitivity portions, and (c) to sample all types of terrain. It was hoped that these goals would result in the location of most of the archaeological sites in the project area.

The actual ground survey more than met the above goals. In addition to accomplishing the above, the large *mauka/makai* lava tube system in the project area was explored extensively. The tube system, since it travels the length of the project area, crosses most of the terrain/ vegetation types in the project area, so that much of "(c)" in the above paragraph was accomplished at the same time the tube system was explored.

DISCUSSION

The present project has added significantly to the number and types of archaeological sites and features known in the Land of Kaupulehu. The formal types encountered in the project area include alignment, C-shape, lava tube cave, cairn, clear area, cupboard, enclosure, excavation, hearth, trail, mound, overhang, pahoehoe excavation, petroglyph, platform, terrace, upright, and wall. Most of these feature types are common elsewhere on Hawaii Island, especially in barren middle elevation areas in North and South Kohala. There appear to be no unique features in the project area; the petroglyph panels (14786) found *mauka* of Puu Kolekole, however, are unusual and worthy of further work and preservation.

Functional types encountered include 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. The limited number of types indicates the project area was never used for permanent habitation. One site that may have been used for long-term habitation is Site 14759. It is quite probable that the permanent habitation sites in the *ahupua'a* are found nearer to the coast (Walker and Rosendahl 1988).

Most sites identified during this survey appear to be prehistoric. A number of agricultural/animal husbandry enclosures are probably prehistoric and historic. Age determination results from the current project range from AD 1450-1955. Other radiocarbon date ranges from the project area are: AD 1645-1763 (Rosendahl 1973:56; for Site 1160 [14806]; overall range for the project was AD 1427-1763), and AD 1030 to present in the *makai* portion of the project area (results of ten radiocarbon ranges) (Walker and Rosendahl 1988).

Numerous stone tool quarries are present throughout the pahoehoe flows in the central and lower portions of the project area. The quarries are usually where there are surface breaks in pahoehoe blisters or tubes. The breaks have usually been enlarged by cracking them with stones, and then removing the broken rock. The quarrying apparently was done to obtain scoriaceous lava, volcanic glass, or other suitable toolstone. Although there are many quarries in the project area, there are no abrader depressions associated with them. Abrader depressions are quite common in some coastal areas on the Big Island (Jensen 1991).

Archaeological work in areas surrounding Kaupulehu, as summarized in Kirch (1985) and used by him to construct a Hawaiian Cultural Sequence, suggests that Kaupulehu (and other marginal leeward areas) was first occupied probably in the coastal region sometime during the 15th or 16th centuries. The rapid dispersal of population throughout the islands, from ecologically favorable windward valleys to marginal regions, suggests that this action may have been due to exploding populations. Kirch has suggested that throughout the island and the archipelago there may have been up to a tenfold increase in the population (1985:304), with a concomitant tenfold increase in the demand for food.

The first population centers (and probably the most permanent "base camps") in Kaupulehu were probably near

the coast, where the ocean and shoreline resources brought the greatest amount of resources (food) to the greatest number of consumers at the least cost. The coastal resources provided protein for the diet, but did not provided sufficient carbohydrates.

The uplands of Kaupulehu, on the other hand, received sufficient rainfall, and soil in the uplands had developed to the point where it was possible to grow a number of food crops—among them dryland sweet potato (*'uala*; *Ipomoea batatas* [L.] Lamm.), breadfruit (*'ulu*; *Artocarpus communis* Forst.), dry taro (*kalo*; *Caladium colocasia* [L.] W.F. Wright), Polynesian arrowroot (*pia*; *Tacca leontopetaloides* [L.] O. Ktze.), and yam (*uhi*; *Dioscorea alata*). In addition, other resources were present in the uplands: wood (specifically, *kou*; *Acacia koa* A. Gray), mountain apple (*ohi'a-'ai*; *Eugenia malaccensis*), nuts and oil from candlenut (*kukui*; *Aleurites moluccana* [L.] Willd.), bark from paper mulberry (*wauke*; *Broussonetia papyrifera* [L.] Vent.), *ti* (*ki*; *Taetsua fruticosa* [L.] Merrill.), and turmeric (*'olena*; *Curcuma domestica* Valet.). These and other items would have required collection, or cultivation and harvesting. The items would also have to be transported, by way of trails, to consumers in population centers.

One can envision people engaged in the carriage of products between the uplands and coast of Kaupulehu. Perhaps they used carrying poles (*'auamo*), with carrying nets (*koko*) and *ipu* (gourd) containers. Many sites in the project area may be linked to this transport of goods, among them, two major Hawaiian trails that run *mauka-makai* through the project area (Sites 1154 and 1319). Many of the temporary habitation sites in the project area may have been used by the transporters of goods. Based on the very limited archaeological assemblages, use of these sites was short-term—perhaps they were used overnight several times a year.

Sites 14768, 14769, and 14770, located in the large lava tube system in the uplands of the project area, are probably temporary habitation sites; they are not, however, proximate to known trails, so they apparently had another use. Perhaps they are similar to "field camps," as defined by L.R. Binford (1983). Drawing upon his work with the Nunamiut Eskimo (Inuit) of north-central Alaska, Binford (1983) has distinguished five different archaeological site types generated by what he terms "logistically organized" collectors, such as the Nunamiut are (as opposed to foragers, who gather food on an "encounter" basis). The site types are (a) the *residential base*, which is self-explanatory, (b) the *location*, where collection is carried out, (c) the *field camp*, a temporary operational center where a task group eats, sleeps, and performs maintenance activities (field camps are differentiated by the nature of the targeted resource; for example, fishing field camps, hunting field camps, adze quarrying field camps, etc), (d) *stations*, which are ambush locations or hunting stands, or areas from which information is gathered (e.g., information on game movement), and (e) *caches*, temporary field storage places (Binford 1983:346-347).

The structural features at Sites 14768, 14769, and 14770 required more time and work to construct than is necessary for just a series of overnight habitations; that they functioned in a manner similar to field camps is plausible. Task groups could have used them seasonally, or yearly, for an extended period, to exploit some resource that was not attainable at the residential base. The target resources could have been *kukui*, *'ulu*, or *'uala*, or even *lau* (leaves) to line a *holua* slide. It is plausible that these task groups, "composed of skilled and knowledgeable individuals" (Binford 1983:344), were not out "searching" for any resource, but instead knew that a specific resource was available at a given time and in a specific location.

On the other hand, there are indications that the sites may not have served as field camps. If the task groups were being housed and fed while collecting resources, one would expect evidence of food preparation at the site. The only midden found at the sites was a very few marine shells and non-cultural pig bones (at Site 14768). One explanation for this is that the task group perhaps was being fed at another location, or perhaps they were subsisting on foods that do not show up in the archaeological record (e.g., *poi* or other vegetable food).

SUGGESTED FUTURE RESEARCH

Future research in the area should consider the following questions:

1. When did initial occupation take place within the project area; what was the nature of the occupation; were people simply using the project area as a transportation corridor between the uplands and the coast?

2. What was the exact nature, intensity, and goals of the work at the project area's numerous toolstone procurement centers (pahoehoe excavations)?

3. What part did the Hawaiian trails in the project area play in the movement of goods and people through the project area?

4. Were there sites generated by "logistically organized" task groups present in the uplands and if so, how can the associated procurement and maintenance sites be located?

Future excavations should attempt to locate datable deposits; these deposits may serve to demonstrate the probable earliest occupation period within the area. Site 14759, a possible permanent habitation site, may yield an early date range.

The quarry and tool production sites need to be investigated further. The temporal ranges of the sites need to be established. The nature of the quarrying, source selection, quarrying techniques, reduction and production sequences, and the organization and control of the quarrying needs to be investigated. The potential for identifying trade patterns through petrographic analyses should be investigated.

A further study of the importance of the Hawaiian trails in terms of their role in the movement of goods and people through the project area needs to be done. Upland production areas close to trails may be directly associated with them. A more complete marking of the route of the upland portion of the Site 1193 trail is necessary.

The sites within the tube system (14768, 14679, and 14770) need further study to determine if they are associated with collector groups. An ancillary study could be to locate an associated site where maintenance activities took place. An attempt should be made to determine the resources that may have been available in the immediate area of the sites.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

To aid in outside review, general significance assessments and recommended general treatments for all identified sites are summarized in *Table 8*. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Historic Preservation Office uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content (Category A, *Table 8*) fall under Criterion D, 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 (Category B) are evaluated under Criterion C, 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" (Draft Report, August 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 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).

Based on the above criteria, of the 77 sites identified in the project area, 25 sites assessed as significant for information content only are recommended for no further work. Sixteen sites assessed as significant for information content only are recommended for further data collection. Twelve sites assessed as significant for information content and as excellent examples of site types are recommended for further data collection and preservation with interpretive development. The remaining sites have various assessments and recommendations. Detailed assessments and recommendations for all sites are presented in *Table 8*.

For project area sites containing confirmed human burials, preservation "as is" would be the preferred method of preservation. When not possible, further testing to determine more accurately the total number of burials present would be recommended. If disinterments are necessary, the procedures of Chapter 6E (Historic Preservation, Haw. Rev. Stat., as amended by Act 306 [1990 S.L.H.]) should be followed. DLNR-HPP/SHPO would be notified and would contact the local Island Burial Council. The developer, the DLNR, and the Island Burial Council would work out a burial treatment plan that would be approved by the Island Burial Council.

To further facilitate client management decisions regarding the subsequent treatment of resources, the general significance of the archaeological sites identified during the current survey was also evaluated in terms of potential scientific research, interpretive, and/or cultural values (PHRI CRM [Cultural Resource Management] value modes). *Research value* refers to the potential of archaeological resources for producing information useful in the understanding of cultural history, past lifeways, and cultural processes at the local, regional, and interregional levels of

Table 8.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

# SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
14757	-	+	-	-	-	+	-	-
14760	-	+	-	-	-	+	-	-
14761	-	+	-	-	-	+	-	-
14763	-	+	-	-	-	+	-	-
14764	-	+	-	-	-	+	-	-
14771	-	+	-	-	-	+	-	-
14773	-	+	-	-	-	+	-	-
14776	-	+	-	-	-	+	-	-
14781	-	+	-	-	-	+	-	-
14782	-	+	-	-	-	+	-	-

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 (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations);

NFW = No further work of any kind necessary, sufficient data collected archaeological clearance recommended, no preservation potential;

PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work);

PAI = Preservation "as is", with no further work (and possible inclusion into landscaping), or possibly minimal furthur data collection necessary.

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* Provisional assessment: definite assessment pending further data collection (i.e., testing features for presence/absence of skeletal remains).

State Inventory of Historic Places (SIHP) numbers. SIHP numbers are five- digit numbers prefixed by 50-10-19 (50=State of Hawaii; 10=Island of Hawaii; 19=USGS 7.5' series quad map ["Kiholo, Hawaii"]).

Table 8. (cont.)

SIHP Site No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
14788	-	+	-	-	-	+	-	-
14805	-	+	-	-	-	+	-	-
14807	-	+	-	-	-	+	-	-
14809	-	+	-	-	-	+	-	-
14810	-	+	-	-	-	+	-	-
14814	-	+	-	-	-	+	-	-
14815	-	+	-	-	-	+	-	-
14816	-	+	-	-	-	+	-	-
14817	-	+	-	-	-	+	-	-
14818	-	+	-	-	-	+	-	-
14820	-	+	-	-	-	+	-	-
14825	-	+	-	-	-	+	-	-
14826	-	+	-	-	-	+	-	-
14828	-	+	-	-	-	+	-	-
14829	-	+	-	-	-	+	-	-
Subtotal	0	25	0	0	0	25	0	0
14768	+	-	-	-	+	-	-	-
14772	+	-	-	-	+	-	-	-
14774	+	-	-	-	+	-	-	-
14775	+	-	-	-	+	-	-	-
14777	+	-	-	-	+	-	-	-
14778	+	-	-	-	+	-	-	-
14779	+	-	-	-	+	-	-	-
14784	+	-	-	-	+	-	-	-
14787	+	-	-	-	+	-	-	-
14789	+	-	-	-	+	-	-	-
14794	+	-	-	-	+	-	-	-
14795	+	-	-	-	+	-	-	-
14800	+	-	-	-	+	-	-	-
14808	+	-	-	-	+	-	-	-
14819	+	-	-	-	+	-	-	-
14824	+	-	-	-	+	-	-	-
Subtotal	16	0	0	0	16	0	0	0
14762	+	-	+	-	+	-	+	-
14767	+	-	+	-	+	-	+	-
14769	+	-	+	-	+	-	+	-
14770	+	-	+	-	+	-	+	-
14790	+	-	+	-	+	-	+	-
14793	+	-	+	-	+	-	+	-
14797	+	-	+	-	+	-	+	-
14799	+	-	+	-	+	-	+	-
14801	+	-	+	-	+	-	+	-
14811	+	-	+	-	+	-	+	-
14812	+	-	+	-	+	-	+	-
14813	+	-	+	-	+	-	+	-
Subtotal	12	0	12	0	12	0	12	0

Table 8. (cont.)

SIHP Site No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
14758	+	-	-	*	+	-	-	*
14765	+	-	-	*	+	-	-	*
14780	+	-	-	*	+	-	-	*
14791	+	-	-	*	+	-	-	*
Subtotal:	4	0	0	4	4	0	0	4
14766	+	-	*	-	+	-	*	-
14802	+	-	*	-	+	-	*	-
14821	+	-	*	-	+	-	*	-
Subtotal:	3	0	3	0	3	0	3	0
10977	+	-	+	+	-	-	-	+
1319	+	-	+	+	-	-	-	+
1193	+	-	+	+	-	-	-	+
Subtotal:	3	0	3	3	0	0	0	3
14786	+	-	*	-	+	-	-	*
14822	+	-	*	-	+	-	-	*
Subtotal:	2	0	2	0	2	0	0	2
14798	+	-	-	+	+	-	-	+
14823	+	-	-	+	+	-	-	+
Subtotal:	2	0	0	2	2	0	0	2
14803	-	+	-	-	-	-	-	+
Subtotal:	0	1	0	0	0	0	0	1
14827	-	+	+	-	-	+	-	+
Subtotal:	0	1	1	0	0	1	0	1
14785	-	+	-	-	-	-	-	+
Subtotal:	0	1	0	0	0	0	0	1
14806	+	-	*	+	+	-	*	-
Subtotal:	1	0	1	1	1	0	1	0
14804	-	-	+	*	-	-	+	*
Subtotal:	0	0	1	1	0	0	1	1
14783	+	-	+	+	+	-	+	+
Subtotal:	1	0	1	1	1	0	1	1
14759	+	-	-	+	+	-	-	-
Subtotal:	1	0	0	1	1	0	0	0
14792	+	-	-	-	+	-	+	-
Subtotal:	1	0	0	0	1	0	1	0
14796	+	-	-	+	+	-	+	-
Subtotal:	1	0	0	1	1	0	1	0
Total:	47	28	24	14	44	26	20	16

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. CRM assessments for individual sites are presented in *Table 2.*

Prior to further work in the project area, as an important initial step, it is recommended that all identified sites be accurately located and plotted, by professional surveyors and with the aid of an archaeologist, on an appropriate scale topographic map of the project area. This locational plotting would greatly aid development planning by allowing further archaeological work determinations (further data collection, data recovery and/or preservation) to be more accurately considered on a site-by-site basis.

The assessments and recommendations presented here have been based on the findings of 100% variable-intensity inventory survey. There is always the possibility, however remote, that potentially significant, unidentified surface and subsurface cultural remains could be encountered in the course of further archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

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APPENDIX A

SITE DESCRIPTIONS

SITE NO.: State: 14757 **PHRI: 1**
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: West base of northwest slope.
VEGETATION: Christmas berry, silver oak, lantana, and fountain grass.
CONDITION: Poor to good
INTEGRITY: Unaltered
PROBABLE AGE: Historic or recent
FUNCTIONAL INTERPRETATION: Indeterminate/ possible habitation/agriculture
DESCRIPTION: The complex is consists of a platform with wall (Feature A), and a box C-shape (Feature B). The overall dimensions for this site are c. 11.0 m (N-S) by 9.5 m (E-W).

FEATURE A: Platform with wall
FUNCTION: Indeterminate/possible habitation
DIMENSIONS: 5.50 m (NE-SW) by 5.30 m (NW-SE) by 1.60 m high
DESCRIPTION: The structure is consists of a roughly rectangular raised platform with an added L-shaped, faced wall section. The platform is constructed in two steps with small stacked aa boulders and large cobbles.

The northwest lower step is c. 5.5 m (northeast to southwest) by 1.8 m by 0.60 m with the northwest side and both ends roughly faced. The upper step is roughly square and measured c. 4.35 m (northeast to southwest) by 3.50 m by 0.90 m above the surface and c. 0. 65 m above the lower step. All sides are crudely faced and surfaces of both steps are roughly level and irregular.

At the northeast side of the platform, the abutting L-shaped wall begins at the point of the lower and upper steps. It runs northeast for c. 4.50 m then turns at c. 90° to the southeast and runs for c. 6.5 m. The height varies from c. 0.45 m to 1.60 m. The average width is c. 0.80 m. The wall is bifaced with the most intact section being the northeast wall with four-six courses high.

A few naturally occurring boulders are incorporated in the northeast section. The ground surface within the sections is littered with wall collapse, mainly from the northwest wall, and very irregular. One ferrous sheet metal piece was noted in outside north corner of the wall. It appeared to be a short stove pipe section.

FEATURE B: C-shape
FUNCTION: Agriculture
DIMENSIONS: 4.00 (NE-SW) m by 2.50 m (NW-SE) by 0.85 m high
DESCRIPTION: The box C-shape is consists of three walls that open on the southeast side. It is constructed with basalt cobbles five to six courses high with wall thickness of one to two cobbles. The ground level stones are between c. 0.20 m to 0.30 m. The size gets smaller as the courses rise.

SITE NO.: State: 14758 **PHRI: 2**
SITE TYPE: Enclosure
TOPOGRAPHY: Prehistoric aa flow and light slope to south west.
VEGETATION: Christmas-berry, silver oak, lantana, and fountain grass.
CONDITION: Fair with much collapse
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric/possible historic
FUNCTIONAL INTERPRETATION: Habitation/ possible burial
DIMENSIONS: 10.00 m (N-S) by 9.00 m (E-W) by 0.90 m high
DESCRIPTION: This enclosure is roughly square. It is constructed with stacked aa basalt cobbles with a few small boulders. The walls run basically in a north-south and east-west (mag.) direction.

The walls vary in width from c. 1.80 m to 2.10 m, with average internal heights of c. 0.50. The external heights vary from c. 0.60 m to 1.20 m. The walls are rounded in cross-section and may have been crudely faced in some sections.

There is an internal linear mound running east-west abutting the east wall. The construction is the same as the wall. The dimension is c. 2.65 m by 1.70 m by 0.75 m. There is also a low internal rubble mound in the southwest quad. This mound is oval, long axis north to south and measured c. 2.40 m by 2.10 m by 0.25 m. The internal surface is roughly level and irregular.

There is what appears to be a bulldozer cut northwest of the structure and running for about 40 m. The cut is approximately 3.0 m wide with pushed sides an average of 0.40 m high. It could not be determined if this is associated with the structure.

SITE NO.: State: 14759 **PHRI: 3**
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Mostly flat bench with gentle slope to northwest and west. Good views of Pacific in distance and Puhua Pele to southwest.
VEGETATION: Silver oak, lantana, and fountain grass.

CONDITION: Poor to good
INTEGRITY: Feature A: probably unaltered; Feature B: altered by cattle.
PROBABLE AGE: Prehistoric/historic
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex is consists of one lava tube cave (Feature A) and one square enclosure (Feature B). The overall dimensions are c. 26.0 m (N-S) by 20.0 m (E-W).

FEATURE A: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 12.00 m by 3.70 m by 2.00 m
DESCRIPTION: The lava tube cave is contained within a mostly square enclosure (Feature B). The cave is found along the southern edge of Feature B. The cave goes in c. 6.0 m at 100°, then turns to 105° and travels c. 7.0 m to the end. The entrance and the back of the cave are filled with boulders. The area between has few boulders with midden and soil deposits.

Rocks probably removed from the center portion of the lava tube cave and placed either in the back or taken outside. The southern side of the entrance has been walled off with a faced wall about four courses high of natural basalt boulders. This low wall is also faced on the exterior and measured c. 2.60 m long by 0.80 m wide 0.70 m high (continuing on as the south wall of Feature B to the east). Possibly some rocks are also placed at the western edge of the entrance to serve as access.

FEATURE B: Enclosure
FUNCTION: Habitation/agricultural
DIMENSIONS: 26.00 m by 20.00 m by 0.50 m
DESCRIPTION: The enclosure is constructed with four walls and the orientation is north-south orientation. It is constructed with walls that are either bifacially core-filled or rubble wall (core-filled or piled). There is a small opening along the west wall. Feature A is located along the south wall of this feature. Construction methods vary around the square. The common biface core-filled walls are stacked one-three courses high.

SITE NO.: State: 14760 *(Figure A-1)* **PHRI:** 4
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Gently rolling aa flows going downslope to the north and northwest.
VEGETATION: Christmas berry, silver oak, lantana, *lama*, *kukui*, and air plant
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric/historic
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: The complex is consists of one terrace (Feature A), and a wall (Feature B). The overall dimensions for the site are c. 21.20 m (E-W) by 10.00 m (N-S).

FEATURE A: Terrace
FUNCTION: Possible agriculture
DIMENSIONS: 21.20 m by 10.00 m by 0.85 m (approx.)
DESCRIPTION: The terrace is oriented on a south-facing gentle slope. The terrace is constructed with aa basalt. The southern end is c. 0.70 m high. There is an extension built off of the southwest corner with some type of cupboard or well contained within.

The floor of this terrace is roughly basin shaped with pieces of aa. The rubble walls are stacked on three sides, the east, the south, and the eastern end of extension. These three walls possess good perpendicular corners and are somewhat faced on the outside. There is an extension built off the southwest corner with a cupboard or well contained within.

FEATURE B: Wall
FUNCTION: Possible prehistoric agriculture
DIMENSIONS: 17.00 m (E-W) by 2.00 m (N-S) by 0.70 m high
DESCRIPTION: The stacked rubble wall is constructed with natural aa basalt. The north side is possibly faced and the south side is collapsed. The central portion appears to be core-filled. The western section forms the northern limits of Feature A. The south side joins the northeast corner of Feature A. It looks like stones were procured from either side of the wall and stacked or piled in the center. The wall is not straight. Rather it travels east and then curves slightly to the northeast.

SITE NO.: State: 14761 **PHRI:** 5
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Prehistoric aa flow, slight westerly slope.
VEGETATION: *Lama*, silver oak, fountain grass, and lantana.
CONDITION: Fair to good
INTEGRITY: Unaltered
PROBABLE AGE: Recent/possibly historic
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: The complex is consists of one wall (Feature A), and a terrace (Feature B). The overall dimensions for the site are c. 21.0 m (SSW to NNE) by 11.5 m (NNW to SSE) by 0.88 m high.

FEATURE A: Wall
FUNCTION: Agriculture
DIMENSIONS: 21.00 m by 2.60 m by 0.88 m (approx.)

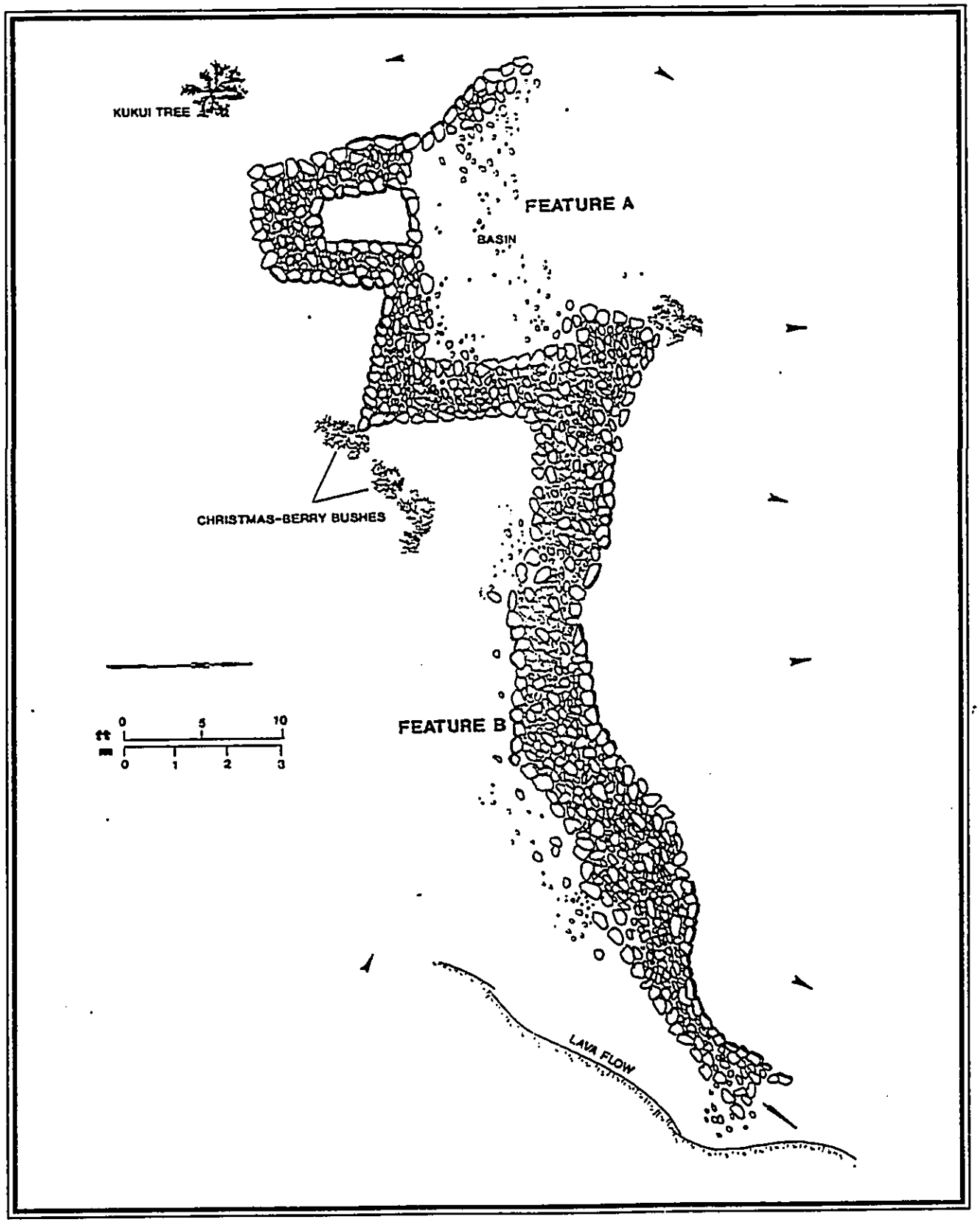

Figure A-1. Site 14760

DESCRIPTION: Feature A is a bifacial core-filled wall running c. 40-220°. There is a bearing of c. 355° to Puu Nahaha and 120-300° to Feature B.

The wall is constructed with basalt boulders stacked two to four courses high, with some core-filling of small stones. Most cobbles average c. 0.20 m by 0.30 m, and the small boulders are c. 0.40 m by 0.50 m. Some areas are still faced. Collapsing has occurred in spots throughout.

This feature is unaltered except for a wooden pole (stick) c. 2.5 m (high) by 0.10 m in diameter standing upright along the southwest side of the wall.

FEATURE B: Terrace
FUNCTION: Agriculture
DIMENSIONS: 2.20 m (N-S) by 4.75 m (E-W) by 0.70 m high
DESCRIPTION: The structure is roughly triangular. It is oriented on a slight westerly slope with the retaining edge facing northwest.

The terrace is constructed with small aa boulders as a faced retaining wall running c. 80-200°. The facing is nearly vertical and stacked two to four courses high, with a measurement ranging from c. 0.50 m to 0.70 m in height. The wall is back-filled to the natural slope with small aa boulders and cobbles. The surface is sloping lightly to the west and is irregular. The back-fill appears to be part of the wall constructed against the natural slope as opposed to building a second face.

SITE NO.: State: 14762 **PHRI:** 6
SITE TYPE: Complex (6 Features)
TOPOGRAPHY: Pahoehoe flow with mild undulations.
VEGETATION: Silver oak, *lama* trees, fountain grass, and lantana.
CONDITION: Fair to good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Transportation/ habitation/markers.
DESCRIPTION: The complex is consists of four cairns (Feature A, B, E, and F), one lava tube cave (Feature C), and a kerbstone trail (Feature D). All features are near Trail #1319 and are probably associated.

FEATURE A: Cairn
FUNCTION: Marker
DIMENSIONS: 1.05 m by 0.90 m by 0.85 m
DESCRIPTION: The cairn is built on a flat basalt boulder. It is constructed with basalt cobbles stacked three-four courses high. The average size of basalt cobble is c. 0.15 m by 0.30 m.

FEATURE B: Cairn
FUNCTION: Marker
DIMENSIONS: 0.54 m by 0.45 m by 0.37 m
DESCRIPTION: The cairn is oriented on a terrain with fountain grass, silver oak, and *lama* trees in the area. It is constructed of basalt cobbles stacked three courses high. The average size of cobbles is c. 0.25 m by 0.15 m.

FEATURE C: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 19.25 m by 7.50 m by 0.77 m (approx.)
DESCRIPTION: The lava tube cave is a small tube with collapsed opening facing 305°. The collapsed section in front of the opening is c. 4.0 m (long) by 3.0 m (wide).

Within the entrance, the tube opens to a wide chamber c. 9.0 m by 7.0 m by 0.77 m. Beyond this chamber, c. 145° from the entrance, is a secondary tube section with a bottle neck entrance that opens up to another chamber, that is c. 11.0 m (wide) by 0.50 m (high). This chamber narrows and runs c. 13.00 m at 125° to a small skylight near the trail. There is also a narrow section of this chamber which runs for c. 7.0 m in length by 0.30 m in height at 320° at the northeast side. No entry is possible at the northwest end.

FEATURE D: Trail
FUNCTION: Transportation
DIMENSIONS: 59.00 m by 3.50 m by 0.65 m
DESCRIPTION: This kerbstone trail is a short section of Site 14762.

This section is running at c. 0-180°. The kerbstone trail is oriented on a slight north to northwest slope on west side with fountain grass, silver oak, *lama*, and lantana in the area.

This kerb stone trail is constructed with pahoehoe slabs and small to medium sized boulders that are placed and stacked along the trail edges. Many of the slabs and boulders have been placed upright or stood on edge. A short area of this section will be mapped as a sample as there are many sections along the length of the known trail which have similar kerbstones. Some of the stones may have been cleared from the trail during construction and some may be from the surrounding area.

FEATURE E: Cairn
FUNCTION: Marker
DIMENSIONS: 2.00 m (N-S) by 2.20 m (E-W) by 1.30 m
DESCRIPTION: This cairn is fairly large and built on a flat pahoehoe surface. It is constructed of pahoehoe cobbles and slabs and is a maximum of six to seven courses high. Average slab size is approximately 0.40 m by 0.40 m. It was built alongside of the #1319 trail and probably served as a trail marker in historic times.

FEATURE F: Cairn
FUNCTION: Marker
DIMENSIONS: 1.95 m by 1.50 m by 1.10 m
DESCRIPTION: This cairn is fairly substantial and well-constructed of mostly pahoehoe slabs with some pahoehoe cobbles, medium and large size. The slab's average size is c. 0.40 m by 0.40 m. The stones are stacked three to six courses high. Most of the slabs are lying flat. The cairn is near vertical on the northeast and south sides. It is oval, with the long axis running east west. The cairn is c. 3.0 m below the crest of the rise to the south c. 25. m.

There are two noted pieces of historic green bottle glass on the cairn.

SITE NO.: State: 14763 **PHRI:** 7
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Upland pahoehoe lava flows undercut by cracks and lava tube cave systems.
VEGETATION: Christmas-berry, *kukui*, silver oak, lantana, and fountain grass.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex is consists of a clear area (Feature A), and a hearth (Feature B).

FEATURE A: Clear area
FUNCTION: Temporary habitation
DIMENSIONS: 7.00 m by 2.50 m by 0.00 m
DESCRIPTION: This is a clear flat area. The stones in the area are c. 0.30 m, or less, in size. The clear area is located along the south of a wall c. 5.0 m from a skylight to the west.

FEATURE B: Hearth
FUNCTION: Temporary habitation
DIMENSIONS: 1.20 m by 0.40 m by <0.01 m
DESCRIPTION: The hearth consists of ash and charcoal and measures less than c. 0.50 m square. It is located along a south wall c. 5.0 m from a skylight to the west. The remaining ashes are c. 0.01 m or less with charcoal flecks mixed in.

SITE NO.: State: 14764 **PHRI:** 8
SITE TYPE: Terrace
TOPOGRAPHY: Lava tube located in area of undulating pahoehoe lava flows
VEGETATION: Fountain grass and lantana on the floor of the skylight.
CONDITION: Fair to good
INTEGRITY: Unaltered
PROBABLE AGE: Indeterminate
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 2.75 m by 2.00 m by 0.30 m
DESCRIPTION: The terrace is situated along the south wall of the cave and c. 10.0 m off the drip line. The terrace is constructed with several placed pahoehoe slabs situated and roughly leveled. There is a historic trash (electrical tape and clear plastic wrappers) within c. 5.00 m of the vicinity that may not be associated with the terrace.

SITE NO.: State: 14765 **PHRI:** 9
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: North trending, gently sloping, upland lava flows.
VEGETATION: Silver oak, lantana, and fountain grass.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric or historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of three terraces (Feature A, B, and C), and a modified outcrop (Feature D). The series of features is located in a lava tube cave that separates into three branches that were labeled Caves A, B, and C.

FEATURE A: Terrace
FUNCTION: Possible habitation
DIMENSIONS: 3.80 m by 2.70 m by 0.40 m
DESCRIPTION: The terrace is collapsed downslope. It is constructed with large natural basalt (aa) pieces. It may have been similar in construction to Feature B. It is located on the left side of the center tunnel of a large tube cave. Method of construction is impossible to determine due to collapse.

FEATURE B: Terrace
FUNCTION: Possible temporary habitation
DIMENSIONS: 2.60 m by 1.80 m by 1.10 m
DESCRIPTION: This feature is a level terrace that is placed on the side of a low bulge separating Caves B and C. It is located c. 5.0 m north of Feature A.

The terrace is constructed with small and large natural aa lava pieces. It is roughly faced along the eastern side. The pieces are stacked a maximum of four courses high with a large (c. 1.0 m by 1.0 m) flat stone and many pieces of small rubble to make the top flat.

FEATURE C: Terrace
FUNCTION: Possible temporary habitation
DIMENSIONS: 2.20 m by 1.50 m by 0.50 m

DIMENSIONS: 2.00 m (N-S) by 1.50 m (E-W) by 0.35 m high
DESCRIPTION: This structure consists of large, stacked pahoehoe cobbles on the top of a low pahoehoe bubble. There are more than 25 stones used, but collapsing has left only one to two courses high to a maximum height of c. 0.35 m and an irregularly shaped pile of rubble. This structure and Feature A appear to be related. There is a small broken section of the rubble immediately to the north, but it is not large enough to supply the cairn cobbles. Feature A is c. 15.0 m to the southwest at (219°). This cairn complex perhaps served as a marker to Site 14774, a cave site c. 40.0 m northeast.

SITE NO.: State: 14774 **PHRI:** 18
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Lava tube within a sunken area, in rolling grassland
VEGETATION: Fountain grass
CONDITION: Fair
INTEGRITY: Goats may have disturbed midden deposit
PROBABLE AGE: Indeterminate
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of a cave (Feature A) and an alignment (Feature B). The overall dimensions are c. 41.0 m (NW-SE) by 4.00 m (NE-SW). A minimal modification near the cave mouth is composed of a rock alignment (Feature B).

FEATURE A: Cave
FUNCTION: Temporary habitation
DIMENSIONS: 45.00 m (NW-SE) by 4.00 m (NE-SW) by 2.40 m (approximately)
DESCRIPTION: The cave is a lava tube cave. There are cultural deposits near the mouth of the cave which include *Thaidadae* shell, *Cypraea* shell, *Echinometra* (sea urchin), and goat mandible. This lava tube cave is located in a low, sunken area c. 40.0 m northwest of Site 897-17.

FEATURE B: Alignment
FUNCTION: Temporary habitation
DIMENSIONS: 2.40 m (NE-SW) by 1.70 m (NW-SE) (cleared portion)
DESCRIPTION: The alignment defines a cleared area. The alignment may be a result of merely pushing rocks aside to form a cleared area. Marine shell concentrated outside of feature on southwest side, and mixed in with rubble on the north side. This feature appears to be an informal, minimally modified clearing that may have served as an eating area, based on discarded shell around the perimeter. There are no vegetation, though fountain grass partially obscured the entrance of the cave. The alignment is located within the cave (Feature A), near the mouth.

SITE NO.: State: 14775 **PHRI:** 19
SITE TYPE: Lava tube cave
TOPOGRAPHY: Rolling plains *mauka* of Puu Mau. Several *mauka-makai* lava tube systems undercut the area.
VEGETATION: Fountain grass, and very sparse indigo.
CONDITION: Good to excellent
INTEGRITY: Possibly altered by goat activity.
PROBABLE AGE: Possible prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 4.00 m (N-S) by 10.00 m (E-W) by 0.00 m
DESCRIPTION: There are no observed constructed features within the cave. On the south wall of the cave are two stones that are placed in a small side tube. This could have performed some type of water catchment function or like. The next cave, *mauka* (across the sink) is Cave #599 (*makai*). There is a very light scatter of *Cypraea* (cowry), *Patella* (*'opihi*), and an unknown shell on the lava about the sink. Most appears confined to the southwest portion of the sink rim.

SITE NO.: State: 14776 **PHRI:** 20
SITE TYPE: C-shape
TOPOGRAPHY: Gently sloping north-trending lava plains undercut by lava tubes.
VEGETATION: Fountain grass, sparse indigo
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 3.20 m (N-S) by 2.72 m (1E-W) by 0.46 m high
DESCRIPTION: The rough C-shape consists of the main body which is constructed in a slot in the lava with two "arms" built out. The arms consist of one or two courses of pahoehoe lava slabs loosely stacked atop one another. There is a possible rough pahoehoe excavation located c. 6.0 m away, at 110°. The possible C-shape structure is located c. 3.5 m (at 143°) from the mouth of cave #596 (*makai*).

SITE NO.: State: 14777 **PHRI:** 21
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Undulating aa and pahoehoe lava flows undercut by lava tube systems. Puu Mau to the south within c. 100.0 m.
VEGETATION: Fountain grass and lantana

CONDITION: Fair
INTEGRITY: Feature A and C, unaltered, Feature B and D altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of a mound (Feature A), an L-shape (Feature B), an upright slab (Feature C), and a cupboard (Feature D). The overall dimension for the site is c. 20.0 m by 7.0 m by 1.73 m.

FEATURE A: Mound
FUNCTION: Habitation
DIMENSIONS: 1.30 m by 1.30 m by 0.90 m (approx.)
DESCRIPTION: The stone support modification is located at the south side of drip line of cave #513. It is constructed with basalt boulders and small slabs and stacked five-six courses high. *Kukui* nut, waterworn pebble, *opihi*, and *ipu* gourd are found in this vicinity.

FEATURE B: L-shape
FUNCTION: Habitation/possible storage
DIMENSIONS: 2.50 m by 1.50 m by 0.87 m
DESCRIPTION: The L-shape enclosure is oriented on northwest edge under overhang of #512/513 sink. The walls may be falling in as evidenced by random stones on interior floor. The feature is constructed with basalt slabs of pahoehoe stacked three-four courses high and placed along the edge of drip line and blocked off on the west side. There are *Echinoidea* and goat bones near this feature.

FEATURE C: Upright
FUNCTION: Habitation
DIMENSIONS: 1.50 m by 0.90 m by 1.00 m (approx.)
DESCRIPTION: The feature is constructed of placed upright basalt slabs. They are positioned at the edge of the drip line. Feature C is oriented between Feature B and D.

FEATURE D: Cupboard
FUNCTION: Storage
DIMENSIONS: 1.10 m by 0.60 m by 0.47 m
DESCRIPTION: The cupboard is located west of Feature B and C. It is constructed in a natural lava blister on the south. Pahoehoe fragments are stacked one-two courses high to form a cupboard in-between There are *ipu* gourd fragments, *Echinoidea*, and goat bone in this vicinity.

SITE NO.: State: 14778 *(Figure A-5)* **PHRI:** 22
SITE TYPE: Complex (5 Features)
TOPOGRAPHY: Gentle north-trending lava plains undercut by lava tube caves.
VEGETATION: Fountain grass (dense) with occasional indigo and *hala-pepe*.

CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of a cupboard (Feature A), a stone alignment (Feature B), two walls (Feature C and D), and a rubble pile (Feature E).

FEATURE A: Cupboard
FUNCTION: Storage
DIMENSIONS: 1.30 m by 1.10 m by 0.55 m
DESCRIPTION: The cupboard is a lava blister that opened to the front and has basalt slabs placed along the face to form a cupboard. It is constructed in a natural lava blister that had a single course of stones placed across its opening.

FEATURE B: Alignment
FUNCTION: Habitation
DIMENSIONS: 4.20 m by 3.80 m by 0.57 m (approx.)
DESCRIPTION: The stone alignment is constructed with large basalt boulder and is faced. It is oriented c. 40-220°, then turns c. 310° following the drip line. The stones that are located at c. 310° are one third to half size of the big basalt. Walls are both c. 1.0 m in from the drip line. Stones are stacked one to two courses high and c. 2.0 m before running into the tube. The wall has small cobbles placed behind them to the wall. The cobbles are the same type as those from the cave floor found in Feature E. Possibly, the 310° portion of the feature represents a later modification. A small amount of *'opihi* shell was located between this alignment and the drip line.

FEATURE C: Wall
FUNCTION: Possible animal husbandry
DIMENSIONS: 4.50 m by 2.90 m by 1.80 m (approx.)
DESCRIPTION: The stone wall is running across a lava tube sink. It is located just northeast of Puu Mau, southeast of Feature D, and northwest of Feature B. The stone wall is stacked four to five courses high with basalt small boulders and some core filling.

FEATURE D: Wall
FUNCTION: Possible animal husbandry
DIMENSIONS: 3.80 m by 1.50 m by 1.40 m (approx.)
DESCRIPTION: The stone wall is running across a lava tube sink. It is oriented on a terrain of dry grass and small lantana. The land is sloping gently to the west. The stone wall is constructed with basalt small boulders, stacked four to five courses high, with some core filling evident.

FEATURE E: Mound
FUNCTION: Indeterminate/habitation
DIMENSIONS: 2.00 m by 1.30 m by 0.30 m

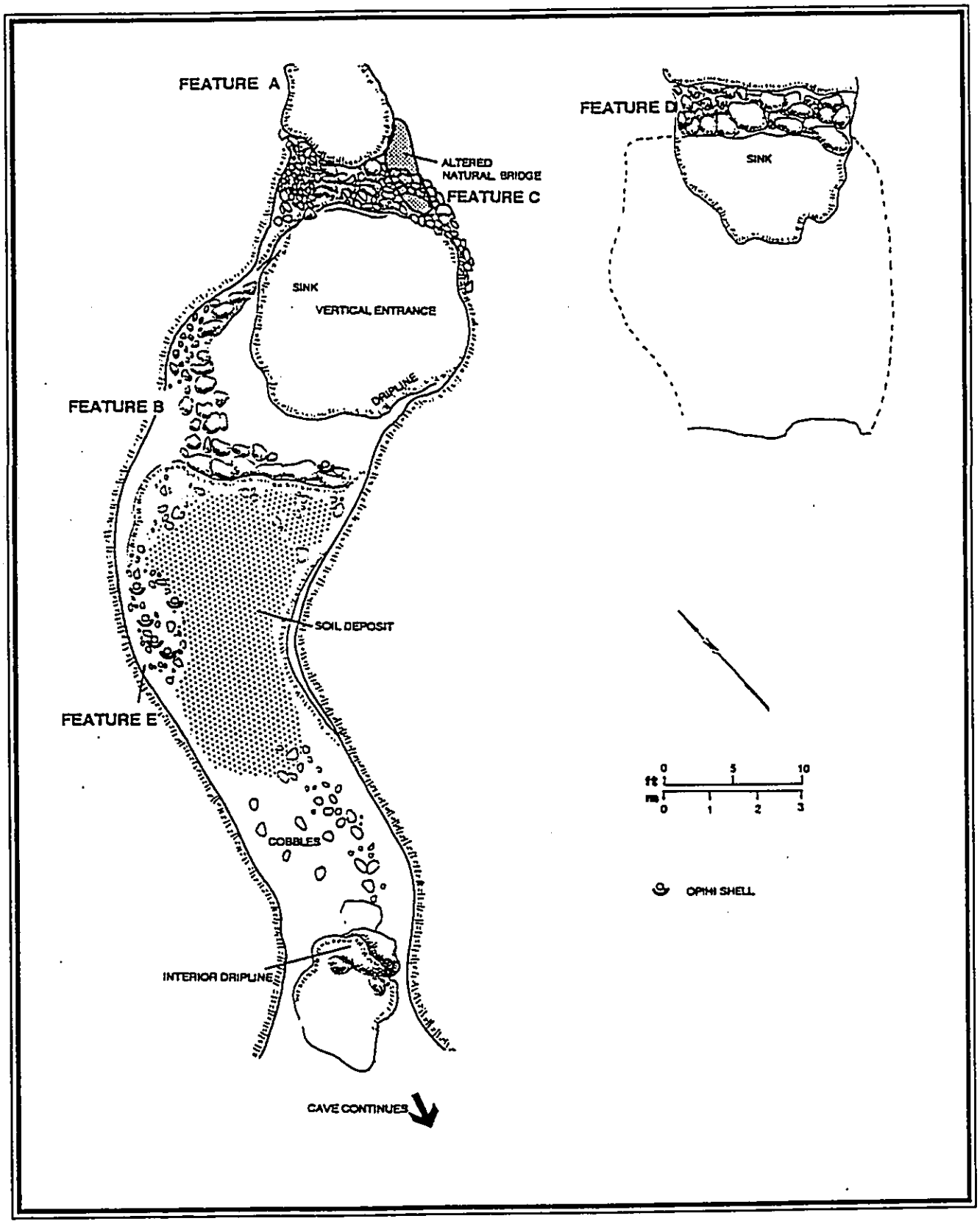

Figure A-5. Site 14778

DESCRIPTION: The rubble pile is located on southwest wall of cave. The rubble pile is constructed with cleared rubble from cave floor and could be the result of cave floor clearing. There are some *kukui* nut and *'opihi* remains found in the area on the cave floor.

SITE NO.: State: 14779 **PHRI:** 23
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Land sloping gently to the west.
VEGETATION: Dense fountain grass, and sparse indigo
CONDITION: Good
INTEGRITY: Partially altered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of two stone walls (Feature A and B) and a stone alignment (Feature C)

FEATURE A: Wall
FUNCTION: Boundary
DIMENSIONS: 1.50 m by 0.50 m by 0.90 m
DESCRIPTION: The stone wall is running c. 50-230° blocking off the northwest end of the tube. It is constructed of broken pahoehoe lava stacked five to six courses high to block the tube. This stone wall is found c. 30.0 m north of Puu Mau in Cave #521 and to the left inside of the cave.

FEATURE B: Wall
FUNCTION: Indeterminate
DIMENSIONS: 2.60 m by 1.00 m by 0.50 m
DESCRIPTION: The stone wall is constructed utilizing small boulders and cobbles one to three courses high running generally east to west. It is oriented c. 30.0 m of Puu Mau and to the right as entering the cave. *'Opihi, Nerita, Echinoidea*, and *Kukui* fragments were found throughout the cave floor.

FEATURE C: Alignment
FUNCTION: Marker
DIMENSIONS: 3.00 m by 1.60 m by 0.00 m (approx.)
DESCRIPTION: The stone alignment is oriented at the edge of the drip line of the cave entrance. It is constructed with basalt small slabs and fist-sized cobbles, which are placed and stacked one-two courses high.

SITE NO.: State: 14780 **PHRI:** 24
SITE TYPE: Lava tube cave
TOPOGRAPHY: Generally level with some slight hills and depressions.
VEGETATION: Dense fountain grass and sparse indigo
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 25.00 m (N-S) by 8.50 m (E-W) by 2.80 m (approx.)
DESCRIPTION: This lava tube cave runs at c. 350°. It consists of four terraces and a midden scatter. The first terrace is oriented on the west wall. It measures c. 4.0 m by 2.0 m. It is constructed with pahoehoe slabs and stacked three to four courses high. The second terrace is oriented on the east wall. The floor of this terrace is cleared. The second terrace is c. 1.0 m by 1.5 m by 0.73 m. It is stacked three-four courses high. The tube heads deeper into the cave. The third terrace is found in the middle of the lava tube cave where the tube gets narrow. It ran the width of the tube cave. The third terrace is c. 4.0 m by 2.0 m. This terrace is c. 9.0 m in from the center of the drip line and is paved with pahoehoe slabs. The fourth terrace is oriented further in the lava tube cave at c. 2.5 m from the third terrace. It continues and ends in an area of roof-fall. A clearing mound separates the third and fourth terrace. A midden scatter of *Cypraea* sp., *Nerita* sp., and *kukui* is located c. 3.0 m in from the center of drip line, north-northeast of the first terrace, and west of the second terrace.

SITE NO.: State: 14781 **PHRI:** 25
SITE TYPE: Lava tube cave
TOPOGRAPHY: Generally flat
VEGETATION: Dense fountain grass and very sparse indigo
CONDITION: Fair
INTEGRITY: Altered by goat activity - dung everywhere
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 2 m (N-S) by 8 m (E-W)
DESCRIPTION: The lava tube cave is not modified. A thin midden scatter is present in the cave. Marine shells present include *Echinoidea, Nerita,* and *Cyprea*, along with *Kukui.*

SITE NO.: State: 14782 **PHRI:** 26
SITE TYPE: Lava tube cave
TOPOGRAPHY: Prehistoric pahoehoe flow, slight northwest slope.
VEGETATION: Dense fountain grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation

DIMENSIONS: 30.00 m (NW-SE) by 20.00 m (NE-SW) by 2.90 m
DESCRIPTION: This is a low cave with an entrance facing southeast to a small collapsed sink. The entrance is low and wide c. 2.90 m by 1.0 m, which drops to a chamber c. 5.25 m (N-S) by 5.0 m (E-W). There is a fairly level floor area of c. 5.0 m (E-W) by 2.10 m (N-S). Some small rubble is scattered on the floor and it may have been cleared at one time. One water-worn basalt pebble and a light scatter of marine shell midden were noted in the central portion of the floor. The tube continues c. 30.0 m at 360°. A site tag is located at the east end of cave.

SITE NO.: State: 14783 **PHRI:** 27
SITE TYPE: Trail
TOPOGRAPHY: Gently north - sloping pahoehoe and aa lava plains undercut by numerous *mauka/makai* lave tube caves.
VEGETATION: Fountain grass and very sparse indigo
CONDITION: Good
INTEGRITY: Unaltered except for some possible movements of stones.
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: 28.00 m (NE-SW) by 3.50 m (NW-SE)
DESCRIPTION: This portion of unknown (unrecorded) trail passes across an aa lava flow by means of about 20 slabs of pahoehoe laying atop the aa in a rough alignment.

SITE NO.: State: 14784 **PHRI:** 28
SITE TYPE: Lava tube cave
TOPOGRAPHY: Gentle north-sloping pahoehoe and aa lava flows with surface and subterranean lava tube sinks and caves.
VEGETATION: Fountain grass and sparse indigo
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Indeterminate/possible prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 11.80 m (N-S) by 9.00 m (E-W) by 1.37 m (approx.)
DESCRIPTION: There is a cleared area c. 5.0 m by 4.0 m across in which rocks are removed. Also a step is built of large pahoehoe slabs down through the skylight entrance. There is a grouping of three small basalts that may have (along with a calabash) served as water catchment.

SITE NO.: State: 14785 **PHRI:** 29
SITE TYPE: Terrace
TOPOGRAPHY: Gently sloping aa and pahoehoe lava plains marked by aa piles and flows and underlain by several *mauka/makai* lava tube systems and sinkholes.
VEGETATION: Sparse fountain grass, with the surrounding area having medium thick fountain grass and sparse *lama*.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 5.00 m (NW-SE) by 3.00 m (NE-SW) by 0.83 m (approx.)
DESCRIPTION: The side walls of the enclosure/terrace are in a lava chute which lies c. 86 m inside of the drip line of the lava tube cave. The floor has been cleared and it is covered by golf ball sized and smaller pieces of rounded aa lava. A low wall (two-three courses high) has been placed between the chute walls for both retaining and enclosure purposes on the northwest. The upslope (SSE) wall is less formal and appears to be a jumble of roof fall. A large upright is present between two large boulders c. 2.7 m (110°) to the southeast and may be associated. The terrace located deep within the cave may have served as a burial terrace.

SITE NO.: State: 14786 *(Figure A-6)* **PHRI:** 30
SITE TYPE: Complex (13 Features)
TOPOGRAPHY: Rolling pahoehoe and aa lava fields at times undercut by *mauka/makai* cave tubes.
VEGETATION: Fountain grass and indigo.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of six enclosures (Features A-C, H, I, and M), three C-shapes (Features D-F), a level area (Feature G), two cairns (Features J and K), and a petroglyph panel (Feature L). The approximate dimensions for the site are c. 200.0 m (NW-SE)) by 100.0 m (NE-SW).

FEATURE A: Enclosure
FUNCTION: Habitation
DIMENSIONS: 4.00 m by 3.50 m by 0.55 m (approx.)
DESCRIPTION: The enclosure is oriented east of Feature B. This feature is constructed with slab pahoehoe some of which are turned upright. Walls are stacked on bedrock. North and south walls are the most intact and they are stacked two-three courses high. This feature is located on rolling grasslands with fountain grass.

FEATURE B: Enclosure
FUNCTION: Habitation
DIMENSIONS: 6.50 m by 6.10 m by 0.65 m (approx.)

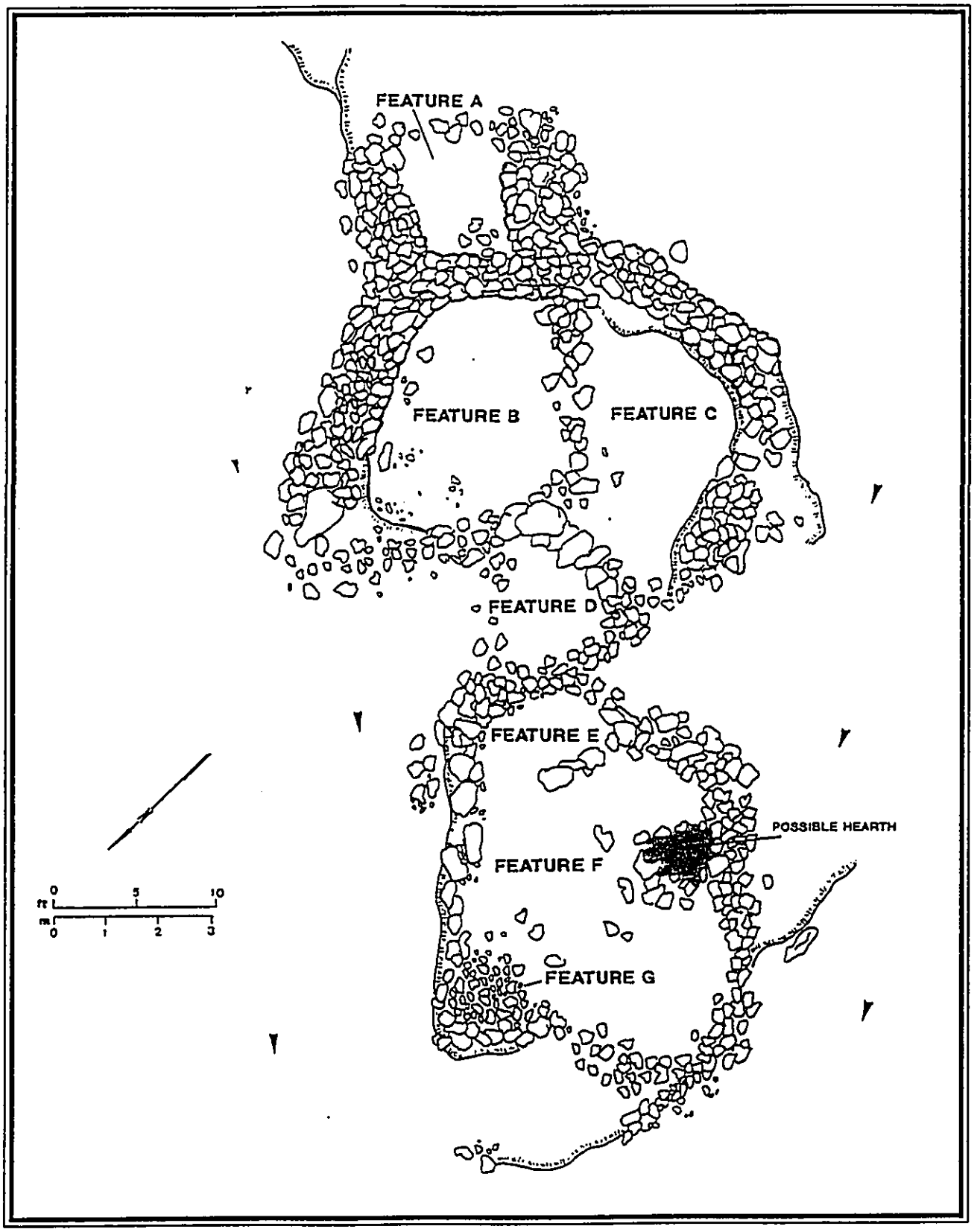

Figure A-6. Site 14786, Features A-G

DESCRIPTION: This D-shape enclosure is adjacent to Feature C and west of Feature A. It is located in a rolling region covered with fountain grass. It is constructed with slab pahoehoe and stacked up to four courses high and faced on the west side.

FEATURE C: Enclosure
FUNCTION: Habitation
DIMENSIONS: 8.00 m by 4.20 m by 0.58 m (approx.)
DESCRIPTION: This is a roughly rectangular enclosure. The east wall of this enclosure is the highest and most massive, though it has eroded to grade. The enclosure is stacked up to three courses high with slab pahoehoe.

FEATURE D: C-shape
FUNCTION: Habitation
DIMENSIONS: 3.90 m by 3.10 m by 0.35 m (approx.)
DESCRIPTION: The C-shape structure is oriented north of Feature C, west of Feature B, and directly east of Feature E on a rolling grasslands with fountain grass in the area. The feature is constructed with pahoehoe slabs. The walls have fallen to grade. The opening appears to be on the north side. The south wall is stacked on a low bedrock outcrop.

FEATURE E: C-shape
FUNCTION: Habitation
DIMENSIONS: 4.30 m by 3.00 m by 0.63 m (approx.)
DESCRIPTION: This is a C-shape structure with a small opening to the south. It is oriented west of and adjacent to Feature D on a rolling grasslands with fountain grass in the area. It is constructed with pahoehoe slabs. The north wall is stacked up to four courses high and it is the most intact. The south wall incorporates upright slabs. The west wall is reduced to grade. There is a rock alignment on the interior of this feature. It may define interior features or may be a result of disturbance.

FEATURE F: C-shape
FUNCTION: Habitation
DIMENSIONS: 7.50 m by 6.00 m by 0.52 m (approx.)
DESCRIPTION: The enclosure is oriented west of and contained within Feature E with a opening to the northwest. It is constructed with pahoehoe slabs that have been generally reduced to grade.

FEATURE G: Level area
FUNCTION: Habitation
DIMENSIONS: 1.50 m by 1.20 m by 0.00 m (approx.)
DESCRIPTION: This is a level area with possible pavement. It is oriented west of and adjacent to Feature F on a rolling grasslands with fountain grass in the area. This feature is constructed with slab pahoehoe levels on area resting on a bedrock outcrop. The feature may be a rock-filled terrace designed to level an area.

FEATURE H: Enclosure
FUNCTION: Habitation
DIMENSIONS: 5.50 m by 4.50 m by 0.75 m (approx.)
DESCRIPTION: The enclosure is rectangular. It is oriented c. 45.0 m southeast of main complex (Feature A-G) on a rolling grasslands covered with fountain grass. It is structured with roughly stacked fragments of slab pahoehoe and the interior is faced with upright slabs.

FEATURE I: Enclosure
FUNCTION: Habitation
DIMENSIONS: 2.90 m by 2.90 m by 0.45 m (approx.)
DESCRIPTION: This is a D-shape enclosure. It is oriented west (270°) of the main complex (Feature A-G) at c. 20.0 m on a rolling grasslands with fountain grass in the area. The main axis of structure runs east to west, with curved wall on north side. It is constructed with slab pahoehoe that are roughly stacked two-three courses high on a bedrock outcrop.

FEATURE J: Cairn
FUNCTION: Possible transportation marker
DIMENSIONS: 2.00 m by 2.00 m by 0.70 m
DESCRIPTION: The cairn is located south (180°) c. 40.0 m from the main complex (Feature A-G) on a rolling grasslands covered with fountain grass. The cairn (along with Feature K) seems to be a "gateway" to the petroglyph fields if approaching from the main complex (Feature A-G) Feature J is roughly triangular and located west of Feature K. Both Feature J and Feature K are located near a possible branch of the #1319 trail.

FEATURE K: Cairn
FUNCTION: Possible transportation marker
DIMENSIONS: 2.00 m by 1.00 m by 0.30 m
DESCRIPTION: Feature K is oriented on a rolling grassland covered with fountain grass. It is loosely stacked with slab pahoehoe up to four courses high. Feature K is located east of Feature J.

FEATURE L: Petroglyph
FUNCTION: Habitation
DIMENSIONS: 20.00 m by 66.00 m by 1.24 m (approx.)
DESCRIPTION: Feature L consists of an unknown number of figures which may be confined to the area south of cairns (Features J & K). It is found on pahoehoe bedrock and is probably associated with the rest of the complex (A-L). Design motifs are varied, although anthropomorphs are dominant, with fish and spirals also noted.

FEATURE M: Enclosure
FUNCTION: Habitation
DIMENSIONS: 8.00 m (SSE) by 3.50 m (NNW) by 0.38 m
DESCRIPTION: This is a small enclosure.. It is oriented c. 37.0 m (318°) to petroglyph field. The enclosure is constructed with basalt pahoehoe large cobbles and small boulders that are stacked one-three courses high. This is roughly rectangular with a possible aligned extension upslope to a flat pahoehoe slab.

SITE NO.: State: 14790 **PHRI:** 34
SITE TYPE: Enclosure
TOPOGRAPHY: Atop a west-trending finger ridge flowing off of Puu Mau. The big *mauka/makai* tube line is found just to the southwest and the nearest sinkhole (#168) is c. 30.0 m away at 240°.
VEGETATION: Fountain grass and indigo
CONDITION: Good
INTEGRITY: Probably unaltered
PROBABLE AGE: Unknown/possible prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 9.60 m (E-W) by 8.80 m (N-S) by 0.90 m (approx.)
DESCRIPTION: The enclosure is constructed with natural basalt blocks with a stacked rubble wall configuration. No attempt appears to have been made at facing the walls.

SITE NO.: State: 14791 **PHRI:** 35
SITE TYPE: Cairn
TOPOGRAPHY: Rolling pahoehoe slopes on the Kailua side of Puu Mau.
VEGETATION: Limited to fountain grass. Sword fern was found at the mouth of the cave.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Marker
DIMENSIONS: 1.37 m by 1.04 m by 1.07 m high (approx.)
DESCRIPTION: The cairn is constructed with pahoehoe slabs stacked horizontally at the mouth of the #163 *makai* cave. It is built atop roof-fall just under the drip line. Cairn is located in a sink with Cave #163 (*makai*) on *mauka* and cave #164 (*mauka*) on *makai*. The placement of this cairn within the mouth of the cave may represent some type of monument to indicate a burial position.

SITE NO.: State: 14792 **PHRI:** 36
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Rolling lava plains which are underlain by lava tube caves
VEGETATION: Fountain grass and indigo
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 18.00 m (N-S) by 10.00 m (E-W) by 0.00 m (approx.)
DESCRIPTION: The lava tube is structured with two caves and two terraces. The two caves are numbered as Cave #169 and Cave #170. Cave #169 is oriented on the southeast end of the natural structure. Cave #170 is oriented on the northeast end, directly opposite of cave #169. A terrace with two levels is located directly west of cave #169. The other terrace is immediately before cave #170 (between cave #169 and cave #170). The overall dimensions of the natural structure is c. 18.0 m by 10.0 m.

SITE NO.: State: 14793 *(Figure A-7)* **PHRI:** 37
SITE TYPE: Lava tube cave
TOPOGRAPHY: Rolling lava fields underlain by tube systems.
VEGETATION: Fountain grass
CONDITION: Excellent
INTEGRITY: Unaltered
PROBABLE AGE: Probably prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 5.00 m (N-S) by 7.00 m (E-W) by 2.30 m (approx.)
DESCRIPTION: The lava tube cave entrance is constructed with upright slabs leaning against the wall. The floor of the cave is solid pahoehoe. There is a possible semicircular rock alignment and wall near the entrance. This possible alignment contains horizontal basalt one course high.

SITE NO.: State: 14794 **PHRI:** 38
SITE TYPE: Enclosure
TOPOGRAPHY: Gently north-trending aa and pahoehoe slopes underlain by *makai/mauka* trending volcanic lava tubes.
VEGETATION: Thick indigo and sparse fountain grass.
CONDITION: Fair
INTEGRITY: Altered by wall slumpage
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 5.40 m (N-S) by 8.10 m (E-W) by 0.64 m high
DESCRIPTION: This is a single rectangular enclosure. It is oriented c. 40.0 m away from a lava tube cave (Site 14795

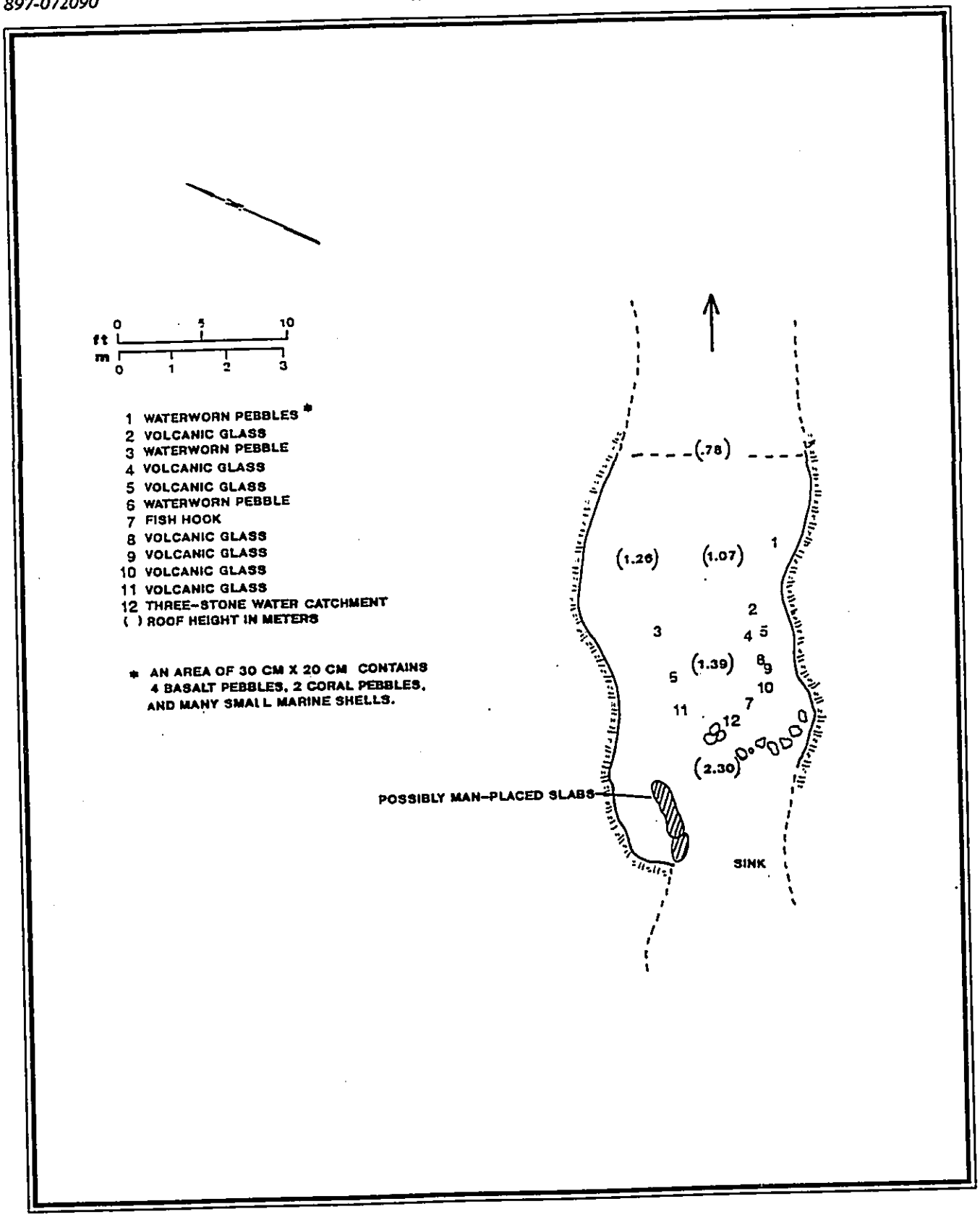

Figure A-7. Site 14793

at 175°). Since Site 14795 is very near, it may be associated. This enclosure is constructed with natural basalt pieces stacked one-two courses high and tied in with a basalt outcrop along the south/southeast side. There are one or two possible internal features in the eastern portion of the structure, although they appear to be mostly displaced. Also a possible feature (internal) was also found in the WNW corner.

SITE NO.: State: 14795 **PHRI:** 39
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Gentle north-trending lava plains (pahoehoe and aa) with aa flows dominating. There are several *mauka/makai* trending lava tube caves.
VEGETATION: Dense fountain grass and very sparse *lama*
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of two lava tubes (Features A and B). The overall dimension (with the intervening sink) for this structure is c. 16.4 m (NW-SE) by 3.5 m (NE-SW) by 1.57 m deep.

FEATURE A: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 9.50 m (NW-SE) by 3.60 m (NE-SW) by 1.50 m high
DESCRIPTION: This lava tube cave entrance faces 135°. Within the tube is a light marine shell midden scatter with *kukui* nut concentrations. The cave floor is irregular with pockets of possible cultural deposition. There are two possible modifications, a possible water catchment set of placed stones c. 2.0 m west of the entrance beside the southwest side wall, and the other is a possible terrace under the drip line at the northeast side wall. There is also possible floor clearing with a rough alignment running perpendicular to the tube, c. 8.0 m within the cave. The tube continues and narrows at 315°.

FEATURE B: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 3.60 m (NW-SE) by 3.40 m (NE-SW) by 1.65 m
DESCRIPTION: This feature entrance faces 315°. This cave has two obvious modifications. The first is a small wing wall built off the northeast side wall of the drip line c. 0.75 m in length. The second modification is a wall running perpendicular to the tube c. 2.0 m back from the entrance. It is c. 3.50 m long and stacked one-three courses high which partly closes off the rear of the cave. Floor surface is irregular with roof fall rubble and sloping to the northwest. There is natural shelf running along the southwest side wall c. 0.5 m wide and 0.4 m high.

SITE NO.: State: 14796 *(Figure A-8)* **PHRI:** 40
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: North-trending pahoehoe and aa lava plains which are riddled with north-flowing lava tube caves.
VEGETATION: Fountain grass in sink, the surrounding country has dense fountain grass, along with sparse indigo and sparse *lama*.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of two lava tube caves (Feature A and B). The overall dimensions are c. 18.0 m (N-S) by 8.70 m (E-W) by 3.00 m.

FEATURE A: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 12.00 m by 7.00 m by 3.00 m
DESCRIPTION: This feature has an entrance facing 330°. It is c. 3.25 m wide and 2.15 m high. Within the cave is a constructed terrace c. 2.5 m (NW-SE) by 2.10 m (NE-SW) by 0.75 m high. The terrace is paved. About 2.5 m northwest of the drip line on the west side wall of the collapsed sink, are stacked stones that are c. 1.5 m by 1.0 m for stairway/ access into the sink. The terrace has been cleared and leveled. Also found within this area were *Cellena*, burned wood and natural stalagtites.

FEATURE B: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 10 m (NW-SE) by 9 m (NE-SW) by 2.0 m high
DESCRIPTION: This feature has an entrance facing a collapsed tube section at 150~ The cave has been modified in two areas. The first is just within the drip line where a paved terrace of pahoehoe slabs measuring 4.0 m NE-SW by 3.0 m NW-SE is found. This terrace is at the northwest side of the tube, just below a small side tube. The cave floor also may be paved to the north and east of the terrace. Approximately 4.50 m into the tube (in the northeast portion of the tube) is a constructed cupboard. Construction here utilizes several large pahoehoe slabs supporting roof fall to the north. Interior dimensions of the cupboard are c. 0.75 m by 0.50 m by 0.50 high.

Remains observed in Feature B included *Echinoidea*, and *Kukui* nuts.

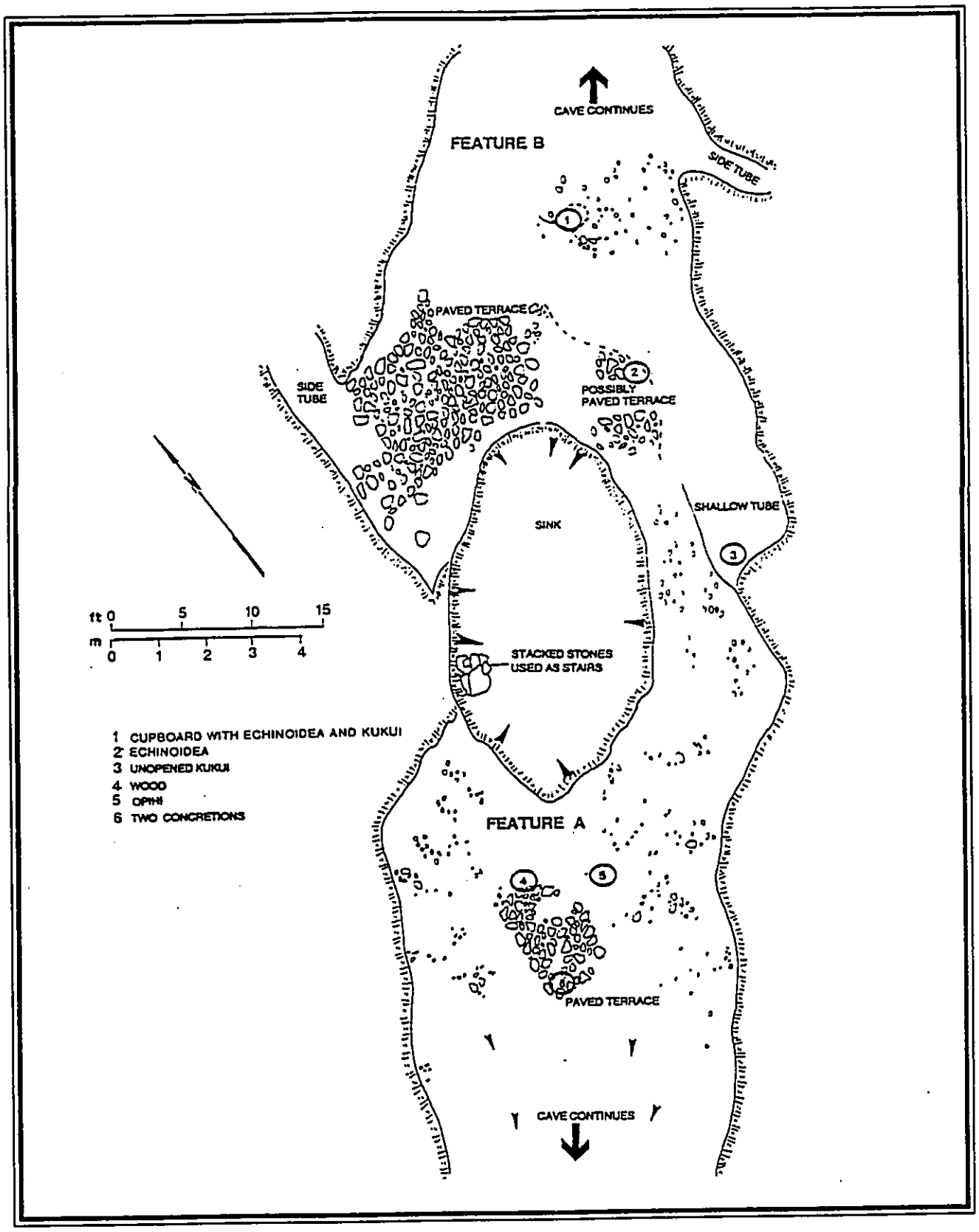

Figure A-8. Site 14796

FEATURE B: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 10.00 m by 9.00 m by 2.00 m
DESCRIPTION: This feature has an entrance facing a collapsed tube section at 150°. The cave has been modified in two areas. Just within the drip line is a paved terrace area of pahoehoe slabs c. 4.0 m by 3.0 m by 2.0 m. The terrace is at the northwest side of the tube just below a small side tube. Cover floor is possibly paved to the north and east of the terrace c. 4.5 m. Within the tube in the northeast central portion of the tube is a constructed cupboard. Construction is of several large pahoehoe slabs supporting each other against roof fall to the north. A cupboard is c. 0.75 m by 0.5 m by 5.0 m.

SITE NO.: State: 14797 **PHRI:** 41
SITE TYPE: Enclosure
TOPOGRAPHY: Gently undulating upland lava flows with lava tube caves in the area. Just to the south is a huge collapsed tunnel.
VEGETATION: *Koa-haole*, *lama*, *'ilima*, lantana, fountain grass, silver oak, and moss. Lantana is dominant in surrounding area.
CONDITION: Fair
INTEGRITY: Probably unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 7.00 m (N-S) by 6.30 m (E-W) by 0.60 m (approx.)
DESCRIPTION: The enclosure is constructed with both pahoehoe slabs and boulders. They are mostly upright. Several of the slabs along the east side are placed vertically as are most along the northwest side. It appears that most or all were vertical at one time. The shape is basically square. The construction of this enclosure utilizing the vertical pahoehoe slabs appears uncommon in this immediate area and would warrant further investigation.

SITE NO.: State: 14798 **PHRI:** 42
SITE TYPE: Lava Tube Cave
TOPOGRAPHY: Upland aa and pahoehoe lava flows trending quickly to the north. These flows are interlaced by lava tube cave systems flowing downslope to the ocean.
VEGETATION: Silver oak, lantana, Christmas berry, *koa-haole*, and fountain grass
CONDITION: Good
INTEGRITY: Partially altered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Burial
DIMENSIONS: 10.00 m (E-W) by 7.70 m (N-S) by 1.50 m (approx.)
DESCRIPTION: The burial is located in a lava tube. The tube has extensive roof fall. There are skull and mandible in the tube. This has the appearance of a secondary burial in the only the skull and mandible are present. The skull does not have the look of great antiquity although it was not closely examined.

SITE NO.: State: 14799 **PHRI:** 43
SITE TYPE: Enclosure
TOPOGRAPHY: Area is composed of north-trending aa and pahoehoe lava flows cut by lava channels and occasional lava tube caves.
VEGETATION: Fountain grass is dominant and dense with occasional lantana, silver oak and *lama*.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic/recent
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DIMENSIONS: 60.80 m (N-S) by 40.00 m (E-W) by 1.10 m (approx.)
DESCRIPTION: This is a rock wall enclosure with small diameter posts and attached "hog" (small panel) wire placed on the interior. It is constructed with small pahoehoe boulders and medium to large pahoehoe cobbles that are stacked to form bifacial core-filled walls ranging in height of c. 0.60 m to 1.10 m. There are two "pig doors," one on the north and the other on the south side. The interiors of the doors are constructed with planed lumber, galvanized hinges and wire (with panels of c. 0.16 m by 0.12 m) by 1.1 m high. Small diameter wooden posts were used, as well as standard fencing staples, to attach the wire. The wire is placed between the posts and the rock wall. This fence is not broken at the pig door locations, but rather travels across. The Hawaiian Trail #1319 appears to run north to south through the center of the enclosure. This large site, especially taken in connection with the trail would seem to be important to the interpretive trail.

SITE NO.: State: 14800 **PHRI:** 44
SITE TYPE: Sink
TOPOGRAPHY: Slopes gently to north and is made up of pahoehoe and aa lave flows undercut by lava tube caves.
VEGETATION: Fountain grass, lantana, and *koa-haole* in the sink and fountain grass, lantana , silver oak, and *lama* above.
CONDITION: Good
INTEGRITY: Unaltered

PROBABLE AGE: Prehistoric or historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 15.00 m (N-S) by 8.00 m (E-W) by 1.90 m (approx.)
DESCRIPTION: The sink is located in the middle of four lava tube caves. The first cave is oriented on the southeast end of the sink. The second cave is immediately next to the first cave on the southwest end of the sink. The first cave travels about 185° and joins with the second cave in a large (c. 8.0 m by 10.0 m) chamber. The tube continues on at 260° for another c. 50.0 m. The chamber floor is very clean. The third cave is oriented at 335° at the west side of the sink. It travels in for c. 8.0 m the gets smaller and travel further in with an unknown distance. There is a small rock alignment along eastern edge (bottom) of the sink. The fourth cave is oriented on the north end of the sink. It travels in for c. 3.6 m and end with a skylight at the very end of the cave. A series of both prehistoric and historic items including marine and land shells, bottle glass, *kukui* fragments, and shoe parts were located.

SITE NO.: State: 14801 *(Figure A-9)*
Other No.: AS #22 **PHRI:** 45
SITE TYPE: Wall
TOPOGRAPHY: Gently north-sloping pahoehoe and aa lava flows. The surface has gentle undulations.
VEGETATION: Dense fountain grass and very sparse *lama.*
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DIMENSIONS: 68.00 (NW-SE) m by 0.90 m (NE-SW) by 1.25 m high
DESCRIPTION: The wall is bifacial and constructed of natural pieces of aa lava and sits on either side (running perpendicularly to the Hawaiian Trail #1319). Several broken bottles are nearby and include large pieces of clear glass with bubbles and marking on the base, complete light green beverage bottle with crown closure and mold marks to top. The wall is oriented northwest to southeast with the Hawaiian Trail #1319 cutting through the middle and divides the wall in two. There are lava bubbles on both northwest and southeast ends of the wall.

SITE NO.: State: 14802 **PHRI:** 46
SITE TYPE: Hearth
TOPOGRAPHY: West northwest slope of Puu Mau overlooking the long tube line at the bottom of the slope. The hearth lies on a narrow bench just c. 20.0 m below the rim of the crater.
VEGETATION: Indigo (dominant) and fountain grass
CONDITION: Excellent
INTEGRITY: Unaltered and sealed by slopewash
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 2.80 m (N-S) by 1.50 m (E-W) by 0.11 m (approx.)
DESCRIPTION: Only two perpendicular vertical slabs are showing on the downslope side. Slopewash apparently has covered the upslope portion, but probing disclosed the presence of one or two more slabs. Materials are pahoehoe slabs. There is a sparse scattering of cowry shells in the area around the hearth, especially upslope. The shells extend to the rim of the crater above and a single Peters .30-.30 cartridge was located at the rim. Also a small waterworn coral piece was found c. 1.8 m away.

SITE NO.: State: 14803 **PHRI:** 47
SITE TYPE: Wall
TOPOGRAPHY: Found on the interior of Puu Mau crater, just east of the vent. It is surrounded on three sides by 45° slopes, the northeast is open and on about the same level.
VEGETATION: Fountain grass, indigo and lantana
CONDITION: Fair
INTEGRITY: Probably unaltered
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DIMENSIONS: 17.70 m (E-W) by 4.00 m (N-S) by 0.70 m (approx.)
DESCRIPTION: This wall consists of a single bifacial core wall of natural blocks. It is constructed with unmodified pahoehoe blocks and pieces stacked on the west end into a bifacial core-filled wall with two uprights propped up with a large slab between. Moving on to the east, construction appears less finished with the route marked by either one or two courses of stones either in groups or in rough alignments. The easternmost portion of the wall ties in nicely with a finger ridge flowing northwest off the side of Puu Mau crater. Moving back to the west side, the two upright slabs are reminiscent of the entrances in pig traps in the area, and perhaps that is what this unfinished construction was originally intended as. As well, there are two piles of stones that appear for use in construction on the west, but were not utilized. The partial wall looks as though someone had planned a natural trap in the Puu Mau crater by walling off this line and then baiting the interior to draw pigs or goats into the trap. For some reason, perhaps a lack of suitable material, the trap was never completed. Also possibly associated is a small

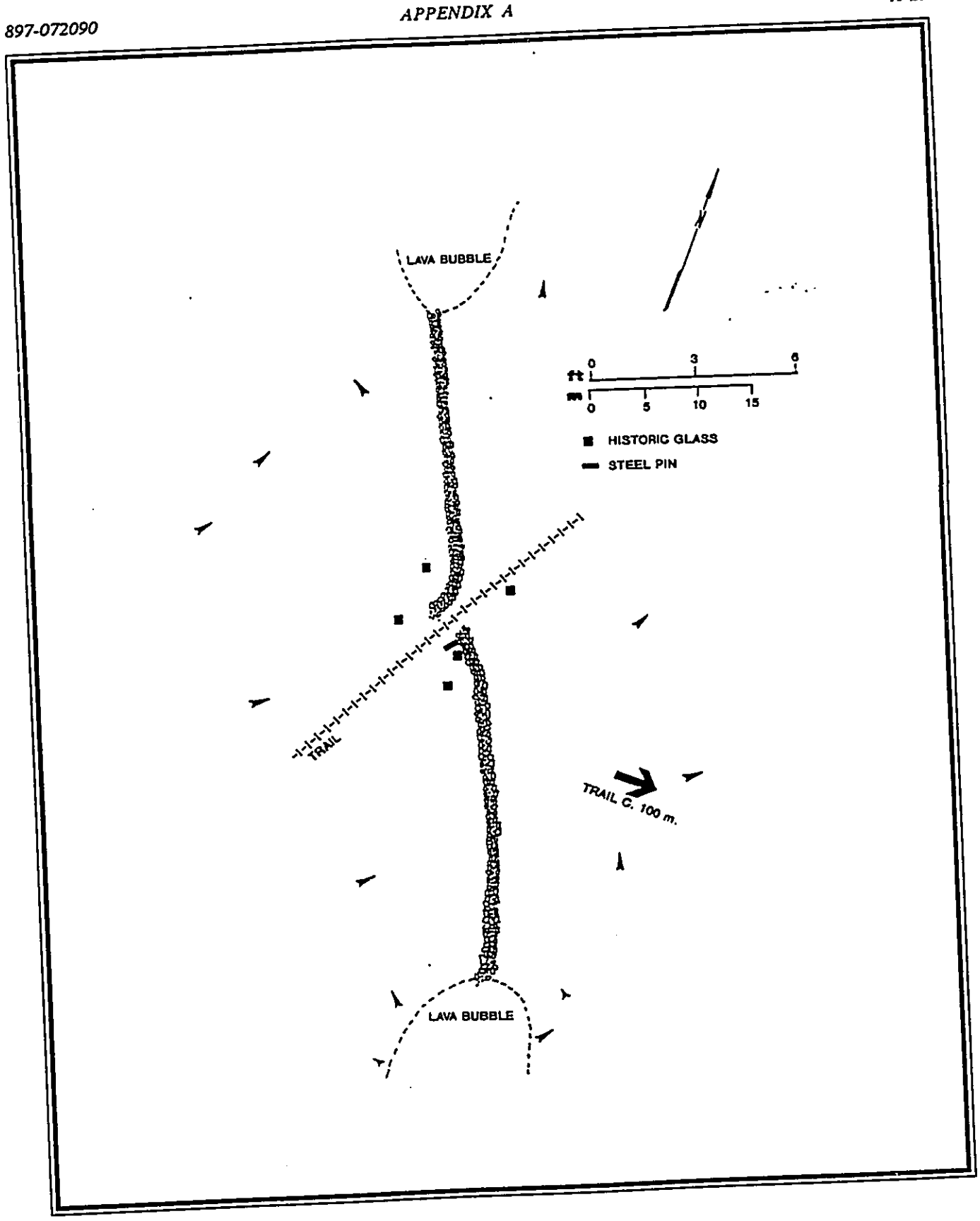

Figure A-9. Site 14801

overhang shelter found just north/northwest of the wall. No midden was observed in the shelter, but a small wall possibly lies along the southeast portion. The *konane* board (14804) is located c. 15.0 m (337°) away from the verticals near the northwest end of the wall.

SITE NO.: State: 14804 **PHRI:** 48
SITE TYPE: Petroglyph
TOPOGRAPHY: Interior of Puu Mau crater just east of the vent.
VEGETATION: Fountain grass, indigo and lantana
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric/historic
FUNCTIONAL INTERPRETATION: Recreation
DIMENSIONS: 0.63 m (NW-SE) by 0.55 m (NE-SW) by 0.00 m
DESCRIPTION: The petroglyph is a single square board. It consists of a grid pattern of small holes (c. 0.005 m deep by 0.02 m across) which has been pecked into a flat pahoehoe lava surface in the clear area.

SITE NO.: State: 14805 **PHRI:** 49
SITE TYPE: Complex (4 Features)
TOPOGRAPHY: Rolling pahoehoe lava flows with aa flows on all sides. The general area has a slight slope to the north-northwest and appears to be undercut by *makai* flowing lava tubes.
VEGETATION: Fountain grass (dominant) and indigo
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of two caves (Features A and B), a modified sink (Feature C), and a cairn (Feature D). The overall dimension is c. 21.5 m (E-W) by 11.0 m (N-S) by 2.5 m high.

FEATURE A: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 10.00 m (E-W) by 4.50 m (N-S) by 1.50 m high
DESCRIPTION: The feature has an entrance to a small collapsed sink area, facing 0.55°. Just within the drip line to the southeast, the tube branches and the southeast side runs off at 105° c. 2.5 m southeast of the drip line. In the side channel, is a large piece of *Echinoidea*. The main channel continued to the west and was unexplored beyond at c. 10.0 m further into the cave. A jeep road is c. 100.0 m due east.

FEATURE B: Lava tube cave
FUNCTION: Possible temporary habitation
DIMENSIONS: 10.00 m (N-S) by 10.00 m (E-W) by 1.45 m high
DESCRIPTION: This feature has an opening facing 280° to a small collapsed sink which is c. 3.0 m wide by 1.25 m high. The tube narrows, and at c. 7.0 m it turns to the south. Gourd fragments were noted c. 5.0 m within the cave but there was no noticeable water catchment construction was seen. Two coconut shell fragments were noted near the north side wall c. 7.0 m within the cave. There was not any modification noted within the cave. The south extension was unexplored beyond c. 10.00 m.

FEATURE C: Modified sink
FUNCTION: Possible temporary habitation
DIMENSIONS: 2.00 m (N-S) by 5.00 m (E-W) by 2.50 m high
DESCRIPTION: The sink was modified on the southern side at the drip line, by stacking collapsed roof fall slabs, two-five courses high to a maximum height of c. 0.65 m. to facilitate access into the sink. Located about 1.1 m east-southeast of the drip line, a possible fire stick was placed in the sink side wall. The possible charred end was placed within the side wall for c. 0.37 m. and the total length was c. 0.52 m. South of the stacked slab is a side lava tube, elevated from the main floor by c. 1.0 m. This small tube runs NNW and narrows quickly. The site tag was placed at the upper ENE edge of the sink.

FEATURE D: Cairn
FUNCTION: Marker/Indeterminate
DIMENSIONS: 0.70 m (N-S) by 0.64 m (E-W) by 0.70 m high
DESCRIPTION: This is a low structure constructed with pahoehoe small to large cobbles, stacked two-four courses high. It is roughly oval, with the long axis running north to south, and is roughly pyramidal in cross section. The cairn is assumed to be associated with the shelter caves to the southeast.

SITE NO.: State: 14806 Other No.: 1158(?)
PHRI: 50
SITE TYPE: Complex (20 Features)
TOPOGRAPHY: Lowland area of pahoehoe and aa lava flows which are marked by both channels and lava tube cave systems.
VEGETATION: Medium density fountain grass with very sparse indigo and *kiawe*.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: The complex consists of six lava tube caves (Feature A-C, L, O, and S), five terraces (Feature D, E, M, N, and Q), one overhang (Feature F), one Cairn (Feature G), one modified bubble (Feature H), one enclosure (Feature I), one C-shape (Feature K), two cupboards (Feature P and R), and one trail (Feature T). The overall dimensions for the site are c. 63.0 m (N-S) by 46.0 m. (E-W)

FEATURE A: Lava tube cave
FUNCTION: Burial/habitation
DIMENSIONS: 70.00 m by 2.00 m by 6.00 m
DESCRIPTION: This cave has an entrance facing 185° which is c. 3.25 m wide by 1.45 m high. the tube runs at 0.15° and drops sharply for c. 6.0 m to a small sink in the floor c. 5.0 m (N-S) by 2.5 m (E-W) by 3.5 m (in height). The cave opens to a cavern c. 10.0 m (N-S) by 5.0 m (E-W) by 3.0 m high. At the southern end of the cavern is an exposed disarticulated human skeleton. The individual was small, perhaps young adult and appears to be male. Gourd fragments appear to be associated with the burial. The long bones are missing. Just below the southwest edge of the floor sink at the southeast side of the cavern are more gourd fragments from a larger gourd. On a cavern ledge below the northeast side of the floor sink is a drip gourd holder of place aa large cobbles. There are more gourd fragments within this holder which is c. 0.70 m by 0.60 m by 0.30 m. There is also a small scatter of burnt sticks near the center of the cavern. Other modifications or artifacts were not noted at this time. From the north end of the chamber, the tube continues c. 330° for c. 50.0 m, then becomes impassable. It measures c. 5.0 m wide by 3.0 m high, gradually narrowing to the back. At c. 10.0 m from this tube line a side chamber opens to 255°. It is c. 8.0 m wide by 6.0 m deep by 2.55 m high, only a small amount of goat bone noted here.

FEATURE B: Lava tube cave
FUNCTION: Possible agriculture or habitation
DIMENSIONS: 4.75 m (NE-SW) by 2.75 m NW-SE) by 1.10 m high
DESCRIPTION: This is the south entrance to a modified tube, which faces 130° and is c. 4.10 m wide by 1.0 m high. The central floor of the cave has been cleared for c. 1.5 m back from the drip line. The roof fall stone and sink collapse have been stacked across the northeast entrance for c. 2.60 m from the sink wall. Stones are stacked two-four courses to a maximum height of c. 0.90 m and are crudely faced on the interior. At the northeast side c. 1.0 m in from the drip line is a pile of large cobbles, which may be a collapsed support for a possible gourd container. These stones are c. 1.10 m (N-S) by 0.75 m (E-W) by 0.35 m. At the rear of this pile is a waterworn small cobble. The cave continues at 315° to meet Feature C.

FEATURE C: Lava tube cave
FUNCTION: Habitation
DIMENSIONS: 30.00 m (NW-SE) by 5.00 m (NE-SW) by 1.35 m
DESCRIPTION: This lava tube has been modified both externally and internally. The tube entrance faces northwest at 320° and is 2.75 m wide by 1.2 m high. The floor has been cleared of roof fall along the southwest wall from c. 5.5 m to 10.0 m back from the drip line c. 3.5 m in width to a smooth, flat surface. Just in front of this area the floor seems crudely paved with slabs. The surface of the rest of the interior is a jumble of roof fall rubble. Roof drip and gourd fragments suggest gourd holding areas within this rubble but may have been altered. At the edge of the massive roof fall c. 9.0 m into the cave, a flagged stone suggests someone previously removed an artifact. The cave continues for c. 15.0 m south-southeast to Feature B. About 3.0 m into the cave is a flat stone upon which someone recently placed manuports and pieces of midden including coconut, waterworn basalt, bone, marine shell, and sticks. Externally just northwest of the drip line and into the east side of the entrance is a constructed flat terrace paved with pahoehoe slabs. This structure continues c. 5.0 m northwest of the entrance and spans the collapsed sink at it's southeast side for c. 4.0 m. At the south point of the terrace, stone has been placed to form a stairway to the sink edge. The northwest side of the terrace abuts Feature D, which is a small cobble paved terrace. It was probably constructed at the same time. Immediately to the southwest, an area between the terrace and the sink side wall, c. 3.0 m (NW-SE) by 2.5 m, has been cleared of collapsed boulders and may be a planter. Mostly within the interior of the cave, and slightly on the exterior paving, is a marine shell midden scatter, with several concentrated areas. Most prevalent is *Echinoidea*. Also there are waterworn basalt large cobbles and many smaller cobbles scattered about.

FEATURE D: Terrace
FUNCTION: Habitation
DIMENSIONS: 4.50 m (NW-SE) by 4.00 m (NE-SW) by 0.80 m high
DESCRIPTION: This feature is a flat and level cleared area on the northeast edge, central area of a semi-collapsed lava tube channel system. The surface is partly level bedrock with a paving of small aa cobbles and large pebbles. The southwest edge is natural bedrock with a large upright boulder placed at the south corner. The southeast side abuts Feature C and may have been constructed at the same time.

FEATURE E: Terrace
FUNCTION: Habitation
DIMENSIONS: 2.90 m (N-S) by 2.50 m (E-W) by 0.55 m high

DESCRIPTION: This is a small structure constructed in the west corner of a collapsed lava tube sink/channel. The surface is a flat, fairly level cleared area of small aa cobbles and large pebbles. The east edge is partly bedrock and placed small aa boulders one course high. At the south end and the northwest corner are two small natural alcoves which may have been utilized as cupboards. The south one is c. 0.40 m wide by 0.45 high by 1.40 m deep. Slabs on the north edge suggest possible modification for retainment and covers. The northwest alcove is c. 0.40 m wide by 0.20 m high. This alcove opens into Feature F.

FEATURE F: Overhang
FUNCTION: Temporary habitation
DIMENSIONS: 6.00 m (N-S) by 4.00 m by (E-W) 0.85 m (approx.)
DESCRIPTION: This is a low natural overhang which opens to the NNW at 345° to a narrow lava channel. The floor has been modified by clearing c. 0.7 m inside and c. 1.10 m outside the drip line. The cleared stone has been roughly stacked c. 1.0-1.5 m to the north on the east side of the channel floor where there is a natural ledge or "step" in the channel side wall. At the rear of the overhang (south) is a skylight, which opens into Feature E. There is a light marine shell midden scatter within the overhang and in the channel along with waterworn basalt cobbles. One coral abrader fragment noted c. 4.25 m northwest of the opening at the channel west edge and collected.

FEATURE G: Cairn
FUNCTION: Marker
DIMENSIONS: 1.05 m (E-W) by 0.95 m (N-S) by 0.65 m high
DESCRIPTION: This feature is roughly oval, with the long axis running east to west. In cross section the sides are nearly vertical, with a depression in the center as if stone had been removed. The east side is a natural aa bedrock protrusion with large aa cobbles and pahoehoe slabs stacked on the west side. This protrusion is on the edge of an aa flow with pahoehoe to the west. There is a possible constructed cupboard feature in the aa flow c. 2.5 m to the north that has no feature designation. There is a possible short trail section (Feature T) running east to west directly west of the cairn. There is also a short slab stepped section running east to west c. 16.0 m directly west of the cairn. There is also a slab stepped section running northeast to southwest c. 35.0 m northeast of the cairn pointing at the cairn.

FEATURE H: Modified blister
FUNCTION: Temporary habitation
DIMENSIONS: 11.70 m (N-S) by 3.10 m (E-W) by 0.90 m high
DESCRIPTION: This small lava bubble has been modified by clearing the floor and constructing a small low wall across the open south end. This wall constructed of rubble appears to have been capped by a large slab of pahoehoe just a little wider than the bubble's crack and resting on a support below. There is another possible wall in the southeast interior. The shelter going on to the north (under the roof) is low and small, but cleared and comfortable inside. The modified rubble is oriented on a terrain with pahoehoe and aa lava flows marked by channels and lava tubes. The vegetation in the area consists of fountain grass.

FEATURE I: Enclosure
FUNCTION: Indeterminate
DIMENSIONS: 3.00 m (N-S) by 3.40 m (E-W) by 0.90 m high
DESCRIPTION: This small enclosure consists of a circular alignment of stones and slabs placed on the east side of an aa lava flow. It overlooks the modified bubble (Feature H) and the rest of the site to the northeast, east to southeast. The enclosure is constructed with pahoehoe slabs and natural aa chunks stacked atop each other.

FEATURE J: Modified outcrop
FUNCTION: Temporary habitation
DIMENSIONS: 7.00 m (NW-SE) by 4.70 m (NE-SW) by 0.50 m high
DESCRIPTION: This pahoehoe outcrop has been modified in three arms along the southwestern boundary. Modification I is a possible short wall meeting the outcrop at a 35° angle. It is c. 0.70 m by 0.60 m and may be a wind stop (or break) for the overhang behind. Modification II is also a wall tying into the outcrop at a 70° angle and looks to be three-four courses high against the outcrop. It is badly slumped, but appears to have traveled from the outcrop across a small channel (c. 4.70 m wide) and tied in with an outcrop on the other (Kailua) side. The stacked wall rubble is c. 3.0 m wide at present. Modification III is another wall joining the *makai* end of the outcrop at an angle of about 30°. This modification is constructed of large pahoehoe slabs. It is c. 3.3 m by 2.0 m and stacked three-four courses high. At c. 4.0 m the wall appears to make a 90 degree turn back to the southeast and a pile of large pahoehoe slabs is found. This measures c. 4.0 m by 2.1 m and may tie in with the Modification II wall (by running *mauka*) up the channel. The outcrop presents a small low overhang on the southeast side that measures c. 7.0 m (NW-SE) by 1.5 m (NE-SW) by 0.50 m high.

FEATURE K: C-shape
FUNCTION: Habitation
DIMENSIONS: 3.80 m (N-S) by 5.10 m (E-W) by 0.80 m
DESCRIPTION: This alignment is one-two courses high and placed atop a pahoehoe lava outcrop that is also associated

with Feature L, M, and N. It is oriented on the rolling pahoehoe and aa lava flows with channels and lava tubes. The dominant vegetation in the area is fountain grass with sparse indigo and kiawe. The C-shape is constructed with natural pahoehoe slabs and aa pieces stacked roughly into an alignment. The open end is on *makai* to north at edge of outcrop. This feature possibly served as a foundation of a pole and thatch structure.

FEATURE L: Lava tube cave
FUNCTION: Possible temporary habitation
DIMENSIONS: 10.00 m (N-S) by 4.50 m (E-W) by 1.20 m high at entrance
DESCRIPTION: The feature is a cave which became exposed with the overlying pahoehoe lava collapsed to open up a short section of tube running at 180° for c. 10.0 m. A skylight has also opened up just southeast of the entrance. The surrounding terrain consists of aa and pahoehoe lava flows cut by north-flowing channels and tubes. Dominant vegetation on the site is fountain grass although sparse indigo and *kiawe* are also present. Sparse marine shells (*Cypraea* sp., *opihi*, *Nerita* sp., *Echinoidea*, brackish shells (*Brachidontes* sp.), and single water worn basalt in were noted in the cave. On lava above the cave (especially between this feature and Feature K) are several broken *Cypraea* sp. A goat skeleton is present as well.

FEATURE M: Terrace
FUNCTION: Habitation
DIMENSIONS: 2.70 m (N-S) by 2.20 m (E-W) by 0.40 m
DESCRIPTION: The feature is part of the modified outcrop which contains Feature K, L, and N. This small terrace is tied in with the *makai* portion of the outcrop and lies immediately below (makai) of Feature K, a C-shape structure. It is situated on a terrain with broken pahoehoe and aa lava flows covered in some places by dense fountain grass and very sparse indigo and *kiawe*. A very thin scatter of *Cypraea* shells are present in the area.

FEATURE N: Terrace
FUNCTION: Indeterminate
DIMENSIONS: 2.60 m (N-S) by 5.00 m (E-W) by 0.30 m high
DESCRIPTION: This badly weathered and collapsed terrace is coming off of the same modified outcrop where Feature K, L, and M are found. This small structure consists of an area which looks as though it were leveled and some type of alignment was placed running roughly *makai*. It is rather poorly constructed of various sized natural aa and pahoehoe pieces. This feature is oriented on rolling pahoehoe and aa lava flows, broken by channels and sinks with fountain grass and sparse indigo and *kiawe*.

FEATURE O: Lava tube cave
FUNCTION: Indeterminate
DIMENSIONS: 8.00 m (N-S) by 6.00 m (E-W) by 6.00 m deep
DESCRIPTION: This cave is found at the bottom of a vertical sink. Access was gained by climbing down the Kailua side of the sink to the level of the floor c. 6.0 m down. No modifications were noted within the cave. There is a possibility of a passage leading to Feature S, another small sink *makai*, but this was not explored on this visit. The floor was covered by roof fall.

FEATURE P: Cupboard (3)
FUNCTION: Storage
DIMENSIONS: Cupboard P-1 0.20 m by 0.30 m by 0.35 m "P-2 0.45 m by 0.40 m by 0.65 m " P-3 0.40 m by 0.30 m by 0.65 m
DESCRIPTION: There are possibly three cupboards in this feature. Two of the cupboards appear to have been somewhat constructed. The third one looks natural. It is very small and choked with rubble. Cupboard P-1 is on the north side of the feature. Cupboard P-2 is located in the middle of the feature between P-1 and P-3. Cupboard P-3 is oriented on the south side of the feature. This feature complex is on terrain with pahoehoe and aa lava flows. The dominant vegetation in this area is fountain grass with sparse indigo and *kiawe*. *Echonoidea*, goat bones, and two pieces of waterworn coral were noted in the general area.

FEATURE Q: Terrace
FUNCTION: Agriculture
DIMENSIONS: 5.00 m (NE-SW) by 3.00 m (NW-SE) by 0.75 m
DESCRIPTION: The feature is a small terrace located in a natural sink found c. 20.0 m east of the sink deemed as Feature S. It is oriented on a terrain of pahoehoe and aa lava flow which are undercut by various lava tubes flowing downslope. Fountain grass is dominant with sparse indigo and *kiawe* in the area. The terrace is constructed in a natural pahoehoe sink filled with various-size lava pieces to attain a mostly level surface.

FEATURE R: Cupboard
FUNCTION: Storage
DIMENSIONS: 1.10 m (N-S) by 1.12 m (E-W) by 0.85 m
DESCRIPTION: This is a small possible storage cupboard located c.10.0 m east of Feature S (lava tube cave). There is also a possible small terrace located just to the southwest of the storage area. A possible agriculture terrace (Feature Q) also lies just c. 8.0-10.0 m east of this feature. Cupboard is constructed by placing small pieces of pahoehoe lava around a natural hole on the side of a flow. The terrace is

constructed by placing like-sized stones down to level the area.

FEATURE S: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 2.00 m (N-S) by 6.00 m (E-W) by 8.00 m to cave floor
DESCRIPTION: This large lava tube cave is located in a pahoehoe lava flow. It is undercut at the entrance and was not entered during recording. It is situated on a terrain with north-trending pahoehoe and aa lava flows with sparse fountain grass. Several *opihi* shells were observed from above. It is probable that this feature has been recorded and tested (Ching 1971, Rosendahl 1973) as Site 1160.

FEATURE T: Trail
FUNCTION: Transportation
DIMENSIONS: 6.80 m by 0.40 m
DESCRIPTION: This feature consists of ten-twelve pahoehoe slabs placed in an alignment stop an area of aa pieces. This short alignment appears to be trending toward Feature L, the C-shape structure. It runs northeast to southwest and begins c. 6.0 m northeast of Feature M. The trail is crudely constructed by placing occasional small pahoehoe slabs on a narrow aa flow. The slabs averaging c. 0.20 m by 0.20 m by 0.07 m. After c. 18.5 m the terrain changes and the trail became indistinguishable. The southwest end of the trail points to cairn (Feature G).

SITE NO.: State: 14807 **PHRI:** 51
SITE TYPE: Pahoehoe excavation
TOPOGRAPHY: Rolling slightly tilted pahoehoe flows with aa flows
VEGETATION: Fountain grass (dominant)
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DIMENSIONS: 5.25 m (N-S) by 6.90 m (E-W) by 0.95 m
DESCRIPTION: Single pahoehoe blister from which rocks have been removed and pitched downslope. Most of the larger rocks removed with some large ones still in interior. This site is located just on Kohala side of #1193 trail. There is a small cairn (#25) found alongside of the trail c. 10.0 m (306°) away.

SITE NO.: State: 14808 **PHRI:** 52
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Gentle north sloping pahoehoe flow with outcrops of aa lava nearby.
VEGETATION: Fountain grass in sink and also densely surrounding
CONDITION: Excellent
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric/historic
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of two lava tube caves (Features A and B). The overall dimension for the site is c. 20.8 m (N-S) by 11.9 m (E-W) by 2.50 m.

FEATURE A: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 6.00 m (N-S) by 7.00 m (E-W) by 1.40 m
DESCRIPTION: This feature has an entrance facing a sink/collapsed area at 150°. This opening is c. 5.0 m wide by 1.8 m in height. The tube runs due north for c. 4.0 m and turns east to 60°. The central area of the cave appears to have been cleared, with a flat surface, and has a surface midden deposit. At the edge of the northwest side wall, c. 3.5 m from the entrance are *ipu* gourd fragments. No constructed water catchment area was noted.

FEATURE B: Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 7.50 m (N-S) by 6.50 m (E-W) by 2.50 m
DESCRIPTION: This feature has an entrance/opening facing 325° to a collapsed/sink. The entrance is c. 6.5 m wide by 1.6 m high. There is a cleared area c. 4.5 m by 3.5 m by 1.5 m within the cave which also has a surface midden scatter. Within this area, a coral abrader was noted and collected, and water worn basalt cobble was noted. Site tag is located at west-central drip line. There are coral abrader, water worn basalt, marine shell, *Cypraea* sp., *Cellana* sp., *Nerita* sp., *Thaidadae* sp., and bird bone in the cave.

SITE NO.: State: 14809 **PHRI:** 53
SITE TYPE: Alignment
TOPOGRAPHY: Quickly rising aa and pahoehoe flows *mauka*, more gently sloping *makai*, both undercut by lave tube caves.
VEGETATION: Fountain grass (dense)
CONDITION: Poor
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 4.50 m by 4.50 m by 0.36 m (approx.)
DESCRIPTION: The alignment consists of a single course of pahoehoe slabs aligned in a roughly circular alignment. No real entrance or internal features are evident.

SITE NO.: State: 14810 Other No.: 851-1
PHRI: 54
SITE TYPE: Terrace
TOPOGRAPHY: Gentle north and west sloping aa and pahoehoe flows that are undercut in some areas by lava tube cave.
VEGETATION: Fountain grass (dominant), lantana and silver oak
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DIMENSIONS: 4.00 m (N-S) by 2.50 m (E-W) by 0.30 m
DESCRIPTION: This badly weather terrace is constructed with pieces of aa lava either atop another aa flow or possibly underlain by pahoehoe lava. The south wall of the terrace is possibly faced but roughly. The site is located on the Kailua side of Puu Nahaha.

SITE NO.: State: 14811 *(Figure A-10)*
Other No.: 720-6 **PHRI:** 55
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Sloping aa and pahoehoe lava flows with channels and lava tubes.
VEGETATION: Fountain grass (dominant) and sparse indigo
CONDITION: Good
INTEGRITY: Probably altered by slumpage
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DESCRIPTION: The complex consists of a enclosure (Feature A) and a alignment (Feature B). The overall dimension for the site c. 60.0 m (N-S) by 30.0 m (E-W) by 2.60 m.

FEATURE A: Enclosure
FUNCTION: Agriculture/animal husbandry
DIMENSIONS: 15.00 m (NW-SE) by 10.00 m (NE-SW) by 2.60 m
DESCRIPTION: This feature is roughly triangular in shape and is constructed within a natural collapsed lava channel. Wall sections of the enclosure are built mainly of stacked pahoehoe slabs and laid horizontally with some small pahoehoe and aa boulders on top of and abutting the lava channel side walls. The southeast wall of the enclosure is perpendicular and across the floor of the channel. Located within this wall c. 2.5 m southwest of the northeast corner is a low break in the wall c. 1.5 m wide by 0.50 m high, which may have served as an entrance, which could easily be blocked with a wood gate, etc. The natural lava channel extends c. 25.0 m southeast of this wall to form a natural corralling/funneling area leading to the enclosure from the fence/stone wall probable drive into the channel/corral. The site tag is located on the north-northeast of wall/corner of coral.

FEATURE B: Alignment
FUNCTION: Agriculture/animal husbandry
DIMENSIONS: 35.00 m (NE-SW) by 5.10 m (NW-SE) by 0.70 m
DESCRIPTION: This feature is a double stone alignment with occasional stacking of two-three courses high of pahoehoe large cobbles and small boulders. The heights of these alignments vary from c. 0.40 m to 0.70 m. The alignments run roughly parallel to Feature A, in a northeast direction. They average c. 4.0 m apart. The lower/west alignment is c. 10.0 m longer than the eastern section. There are fence posts to the south leading to the alignments. There is also a fence post support/cairn c. 3.0 m from the south end of the northwest alignment. This support is c. 1.50 m (E-W) by 0.88 m by 0.55 m. There is also a short alignment northwest of this feature which runs northeast to southwest. This section is c. 7.5 m northwest of the central area of the feature and c. 16.0 m southwest of the site datum.

SITE NO.: State: 14812 **PHRI:** 56
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Gently sloping pahoehoe and aa lava flows. Land rises more steeply just to east and Puu Nahaha lies just to north- northwest.
VEGETATION: Fountain grass (dominant), silver oak, lantana, *koa-haole*, and *pa-nini*.
CONDITION: Fair
INTEGRITY: Partly altered by slump and road-building damage
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DESCRIPTION: The complex consists of three enclosures (Feature A, B, and C). The overall dimension for the site is c. 85.0 m by 85.0 m 1.75 m.

FEATURE A: Enclosure
FUNCTION: Agriculture/animal husbandry
DIMENSIONS: 4.00 m by 3.60 m by 1.55 m
DESCRIPTION: This small feature is located at the east side of Feature C and the south side of Feature B. It is basically rectangular and may have been constructed after Features B and C. The east wall is part of Feature C enclosure, and the north wall is part of Feature B enclosure. The southern wall has a constructed "pig door" at the south corner, c. 1.0 m from the intersection with Feature C enclosure wall. The door is c. 0.80 m wide by 0.75 m internal

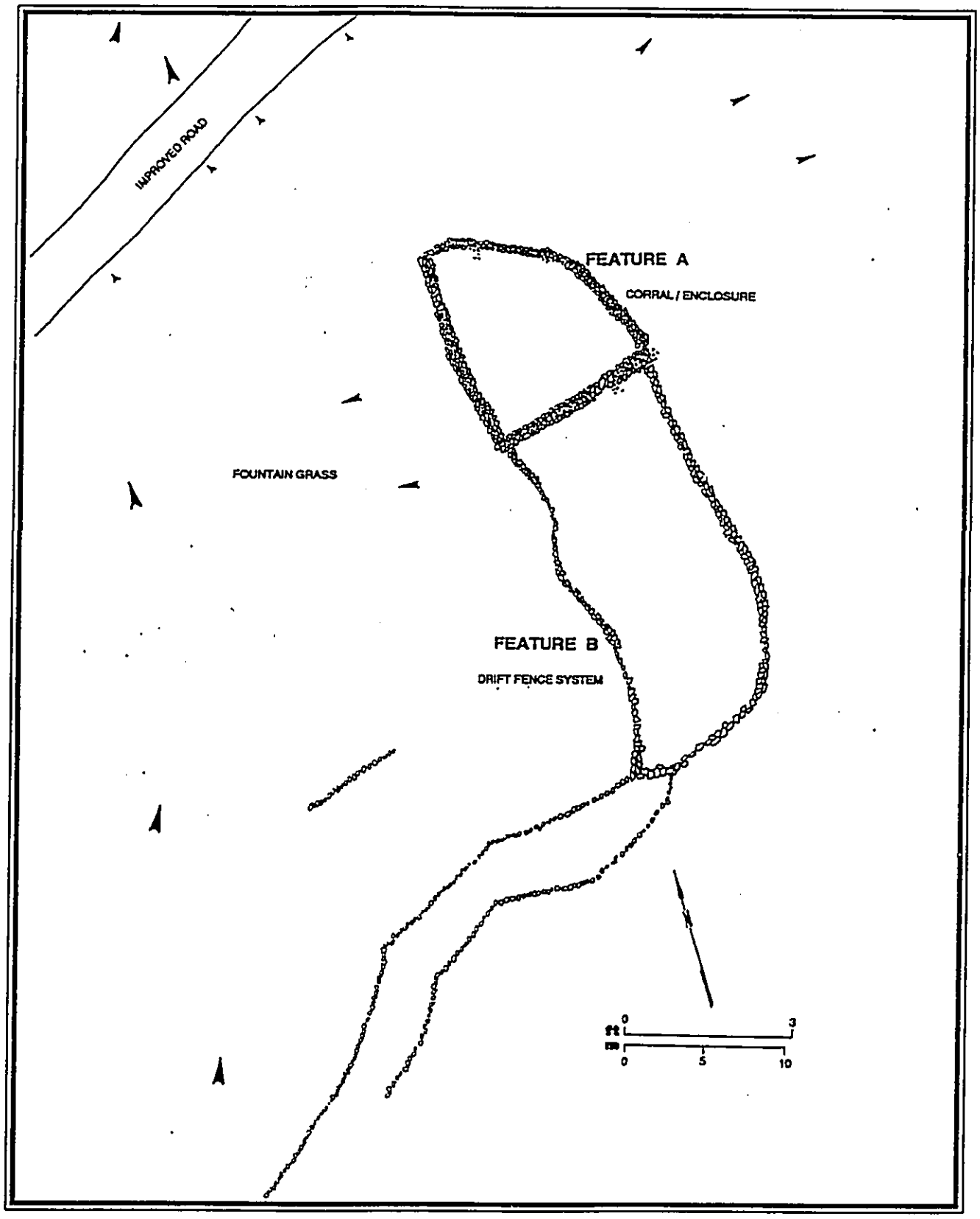

Figure A-10. Site 14811

height and 1.25 m external height. The door is constructed of milled wood and galvanized hinges at top and nailed with wire nails.

FEATURE B: Enclosure
FUNCTION: Agriculture/animal husbandry
DIMENSIONS: 18.50 m (N-S) by 17.50 m (E-W) by 1.55 m
DESCRIPTION: This feature is constructed at the northeast corner of enclosure Feature C, and shares the same corner walls as Feature C. The walls are the same construction of core-filled/bifacial aa small boulders and cobbles. Found in the north corner, at the intersection of Feature C wall is a pig door/gate abutting the intersection at the east side. Door is c. 0.60 m wide by 0.80 m internal height and c.1.40 m external height. Site tag is located on wall at east edge of the "pig door." Door is constructed of milled lumber, wire nails, and two galvanized gate hinges.

FEATURE C: Enclosure
FUNCTION: Agriculture/animal husbandry
DIMENSIONS: 85.00 m (N-S) by 71.50 m (E-W) by 1.75 m
DESCRIPTION: This feature is roughly circular and is constructed of bifaced core-filled walls of aa boulders and cobbles. The structure also encloses two smaller enclosures at its northeast corner, which may have been added after initial construction. There are two gates/entrances in the structure at the south end and the ESE side. Both gates are c. 10.0 m wide with collapsed edges. At the north side is a constructed "funnel" opening to the north, presumed to be for driving stock into the enclosure. Running through the middle of the enclosure c. 225-25° is a bulldozed road which destroyed sections of the northeast and southwest walls. There is also bulldozer disturbance within the south corner and outside the northwest corner next to the road. Internal surface is flat but irregular with aa rubble. Site tag is located on the wall at north northeast corner of Feature B.

SITE NO.: State: 14813 Other No.: 642-3(?)
PHRI: 57
SITE TYPE: Enclosure
TOPOGRAPHY: Sloping pahoehoe and aa lava flows marked by channels and tubes trending toward Puhia Pele.
VEGETATION: Christmas-berry (dominant) *kukui*, lantana, *koa-haole*, and silver oak.
CONDITION: Fair
INTEGRITY: Partially altered by slump
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Agriculture/animal husbandry
DIMENSIONS: 12.00 m (N-S) by 16.00 m (E-W) by 1.50 m (approx.)
DESCRIPTION: The enclosure is located on the Kailua side of the bifacial core-filled wall which begins near Puhia Pele and travels c. 125° bearing *mauka* toward the highway. This enclosure is also a bifacial core-filled wall square structure with a badly fallen "pig door" near the northwest corner and also another (in better preservation) in the east wall. The eastern door appears to have been walled off on the outside and possibly never used. There are a total of five fence posts along the inside of the north and west walls. Both of these walls (especially the northernmost) are lower than on the east and south.

SITE NO.: State: 14814 Other No.: 720-11
PHRI: 58
SITE TYPE: Lava tube cave
TOPOGRAPHY: At *the bottom of a wide northwest* trending channel with large aa flow just to northwest. The slope is quite gentle to the north.
VEGETATION: Fountain grass (dominant), and sparse indigo.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 2.60 m (N-S) by 2.00 m (E-W) by 1.10 m (approx.)
DESCRIPTION: This is a single lava tube cave. There is no evidence of modification. The floor surface is irregular and sloping. There are *Cocos*, *Echinoidea*, waterworn basalt present in the cave, and three pieces of broken *Cypraea* sp. observed on the surface.

SITE NO.: State: 14815 Other No.: 720-9
PHRI: 59
SITE TYPE: Lava tube cave
TOPOGRAPHY: Rolling and gentle north-sloping aa and pahoehoe lava flows with lava tube blisters and channels.
VEGETATION: Fountain grass (moderate to dense) dominates and very sparse indigo.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 2.90 m (N-S) by 2.50 m (E-W) by 1.00 m (approx.)
DESCRIPTION: This is a single lava tube cave with a possible cleared area at the entrance. There are *Echinoidea* sp. and *Cypraea* sp. in the area. The cave is opened to the

east. A collapsed area is present on the east of the opening. It measured c. 1.40 m (N-S) by 1.80 m (N-S). The collapsed area has partially been cleared of boulders.

SITE NO.: State: 14816 Other No.: 720-10
PHRI: 60
SITE TYPE: Lava tube cave
TOPOGRAPHY: Gentle north sloping exposed lava flows with both channels and lava tube blister caves.
VEGETATION: Dense to moderate fountain grass (dominant) and very sparse indigo.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 4.10 m (E-W) by 2.00 m (N-S) by 0.67 m (approx.)
DESCRIPTION: This is a single lava tube cave without modification. There are five small blisters included in the site boundaries but not given feature designation. The tunnel entrance and sink appears cleared of roof fall and debris appears to have been tossed into a pile on the south. Light midden scatter of *Cypraea* sp. in site tag cave. There is a light surface scatter within the site boundaries. Midden in these areas also consists mostly of a light scatter of *Cypraea* sp. and small water worn basalt. Also *Cellana* sp. in the area. Site area appears to have been utilized only slightly. There is only a small chance of significant cultural deposits.

SITE NO.: State: 14817 Other No.: 720-8
PHRI: 61
SITE TYPE: Complex (2 Features)
TOPOGRAPHY: Gently sloping aa and pahoehoe lava flows marked by channels, tubes, and blisters.
VEGETATION: Fountain grass (dominant) and very sparse indigo.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 3.80 m (N-S) by 7.90 m (E-W) by 0.95 m (approx.)
DESCRIPTION: The complex consists of two caves (Features A and B).

FEATURE A : Cave
FUNCTION: Temporary habitation
DIMENSIONS: 3.20 m (E-W) by 2.15 m (N-S) by 0.85 m
DESCRIPTION: Feature A is a collapsed lava tube blister. It opens to the east. The entrance measures c. 2.15 m (N-S) with a height of 0.85 m. The thickness of the ceiling is c. 0.15 m. The interior measures c. 3.2 m (E-W) by 1.4 m. The interior floor is rough pahoehoe floor with sparse scattered boulders and rubble on the floor. This feature is oriented on a terrain of smooth and rough pahoehoe with fountain grass in the area. It is constructed of a natural lava tube. There is no modification except for a cleared area at the entrance.

FEATURE B : Cave
FUNCTION: Temporary habitation
DIMENSIONS: 1.80 m (N-S) by 1.15 m by 0.95 m
DESCRIPTION: The natural lava tube is collapsed at the east end. The collapsed area measured c. 1.9 m (E-W) by 1.15 m (N-S). There are pahoehoe slabs and boulders in the collapsed area. The entrance faces east at 90°. The interior measures c. 3.0 m by 2.8 m. The main interior area is ropey pahoehoe floor with sparse shell and soil. The rear of the cave interior extends southwest and northwest (natural tube extension). The southwest measures c. 2.5 m in length by 1.6 m in width. The northwest measures c. 3.0 m in length by 1.2 m in width. No portable remains were identified. An area (c. 1.5 m east to west by 1.0 m north to south) in the north half of the main interior of the cave has a grayish soil deposit of c. 0.03 m thick.

SITE NO.: State: 14818 Other No.: 720-16
PHRI: 62
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Gentle north sloping aa and pahoehoe lava flows trending to the Pacific Ocean. This area is undercut by lava channels and tubes.
VEGETATION: Dense fountain grass and occasional indigo.
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of a lava tube cave (Feature A), a cairn (Feature B), and a excavation (Feature C). The overall dimension is c. 30.0 m (E-W) by 25.0 m (N-S) by 2.10 m.

FEATURE A : Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 5.00 m (E-W) by 4.75 m (N-S) by 2.10 m high
DESCRIPTION: This feature has an opening facing due south, which is c. 3.5 m wide by 2.10 m high. The small cave runs further to the northwest for c. 5.0 m. Within the cave, c. 1.20 m to 1.50 m, an area crossing the cave floor appears

to have been cleared and paved with small pahoehoe slabs. This area extends within the cave for c. 1.5 m. The floor is slightly irregular and slopes strongly into the cave at the north edge of the paving. The roof fall north of this area is too low for passage.

FEATURE B : Cairn
FUNCTION: Possible habitation/marker
DIMENSIONS: 2.30 m (N-S) by 3.30 m (E-W) by 0.75 m high
DESCRIPTION: This feature is constructed on a low pahoehoe ridge. Stone used in this cairn consists mainly of pahoehoe slabs, stacked horizontally three-four courses high to a maximum height of c. 0.75 m. It is semi-collapsed and unaltered, but fair in condition.

FEATURE C : Pahoehoe excavation
FUNCTION: Possible quarry
DIMENSIONS: 15.00 m (E-W) by 10.00 m (N-S) by 0.40 m (approx.)
DESCRIPTION: This is an area c. 7.5 m (E-W) by 6.0 m (N-S) which may have been broken up in the search for volcanic glass. Stones from several pahoehoe bubbles have been removed and tossed about the area in a random manner. No construction within the area is apparent.

SITE NO.: State: 14819 **PHRI:** 63
SITE TYPE: Lava tube cave
TOPOGRAPHY: Gently sloping pahoehoe and aa lava flows with hills, channels, tubes and blisters. Poopoomino is located to the northeast.
VEGETATION: Sparse fountain grass with occasional indigo. *Kiawe* found on Poopoomino
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 5.50 m (N-S) by 4.50 m (E-W) by 1.75 m deep
DESCRIPTION: This is a single lava tube cave without modifications. There are *Cypraea* sp., *Echinoidea*, sp. and *kukui* in the area.

SITE NO.: State: 14820 **PHRI:** 64
SITE TYPE: C-shape
TOPOGRAPHY: Gently undulating pahoehoe and aa lava flows just down slopes from large rim.
VEGETATION: Fairly dense fountain grass
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 3.55 m (N-S) by 2.20 m (E-W) by 0.64 m
DESCRIPTION: The C-shape (0.70 m wide) is built of aa pieces and a few pahoehoe slabs in spaces and piles, but higher on the northern end. On the south, the wall consists of single blocks. Structure opens on the west and is built on a wide aa flow.

SITE NO.: State: 14821 **Other No.:** 720-20
PHRI: 65
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Gentle northwest sloping pahoehoe and aa lava flows. Flows undulate slowly and are underlain by lava tube channels and caves.
VEGETATION: Fairly thick silver oak, with lantana, Christmas-berry, and fountain grass
CONDITION: Excellent
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DESCRIPTION: The complex consists of a lava tube cave (Feature A), a hearth (Feature B), and a alignment (Feature C). The overall dimension is c.19.0 m (N-S) by 5.0 m (E-W) by 1.95 m.

FEATURE A : Lava tube cave
FUNCTION: Temporary habitation
DIMENSIONS: 15.00 m (N-S) by 5.00 m (E-W) by 2.00 m
DESCRIPTION: This tube runs in a basic north-northwest to south-southeast direction. There is a small skylight c. 5.5 m from a bulldozed/corridor road which is where the site tag and flagged trees can be seen. The skylight is directly east of the road, and is roughly circular and averaged c. 0.75 m in diameter. Directly beneath this opening the tube side walls are c. 1.50 m to the east, and c. 2.0 m to the west. Rubble from this collapsed skylight almost reaches the opening in a circular pyramid which may be partly stacked. Site tag is c. 2.10 east of the skylight on a pahoehoe ledge. The raised ledge running along west edge of Puu Nahaha is c. 251° from the site tag. Feature B is c. 1.5 south of skylight, and Feature C is c. 7.5 m south-southeast of skylight.

FEATURE B : Hearth
FUNCTION: Habitation
DIMENSIONS: 0.50 m (N-S) by 0.40 m (E-W) by 0.10 m
DESCRIPTION: This feature is located south and at the base of a rubble pile directly beneath the skylight-entrance. The hearth area is c. 0.5 m north to south by 0.40 m east to west by 0.10 in height. The hearth area did not seem to be

a constructed area but charcoal fragments and the ash deposit suggested it had been used several times allowing the skylight to be the smoke hole.

FEATURE C : Alignment
FUNCTION: Indeterminate
DIMENSIONS: 0.75 m (E-W) by 0.45 m (N-S) by 0.15 m
DESCRIPTION: This feature is a low stone alignment starting at the north edge of the tube side wall c. 7.0 m south-southeast of the entrance/skylight. The alignment extended south-southwest from the side wall for c. 1.45 m and basically a single stone arrangement with a maximum height of c. 0.40 m. East of the alignment is a deposit of white silt which may be a calcium carbonate deposit of the lava tube or unknown cultural deposit.

SITE NO.: State: 14822 **PHRI:** 66
SITE TYPE: Wall
TOPOGRAPHY: Rolling aa and pahoehoe lava; marked on the western end by Puu Nahaha. Upland lava flows near a long *mauka-makai* tube line.
VEGETATION: Dense fountain grass, lantana, and *panini*
CONDITION: Fair
INTEGRITY: Altered
PROBABLE AGE: Possible prehistoric
FUNCTIONAL INTERPRETATION: Boundary
DIMENSIONS: 0.96 m high by 0.86 m wide by 2.30 km (approx.)
DESCRIPTION: This is a rock wall of natural basalt pieces which runs *mauka-makai* from near the upper highway (Mamalahoa Highway) to the eastern slopes of Puu Nahaha.

SITE NO.: State: 14823 **PHRI:** 67
SITE TYPE: Lava tube cave
TOPOGRAPHY: Steeply flowing aa and pahoehoe lava undercut by lava tube caves and channels.
VEGETATION: Fountain grass, lantana, *pa-nini*, silver oak, *hala-pepe*, and morning glory.
CONDITION: Good
INTEGRITY: Altered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Burial
DIMENSIONS: 11.00 m by 8.50 m by 3.75 m (Cave entrance)
DESCRIPTION: The lava tube cave is facing 350°. No apparent modification, but a natural lava channel was observed in the rear of the cave running c. 155°. A single partial cranium (badly broken) was found in the cave. The skull is in poor condition.

SITE NO.: State: 14824 **PHRI:** 68
SITE TYPE: Lava tube cave
TOPOGRAPHY: Sharply trending (to the northwest) slopes composed of pahoehoe and aa lava underlain by lava tube systems and channels.
VEGETATION: Dense fountain grass at entrance with lantana, guava, Christmas-berry, and *'ohi'a lehua* (sword fern).
CONDITION: Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary habitation
DIMENSIONS: 17.50 m (N-S) by 11.00 m (E-W) by 8.00 m
DESCRIPTION: This is a large cave with "bridge" over chasm in the front and several other areas where torch locations were indicated as well as water catchment areas. The bridge is composed of large basalt pieces filling a deep chasm near the entrance. Various other constructions (small) were observed, but not described. Pieces of probable gourd (*ipu*) were noted near water catchment areas and copious amounts of charcoal both in clusters and also throughout the cave. The main cave splits into at least three others. None were explored. They are c. 100.0 m in from the entrance.

SITE NO.: State: 14825 **PHRI:** 69
SITE TYPE: Enclosure
TOPOGRAPHY: Gentle aa and pahoehoe flows running generally to the west-southwest. The feature Puhia Pele is across the road to the southeast.
VEGETATION: Dense fountain grass, with silver oak, lantana, Christmas-berry, and guava.
CONDITION: Fair
INTEGRITY: Altered from probable wall collapse
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Agriculture/ animal husbandry
DIMENSIONS: 26.00 m (E-W) by 12.75 m (N-S) by 0.75 m high
DESCRIPTION: The enclosure is a rough triangle pointing to the west. No interior feature were noted. Walls are constructed of stacked aa rubble. This may have been an attempt at a pig trap or other type of enclosure at one time.

SITE NO.: State: 14826 **PHRI:** 70
SITE TYPE: Wall
TOPOGRAPHY: Found in a broad depression in an area of aa and pahoehoe lava flows.
VEGETATION: Dense fountain grass, thick lantana, sparse silver oak, and *pa-nini*

CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 11.00 m (E-W) by 1.00 m (N-S) by 1.00 m high
DESCRIPTION: The wall is a single bifacial rubble core design. It is oriented almost east to west. The wall is constructed with natural pahoehoe and aa blocks stacked on each other. It is roughly faced on the south side, but even rougher on the north side. Basic alignment is c. 100-280°.

SITE NO.: State: 14827 **PHRI:** 71
SITE TYPE: Cairn complex
TOPOGRAPHY: Quickly to gently sloping lava flows marked by both aa and pahoehoe areas.
VEGETATION: Fountain grass (dense) with sparse indigo.
CONDITION: Poor to Fair
INTEGRITY: Altered mostly by slumpage
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Marker
DIMENSIONS: 600.00 m (N-S) by 50.00 m (E-W) by 1.00 m high (approx.)
DESCRIPTION: The complex consists of nineteen separate cairns, complete and collapsed, which are thought to mark the main route of the #1193 Hawaiian trail. Also a slight trail variant to the Kailua side (west) is included within the complex. As an aid in identification, the *makai* end of the cairn complex begins near 14807 with C-25 and ends with C-42 which is somewhat near 14809 (although probably not associated with this latter site). All cairns are constructed of locally available pahoehoe and aa lava cobbles, boulders, and slabs. The cairns are each given an identification number starting from C-25 to C-42.

SITE NO.: State: 14828 **PHRI:** 72
SITE TYPE: Cairn
TOPOGRAPHY: The cairn lies on the southwest top edge of exposed aa flow.
VEGETATION: Fountain grass (dense)
CONDITION: Fair-Good
INTEGRITY: Unaltered
PROBABLE AGE: Indeterminate
FUNCTIONAL INTERPRETATION: Indeterminate
DIMENSIONS: 0.70 m (N-S) by 0.55 m (E-W) by 0.80 m high
DESCRIPTION: This is a low small structure constructed of stacked large aa cobbles and small boulders three-four courses high. The cairn is pyramidal and is roughly oval in plan view. The flagged range pole at road is c. 80.0 m (224°).

SITE NO.: State: 14829 **Other No.:** 720-7
PHRI: 73
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Pahoehoe and aa flow.
VEGETATION: Fountain grass moderate to dense, very sparse indigo.
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry
DESCRIPTION: The complex consists of three pahoehoe excavation (Feature A, B, and C). The overall dimension is c. 20.50 m (NW-SE) by 2.5 m (NE-SW). All features consist of excavated pahoehoe blisters. The excavated materials are small to large blocky boulders. These boulders are piled outside of the blister opening and are haphazardly placed.

FEATURE A : Pahoehoe excavation
FUNCTION: Quarry
DIMENSIONS: 1.80 m (E-W) by 0.90 m (N-S) by 0.53 m deep
DESCRIPTION: Feature A is the easternmost pahoehoe excavation. The excavated feature thickness is c. 0.20-0.25 m.

FEATURE B : Pahoehoe excavation
FUNCTION: Quarry
DIMENSIONS: 1.30 m (E-W) by 0.60 m (N-S) by 0.60 m deep
DESCRIPTION: Feature B is located between Feature A and Feature C. The excavated feature thickness is c. 0.15-0.20 m.

FEATURE C : Pahoehoe excavation
FUNCTION: Quarry
DIMENSIONS: 0.70 m (E-W) by 0.30 m (N-S) by 0.50 m deep
DESCRIPTION: Feature C is the westernmost pahoehoe excavation. It has a thickness of c. 0.15 m.

SITE NO.: State: 14830 **Other No.:** 720-14
PHRI: 74
SITE TYPE: Complex (3 Features)
TOPOGRAPHY: Smooth pahoehoe flow
VEGETATION: Fountain grass and indigo
CONDITION: Fair to Good
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Quarry/marker
DESCRIPTION: The complex consists of a cairn (Feature A), and two pahoehoe excavations (Feature B and C).

FEATURE A : Cairn
FUNCTION: Marker
DIMENSIONS: 0.90 m (E-W) by 0.76 m (N-S) by 0.48 m high
DESCRIPTION: Feature A consists of nine boulders roughly centrally raised two courses high. It is constructed on smooth pahoehoe.

FEATURE B : Pahoehoe excavation
FUNCTION: Quarry
DIMENSIONS: 0.60 m by 0.60 m by 0.45 m
DESCRIPTION: The pahoehoe excavation consists of an excavated pahoehoe blister with the opening to the northeast. The excavated materials are blocky boulders that are haphazardly placed along the northeast exterior of the opening. The blister extends c. 0.60 m to the southwest. The excavation thickness is c. 0.18 m.

FEATURE C : Pahoehoe excavation
FUNCTION: Quarry
DIMENSIONS: 1.40 m (E-W) by 1.25 m (N-S) by 0.55 m deep
DESCRIPTION: This is a level area of pahoehoe that has been excavated for quarry material. Natural, large, blocky boulders are haphazardly placed along the northern exterior of the pahoehoe excavation. The immediate surrounding is smooth pahoehoe. The excavation has a thickness of c. 0.15 m.

SITE NO.: State: 1193
SITE TYPE: Trail
TOPOGRAPHY: Pahoehoe flow
VEGETATION: --
CONDITION: Fair
INTEGRITY: --
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: --
DESCRIPTION: Initially identified by Ching (1971) as Kukio-Puhia Pele Trail. Runs *mauka-makai;* was once used by mules.

SITE NO.: State: 1319
SITE TYPE: Trail
TOPOGRAPHY: Pahoehoe and Aa flows
VEGETATION: --
CONDITION: Fair
INTEGRITY: --
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DIMENSIONS: --
DESCRIPTION: Initially identified by Ching (1971) as Kiholo-Kaupulehu Trail. Trail includes kerbstones of upright pahoehoe slabs. Most of trail is covered with small stones.

APPENDIX B:

HISTORICAL DOCUMENTARY RESEARCH

by Lehua Kalima, B.A. and Helen Wong Smith, B.A.

INTRODUCTION

The *ahupua'a* of Ka'upulehu 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 Kuki'o Ahupua'a, Ka'upulehu extends westward from the sea to Mount Hualalai, which rises to an elevation of about 8251 feet.

Ka'upulehu has a rich, varied and well-documented history. However, because most of the documentation concerns the coastal region, and the current project area is inland, this report will encompass both the *makai* lands of the *ahupua'a* and the upland region.

The name Ka'upulehu is translated by some sources as "the roasted breadfruit", the ('*u* being short for *'ulu*) (Puku'i et al. 1974:96). Kelly interprets the name as a combination of two words, *ka'upu* (meaning a kind of bird) and *lehu* (meaning numerous), together meaning "many birds of this kind" (1985:89). The Hawaiian Dictionary suggests that *ka'upu* may be a term for a Laysan albatross, although the term *moli* is more commonly used (Puku'i and Elbert 1986:139). It should be noted that the term *ka'upu* also is the name of a native fern (ibid.), which would result in the translation "numerous ferns" for the name of this *ahupua'a*. 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 KA'UPULEHU

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

The entire portion of North Kona which lies between Honokahau 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 Kekeha:

> *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 Hoolua 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 (Ii 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 ..... 'ohi'a'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

(ibid.).

The following names are also found within the boundaries of Ka'upulehu (Figure B-1):

Kumu-kea Point ..... white base
Wai-a-kuhi Pond
Kahu-wai Bay ..... contraction of Kahua-wai, place of water
Mahewalu Point
Pu'u Kolekole
Pu'u Mau'u (Pu'u Mau-USGS map) ... grass hill
Kileo
Pu'u 'Alauwa (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 Kanka-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 an ancient name of Manuahi. This name translates as "fire bird" (Puku'i et al. 1974:146) by breaking the name into two words "*manu*" (bird) and "*ahi*" (fire). The word *manuahi* as a unit means "gratis, gratuitous, free of charge, adulterous" (Puku'i and Elbert 1986:239), but no reference consulted for this report applied this meaning to Ka'upulehu. Although Puku'i 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

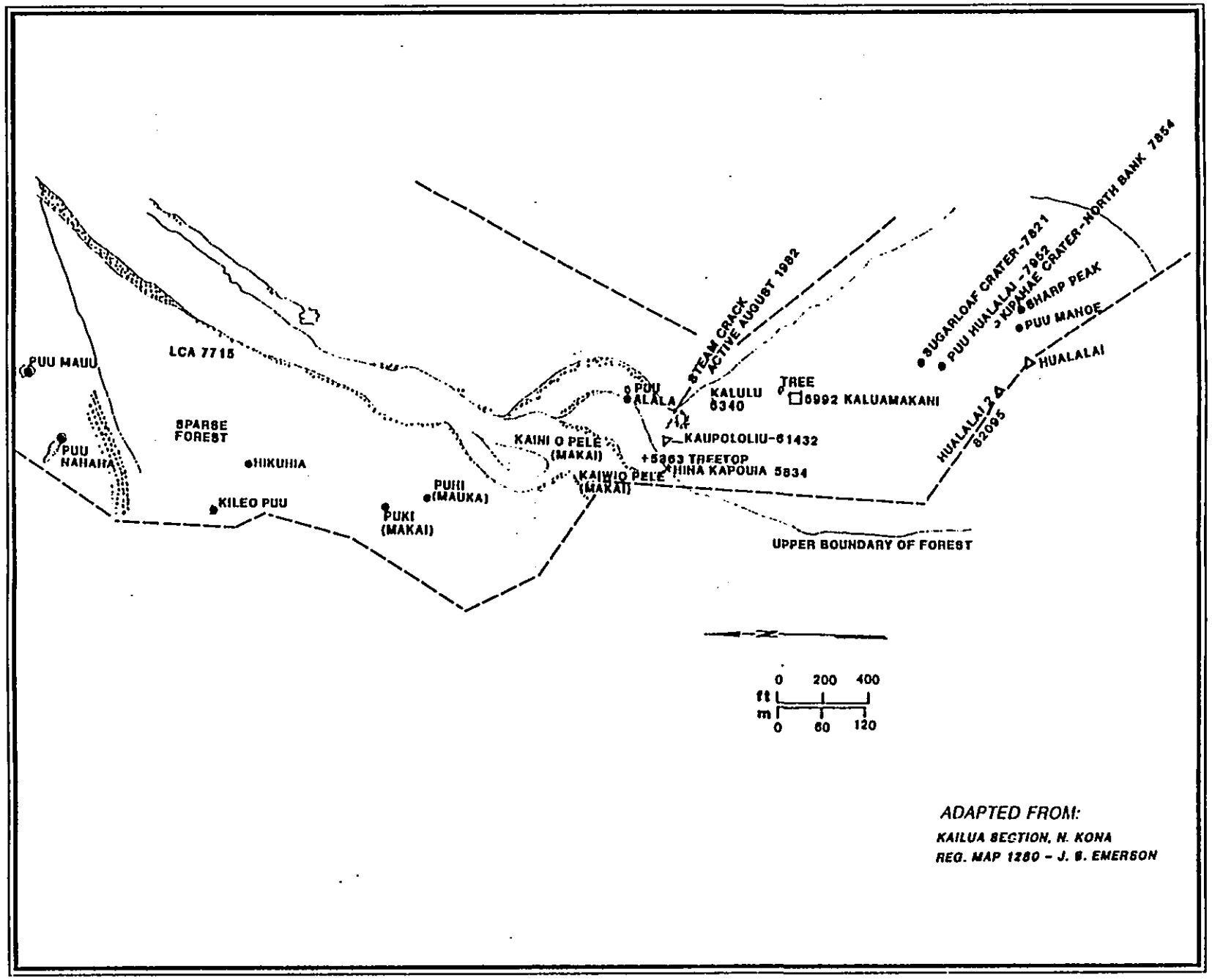

Figure B-1.
Inland Ka'upulehu, Part of Which Lies in Project Area
Kailua Section Map of N.Kona, Reg. Map 1280 by J.S. Emerson

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 Kolomu'o, 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 Hu'ehu'e, destroying the village of Manuahi and the fish pond of Pa'aiea. 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 native historian, refers to a similar story about breadfruit, but his tale involves Kamehameha and the Hualalai Flow of 1800-1802 (see Figure B-2):

> The people believed that this earth-consuming flame came because...[Kamehmeha's] refusing her [Pele] the tabu breadfruit of Kameha'ikana which grew in the uplands of Hu'ehu'e where the flow started." (1961:184).

According to Kamakau, Pele may have had other reasons for launching 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 Kaheiheimaile (one of his wives) and neglecting Ka'ahumanu (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* Our husband
> *ha'awe 'olo'olo e* has gone to carry
> the bigger load [Kaheiheimaile]

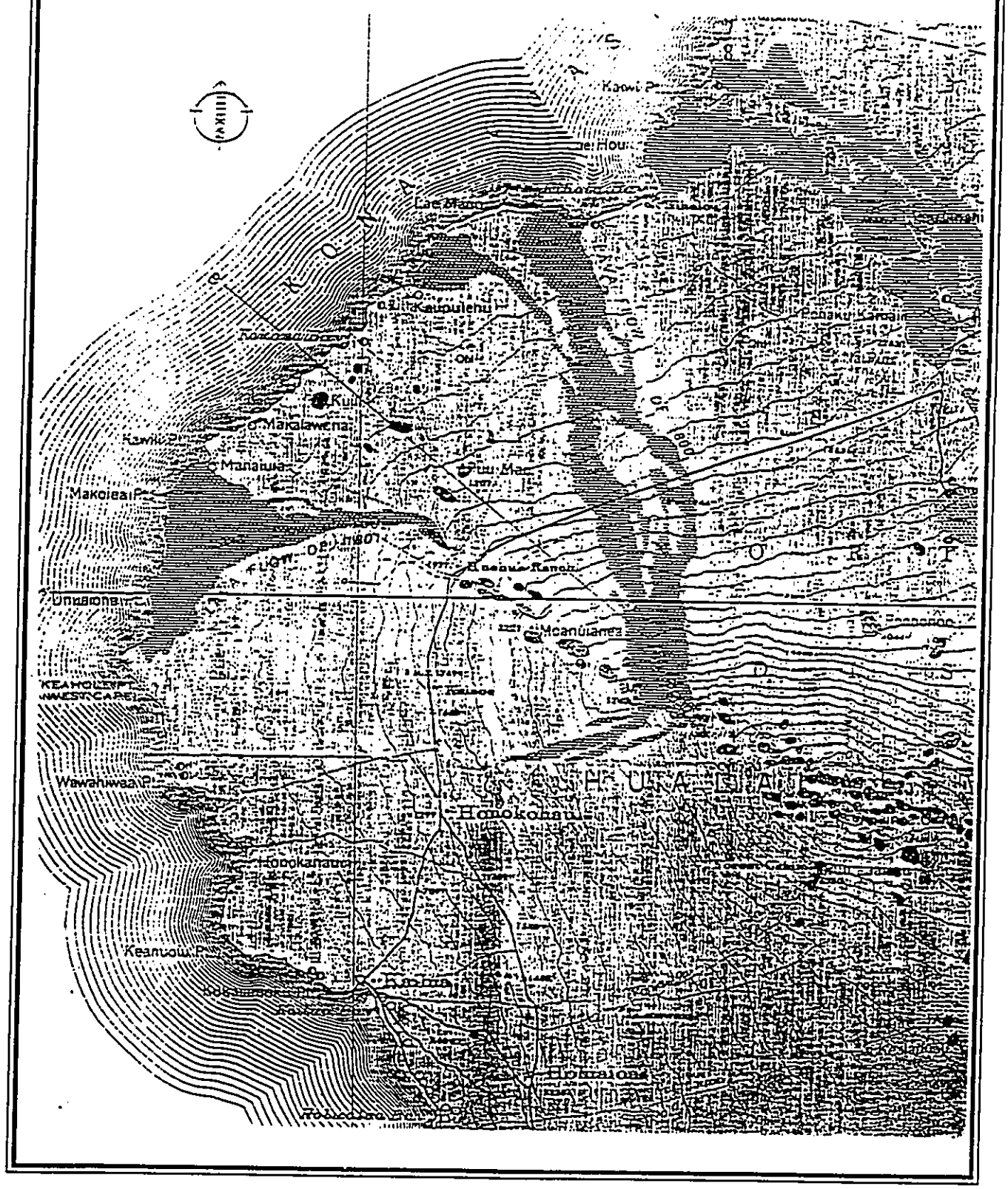

Figure B-2.
Portion of Map Showing 1800 and 1801 Lava Flows in North Kona, Taken from Carter 1985

Ha'alele ia ka ha'awe leilei e leilei e. While the lighter load [Ka'ahumanu] 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 and Alapa'i waged war, and "Kekaulike cut down the trees throughout the land of Kona" (ibid.).

EARLY HISTORICAL ACCOUNTS

During the reign of Kalani'opu'u, the lands of Kekaha belonged to the twins Kame'eiamoku and Kamanawa, half-brothers of Ke'eaumoku (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 revenge 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 natives 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 lava flow of 1859 from Mauna Loa (Soehren 1963:8).

Ka'upulehu was first mentioned by a foreigner in the journal of Archibald Menzies, who visited Hawaii with Capt. 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 Ii made similar observations, "The sustenance of those lands was fish." (1973:109). The lands noted by Ii were Kaelehuluhulu, the kaha lands (Kekaha) and Ooma (Ching 1971:33).

In 1823, eleven years after Ii 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 mentioned "...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 (Wainana'lii) 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 *Wainana'lii at Kiholo Bay must have been quite impressive* as this is the only one of the nineteen fishponds along this coast which he described (Ching 1971:34). This pond was destroyed thirty-six 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 (Wilkes 1845:91). 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 western description of a traveller through the inland area was written in 1880 by George Bowser:

> From Kiholo the road southwards is rough and laborious. Perpetual travelling 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 traveller 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'upulehua 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'u Wa'awa'a (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 Hawai'i. According to Kamakau the chiefs precipitated 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 Jan. 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 was awarded to Lot Kamehameha, along with Kaloko to the South. 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 lists 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 indicates only that this land was awarded to Lot, and no other data was given; likewise for information in the Native Register.

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 Kahaluuk Keopu & Kaloko be not included is 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 of 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, which 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 for 65 years 18,228 acres of Kaupulehu ahupua'a to Hualalai Development. 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 Kaupulehu 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, and in 1984 Barnwell Hawaiian Properties joined in a partnership with Cambridge Pacific, Inc., and the lease was assigned to Kaupulehu 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. This hotel provides 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 Maka'ai (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 that 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 said that Ka'ulupulehu was located up *mauka*. He 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 the 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 which 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 Mahiula. He rode his donkey to elementary school in Kalaoa. They also used donkeys to trade fish for goods at the "Ahuna" and "Akuna" stores in Kalaoa. 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*. He spoke of Waiakuhi Pond, which is where they 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 was a valuable source of information on the entire Kona area. Mrs. Greenwell supplied several items of information relevant to the Ka'upulehu area, mentioning 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.

Mrs. Hannah Springer has been a resident on the land *mauka*, at Hu'ehu'e 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 wasn't 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 Ka'ulupulehu 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'eiaumoku 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.

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