September 2008

Final Environmental Impact Statement: Appendices

KEAHUOLU

AFFORDABLE HOUSING PROJECT

Kailua-Kona, North Kona, Island of Hawaii

Volume 2 of 2

PREPARED BY

BeltCollins

PREPARED FOR

Housing Finance & Development Corporation · State of Hawaii · 1959

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This Environmental Impact Statement has been prepared by Belt Collins Hawaii Ltd.
acting as a consultant to the Hawaii Housing Finance & Development Corporation

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State of Hawaii 1959

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Appendix A

April 2007 – List of stakeholders who received two preliminary land use concept plans for the HHFDC Keahuolu Affordable Housing Project:

A. State Agencies

Department of Business, Economic Development and Tourism (DBEDT)
Ms. Laura Thielen, Director, Office of Planning
Department of Education (DOE) (Ms. Heidi Meeker)
Department of Hawaiian Home Lands (DHHL)
Mr. Micah A. Kane, Chairman
Mr. Larry Sumida
Department of Land & Natural Resources (DLNR)
Chairperson
Administrator, State Historic Preservation Division
Department of Transportation (DOT)
Mr. Barry Fukunaga, Director
Mr. Stanley Tamura, Engineering Program Manager, Highways Division – Hawaii District Office
Office of Hawaiian Affairs (Mr. Clyde Namu‘o, Administrator)
Office of the Governor
Mr. Andy Smith, Liaison Officer, Kona/West Hawaii Office

B. County of Hawai‘i

Department of Environmental Management
Ms. Barbara Bell, Director
Ms Dora Beck
Department of Parks and Recreation (Ms. Pat Engelhard, Director)
Department of Public Works (Mr. Bruce McClure, Director)
Department of Research and Development (Ms Jane Testa, Director)
Department of Water Supply (Mr. Milton Pavao, Manager)
Fire Department (Mr. Darryl Oliveira, Fire Chief)
Office of Housing and Community Development (Mr. Edwin Taira, Housing Administrator)
Office of the Mayor;
Ms Dixie Kaetsu, Managing Director
Mr. Roy Takemoto, Executive Assistant
Planning Department (Mr. Chris Yuen, Director)
Police Department (Mr. Lawrence Mahuna, Chief of Police)

C. Elected Officials

Councilmember Dominic Yagong, County of Hawai‘i District 1
Councilmember Donald Ikeda, County of Hawai‘i District 2
Councilmember J. Yoshimoto, County of Hawai‘i District 3
Councilmember Stacy Higa, County of Hawai‘i District 4
Councilmember Emily Naeole, County of Hawai‘i District 5
Councilmember Bob Jacobson, County of Hawai‘i District 6
Councilmember Brenda Ford, County of Hawai‘i District 7
Councilmember Angel Pilago, Vice Chair, County of Hawai‘i District 8
Councilmember Pete Hoffman, Chair, County of Hawai‘i District 9
Representative Josh M.D. Green, State of Hawai‘i, District 6
Senator Paul Whalen, State of Hawai‘i, District 3

D. Local Utilities

Hawaii Electric Light Company, Inc. – Hilo
- Mr. Hal Kamigaki
- Ms. Shelley Tomita
- Mr. Kevin Whitener

Hawaiian Telecom, Inc.
- Mr. Kevin Ayano
- Mr. Gordon Yadao
- Mr. Michael Chang

Oceanic Time Warner (Mr. Robert Moeller)

E. Community Organizations, Associations, and Other Groups

A & B Properties, Inc. (Mr. Stanley M. Kuriyama, Chief Executive Officer)

Akinaka and Associates, Ltd. (Mr. Robert Akinaka)

Stanford S. Carr Development Corporation (Mr. Stanford S. Carr)

Castle & Cooke Homes Hawaii, Inc. (Mr. W. Bruce Barrett)

Community Planning and Engineering, Inc. (Mr. Bernard P. Kea, P.E.)

D.R. Horton, Schuler Division (Ms. Tracy Nagata AIA, Vice President of Development, Neighbor Island Group)

Hawai‘i Leeward Planning Conference (Ms. Jacqui Hoover, President)

Kamehameha Schools
- Mr. Jeffrey Mau, Senior Asset Manager, Commercial Asset Division, Asset Mgmt & Operations Endowment Group
- Ms. Susan W.F. Todani, CRE, Director, Special Projects Endowment Group

Kona Community Development Plan Steering Committee
- Mr. Ken Melrose
- Mr. J. Curtis Tyler III

Kona-Kohala Chamber of Commerce (Ms. Vivian Landrum, Executive Director)

Kona Traffic Safety Committee (Mr. Joel Gimpel)

The Maryl Group, Inc. (Mr. Mark Richards, President)

Neighborhood Place of Kona (Mr. Wally Lau)

Pacific Kona Landscaping (Ms. Brenda Lam, President)

Queen Lili‘uokalani Trust (Ms. LeeAnn E.P. Crabb)

Steelhead Capital (Mr. Sean Aguila)

UniDev Hawaii, LLC (Mr. Jeffrey A. Minter, Chief Executive Officer)

F. Individuals

Ms. Elaine Watai

Appendix B

B-1
November 2007

Botanical Survey

of

The Proposed Keahuolu Affordable Housing Project

North Kona, Island of Hawai‘i

by

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

Report prepared for

Belt Collins and Associates
Honolulu, Hawai‘i

November 2007

INTRODUCTION

The study site encompasses 272 acres located in North Kona on the island of Hawai‘i. The project site is part of the former Queen Lili‘uokalani Trust (QLT) lands that have been subdivided into several portions earmarked for development and conservation, and is situated just northeast of Kailua-Kona town, and mauka (inland) of Queen Ka‘ahumanu Highway. The project site is an irregularly shaped polygon (Fig. 1) bordered on the south side by Palani Road, just northeast of where Henry Street intersects it, and the northeast corner abuts Kealakehe Drive. The project parcel is Tax Map Key 7-4-021: 020. Construction of homes and other facilities is planned for the project area, called Keahuolu, and this requires an up-to-date botanical survey, especially since there are federally listed threatened and endangered plant species occurring in the general vicinity.

The project area is comprised of lava flows of various ages that are covered mostly by an alien-dominated scrub vegetation that has been highly disturbed in the past. A botanical survey was carried out by Char and Associates in 1989 on the area, but that survey included a much larger area comprising 1100 acres, some of it extending west of the present study site and makai of the Queen Ka‘ahumanu Highway.

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

METHODOLOGY

Before the fieldwork was carried out, a review of the literature was undertaken by the Principal Investigator (PI). The current status of any endangered species previously reported from the general area was checked using the official database of threatened and endangered species (USFWS 2005). This list is identical to the State of Hawai‘i list of threatened and endangered plant species. In addition, information about threatened and endangered plant species found in the area was extracted from the Hawai‘i Natural Heritage Program database (Anon. 2005) of federally listed plant species (Fig. 2). Topographic maps and aerial photos were studied to determine the best access points and to locate places where native species are most likely to be found (lava flows).

After the literature review, a botanical field survey was conducted at the Keahuolu project site by a two-person botanical team consisting of the PI (Art Whistler) and a Field Assistant (Beate Neher) from 4 to 7 April 2007. No roads lead into the property, so access was attained from Palani Road for the southern portions and from Kealakehe Drive for the northeastern corner. A walk-through survey was employed, with transect lines marked for the purpose with flagging tape being used to keep bearings. All plant species encountered during the survey were recorded, along with an indication of their frequency. Particular care was taken in ‘a‘a areas, since this type of habitat is where most of the native species and endangered species are most likely to occur. New lists were made for each vegetation type and/or day, and these were combined into a comprehensive checklist of all plants found at the study site (see Table 2).

Fig. 1. The Keahuolu Affordable Housing Project Study Site.

Notes were also taken on vegetation types present, indicating the dominance and frequency of the plant species found there. This was later analyzed and written up to form the vegetation section below. All of the species encountered during the fieldwork were familiar to the field team and were identified in the field.

THE VEGETATION

Four types of vegetation can be recognized on the Keahuolu property: (1) Managed Land Vegetation; (2) *Prosopis* woodland; (3) *Leucaena* Scrub; and (4) *Schinus*/*Psydrax* Scrub. These types are described below.

(1) Managed Land Vegetation

This comprises the areas of the parcel that are under periodic or frequent management, such as the edges of roads. This is a relatively minor component of the overall vegetation on the property, since only the roadsides of Palani Road are currently being managed. The roadsides are dominated by alien weedy species, such as swollen fingergrass (*Chloris barbata*) and the dicot herbs coat buttons (*Tridax procumbens*), garden spurge (*Chamaesyce hirta*), Florida beggarweed (*Desmodium tortuosum*), and cow pea (*Macroptilium lathyroides*). There are also a number of ornamentals planted along the roadside, particularly bougainvillea (*Bougainvillea glabra*), mulberry (*Morus alba*), and candlenut (*Aleurites moluccana*), although the latter may be natural there since it is a naturalized Polynesian introduction to Hawai‘i.

(2) *Prosopis* Woodland

This type of vegetation, which is dominated by the tall alien tree species kiawe (*Prosopis pallida*), is found only in an indistinct zone north of and paralleling Palani Road (Fig. 3). It is an open woodland with few other tree species besides the koa haole (*Leucaena leucocephala*). The two other trees more common outside of this zone, Christmas berry (*Schinus terebinthifolius*) and the native alahe‘e (*Psydrax odoratum*), are occasional here. The ground cover is sometimes dense, dominated mostly by Guinea grass (*Panicum maximum*) and Philippine violet (*Barleria cristata*), two species otherwise uncommon at the study site. Talinum (*Talinum triangulare*), a succulent weed, is also often common in places. Other than the alahe‘e, few native species are found here, mostly because of the dominance of the kiawe. This type of vegetation was called “Kiawe woodland” by Char and Associates (1989).

(3) *Leucaena* Scrub

This is the type of vegetation found on areas of older lava flows dominated by the alien scrubby tree koa haole (*Leucaena leucocephala*). It is not a homogeneous type of vegetation, since with increasing elevation going eastward up the slope, its density and the species associated with it change. On the lower portions (Fig. 4) of the study site, koa haole is mostly 1–3 m in height, scattered in an open-to-dense matrix of *Pennisetum setaceum* (fountain grass). Also significant here is the native shrub or small tree alahe‘e (*Psydrax odoratum*), which in some places is almost a co-dominant. Several other trees and shrubs are found here, but in low

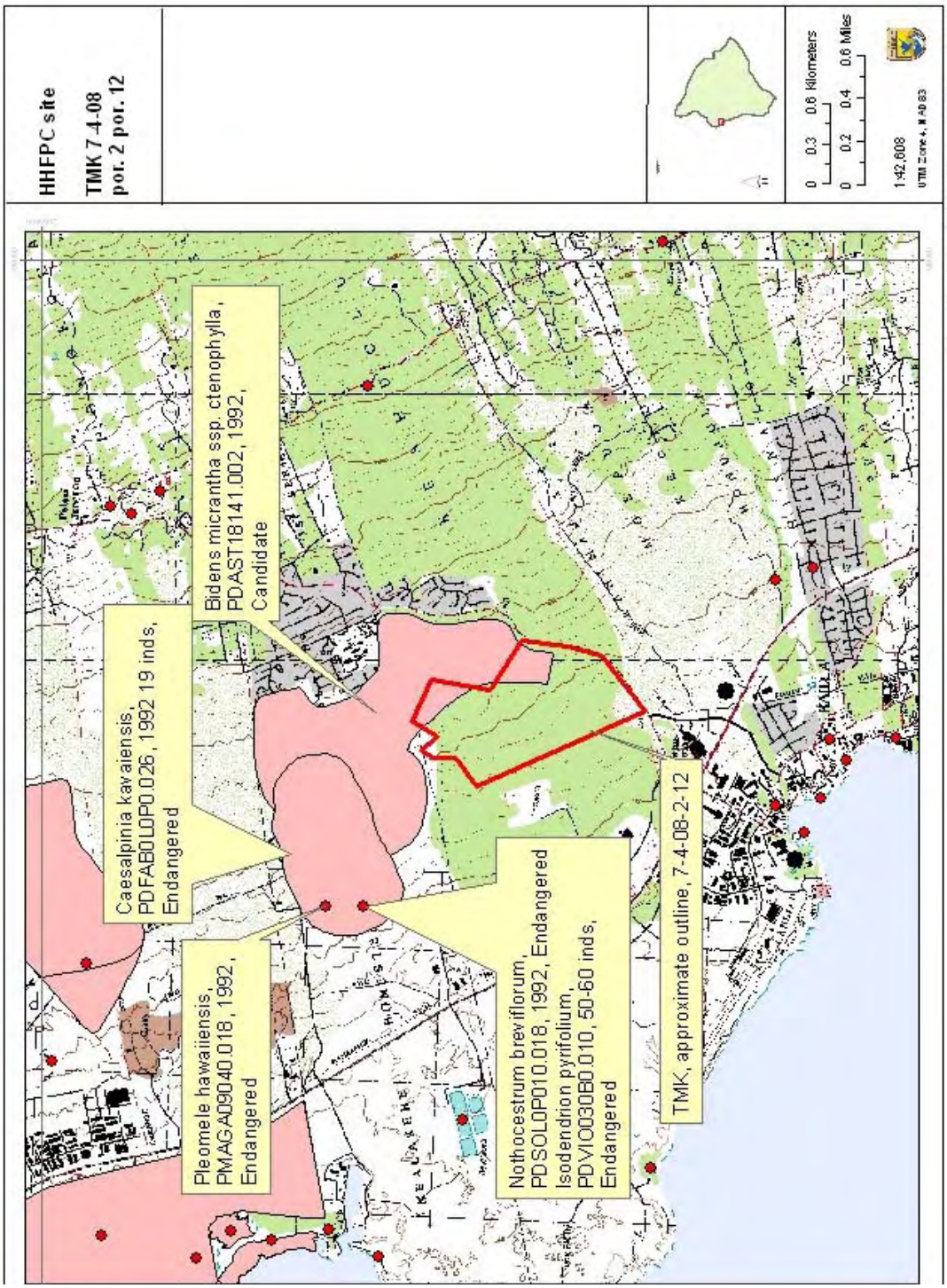

Fig. 2. Hawai‘i Natural Heritage Program database map of federally listed plant species.

numbers. This includes the alien tree Christmas berry (*Schinus terebinthifolius*) and the alien shrub klu (*Acacia farnesiana*). Fountain grass dominates most of the open areas having some soil, but a number of other herbaceous species are found in the shade of koa haole or on pahoehoe rocks free of fountain grass, particularly talinum (*Talinum triangulare*), air plant (*Kalanchoë pinnata*), lantana (*Lantana camara*), and carrion flower (*Stapelia gigantea*). Two indigenous vines are found in the area, huehue (*Cocculus trilobus*), which is common, and the kowali-ʻawa (*Ipomoea indica*), which is uncommon. The native herb ʻalaʻala-wai-nui (*Peperomia leptostachya*) is occasional on rocks. At higher elevations, koa haole is generally less dominant, and is gradually replaced with Christmas berry (*Schinus terebinthifolius*). On deeper soils, however, it extends up to higher elevations (Fig. 5). This vegetation was called "Scrub" by Char and Associates (1989).

Leucaena scrub is classified as disturbed, since fires periodically sweep through the area and goats are known to be present. These two factors account for the dominance of alien species, which are better adapted to these disruptive conditions than are the native species. According to the flora of Hawaiʻi (Wagner et al. 1999), fountain grass "is rapidly expanding its range in the Kona district of Hawaii." Introduced into the Kona District "in the early 1900s as an ornamental, [it] has aggressively spread and now dominates abandoned pastures, young lava flows, and burn areas. Fountain grass poses one of the most serious contemporary conservation problems because it is disrupting the more sparsely vegetated lowland native dry forests and shrublands, which contain several endangered and many candidate endangered plant species."

(4) *Schinus*/*Psydrax* Scrub

This is the type of vegetation on more recent lava flows, ones that are decidedly composed of ʻaʻa lava. It is the same vegetation described by Char and Associates (1989) as "*Canthium*/ Christmas Berry Shrubland" (*Canthium* is the old name for *Psydrax*). It is found in a patchy distribution within the site, which comprises lava flows of various ages and stages of development into soil. It gradually increases in frequency with increasing elevation, particularly above 400 ft. elevation (Fig. 6), since it is dominated by species that do better in the somewhat wetter conditions found upslope. The main species dominating this community is the alien tree Christmas berry (*Schinus terebinthifolius*), along with the indigenous tree alaheʻe (*Psydrax odoratum*). These two species are also found at lower elevations, mostly on or near aʻa lava flows, but at the higher elevations at the site they dominate rather than being of secondary importance to koa haole (*Leucaena leucocephala*). The third most prevalent tree in this community is the koa haole, which, as noted above, sometimes forms nearly pure strands on some soil types. The fourth most prevalent tree is perhaps the introduced shrub or small tree klu (*Acacia farnesiana*). Other tree species found here include the uncommon endemic ʻohe (*Reynoldsia sandwicensis*), the uncommon indigenous shrub pua pilo (*Capparis sandwichiana),* the somewhat more common endemic shrub or tree mamane (*Sophora chrysophylla*), the occasional indigenous shrub ʻaʻaliʻi (*Dodonaea viscosa*), and the introduced (by Polynesians) noni (*Morinda citrifolia*).

The ground cover is also sparse in this type of vegetation, with scattered clumps of *Pennisetum setaceum* (fountain grass) found mostly in pockets of soil or pahoehoe, and perhaps being the most common species found here. The ground cover is particularly sparse (Fig. 7) under the dense canopy of the Christmas berry trees. Second in importance is probably the air

plant (*Kalanchoë pinnata*), which forms a dense undergrowth in some places, but is entirely lacking in others. There are many patches of huehue (*Cocculus trilobus*), and a few patches of kowali-ʻawa (*Ipomoea indica*), and the native fern kupukupu (*Nephrolepis exaltata*), as well as the thorny alien shrub *Lantana camara* (lantana). In a few places at the highest elevations of the plot, the endemic subshrub *Bidens micrantha* ssp. *ctenophylla* occurs. This species was a candidate for federal listing as endangered or threatened, but was never classified as such, and hence has no protected status. It is occasional in other areas of similar vegetation at about the same elevation in the area (Whistler 2006).

Like *Leucaena* Scrub, this vegetation is classified as disturbed, since fires periodically sweep through the area, and goats are known to be in the area. It somewhat matches the description of the "Lowland Dry Shrublands" described in Wagner et al. (1999), which is described as occurring in leeward situations on most of the main islands, at 330 to 2000 ft elevation, and being open and not exceeding 10 ft in height.

THE FLORA

A total of 83 plant species (see Table 2) was recorded in the study site. Seventeen of the 83 species recorded are native and six of these native species are endemic. Indigenous plants are species that are native to a region or place, but are also found elsewhere. Endemic plants are species restricted to a single region or area, i.e., in the case of Hawai‘i, they are found only in Hawai‘i. In biodiversity terms, the endemic status is the more important of the two categories, since if a species belonging to it is endangered or threatened in Hawai‘i, it would likewise be classified globally. Indigenous species, however, can be rare in Hawai‘i, but may be common elsewhere in the Pacific. Over 90% of the native plants in Hawai‘i are endemic, one of the highest rates in the world.

The majority of the 83 species encountered during the survey are naturalized "alien" plants that were accidentally or intentionally introduced to Hawai‘i, but which have now become established in the islands and can spread on their own. The checklist of Char and Associates (1989) for the area included 148 species, but that study, which included the present study site, was for a larger property (about 2.5 times the area of the present study site) and included areas that are much nearer to the coast. The present survey was conducted during a fairly dry part of the year, and if done in a rainy part or a wetter year, it is likely that additional species, mostly herbaceous alien weeds, would have been recorded.

Most of these additional species found by Char and Associates were adventive species (weeds) that would be expected in the area, but many of these are herbaceous species that die back during the dry season, and consequently might have turned up during the current survey. Char and Associates also found several native species in their study that did not turn up in the present study: *Doryopteris decora* (an endemic fern occasional on the lava flows of the area); *Fimbristylis hawaiiensis* (an endemic sedge of coastal areas, not to be expected in the present study site); *Pandanus tectorius* (an indigenous tree-like monocot of coastal areas, not to be expected in the present study site), *Digitaria setigera* (a coastal grass not to be expected in the present study site); *Heliotropium curassavica* (a native coastal herb not to be expected at this inland study site); *Ipomoea pes-caprae* (an indigenous coastal vine not to be expected at this inland study site); *Diospyros sandwicensis* (an endemic tree occasional on lava flows at higher elevations in the area); *Senna gaudichaudii* (an indigenous tree occasional on lava flows at

higher elevations in the area); *Plectranthus parviflorus* (an indigenous herb occasional on lava flows at higher elevations in the area); *Argemone glauca* (an indigenous herb occasional on lava flows at higher elevations in the area); *Osteomeles anthyllidifolia* (an indigenous shrub occasional on lava flows at higher elevations in the area); and *Solanum americanum* (an indigenous herb common in Hawai‘i). None of these native species are particularly uncommon and are not even listed as species of concern (SOC).

Several threatened or endangered species have been reported in the area, and are shown on the Hawai‘i Natural Heritage Program database map (Fig. 2). Uhiuhi (*Caesalpinia kavaiensis*) was recorded in the vicinity north of the present study site, but it was not found on the project site during the present study nor in the larger study area surveyed by Char and Associates (1989). There is a single record of hala pepe (*Pleomele hawaiiensis*) collected in the uhiuhi area northwest of the study site in 1992, but it was not seen by Char and Associates in the larger area south of this population nor during the present study. There is, however, a relatively large population at Kaloko a few miles north of the current study site (Whistler 2006). ‘Aaea (*Nothocestrum brevifolium*) was found in 1992 near the record of hala pepe, but it was not seen by Char and Associates (1989) in the larger area south of this population, nor during the present study. At about the same point, a population of about 50 to 60 individuals of aupaka (*Isodendrion pyrifolium*) was found in 1992, but this shrub was not seen by Char and Associates in the larger area south of this population, nor during the present study. Figure 2 also lists “species of concern” *Bidens micrantha* ssp. *ctenophylla* as occurring in the area north of the present study site. This species was found during the present study, but it has not been listed as Threatened or Endangered, and thus has no official status.

Table 1. Native species found at the study site

Bidens micrantha ssp. *ctenophylla* (Asteraceae)	ko‘oko‘olau	Endemic
Capparis sandwichiana (Capparaceae)	pua pilo	Endemic
Cocculus trilobus (Menispermaceae)	huehue	Indigenous
Cuscuta sandwichiana (Cuscutaceae)	dotter	Endemic
Dodonaea viscosa (Sapindaceae)	a‘ali‘i	Indigenous
Erythrina sandwicensis (Fabaceae)	wiliwili	Endemic
Heteropogon contortus (Poaceae)	pili grass	Indigenous?
Ipomoea indica (Convolvulaceae)	koali-‘awa	Indigenous
Nephrolepis exaltata (Nephrolepidaceae)	kupukupu	Indigenous
Peperomia leptostachya (Piperaceae)	‘ala‘ala-wai-nui	Indigenous
Plumbago zeylanica (Plumbaginaceae)	‘ilie‘e	Indigneous
Psilotum nudum (Psilotaceae)	moa	Indigenous
Psydrax odoratum (Rubiaceae)	alahe‘e	Indigenous
Reynoldsia sandwicensis (Araliaceae)	‘ohe	Endemic
Sida fallax (Malvaceae)	‘ilima	Indigenous
Sophora chrysophylla (Fabaceae)	mamane	Endemic
Waltheria indica (Sterculiaceae)	‘uhaloa	Indigenous

DISCUSSION

A total of 83 plant species (see Table 2) was recorded at the study site, with 17 of them native—six endemic and eleven indigenous. No species federally listed as threatened or endangered were found at the site. One endemic subshrub found in the study site, koʻokoʻolau (*Bidens micrantha* ssp. *ctenophylla*), was at one time considered a candidate species for one of these categories, but it has no current protected status. It occurs in other places north of Kona where it is sometimes even found in disturbed places such as quarries (see Whistler 2006). It is shown in the Hawaiʻi Natural Heritage Program Database map (Fig. 2) as occupying the northeastern part of the current study site, and this was found to be the case.

That database map also shows a record of the federally listed endangered tree uhiuhi (*Caesalpinia kavaiensis*) as occurring in the area just northwest of the study site, but it has not been recorded from the study site nor was it seen there during the botanical studies of Char and Associates (1989) nor during the present study. The tree is restricted to populations found in the Waianae Mts. on Oʻahu, Hualalai on Hawaiʻi, and on Lanaʻi. Subpopulations on Maui and Kauai are now apparently extinct. Currently fewer than 50 reproductive individuals are known, and a preserve of 11.2 acres near the study site has been set aside for their protection.

Three other federally listed threatened or endangered species have been recorded from the general area, as shown in Fig. 2 on the Hawaiʻi Natural Heritage Program Database map: hala pepe (*Pleomele hawaiiensis*), ʻaiea (*Nothocestrum breviflorum*), and aupaka (*Isodendrion pyrifolium*). Hala pepe is a member of the agave family, and historically had many uses by native Hawaiians. Currently, these plants are experiencing poor reproductive success in the wild, which may be attributed to a number of causes. Eight populations of this plant are known to exist, comprising about 250 to 300 individuals, with two of the populations in the Kaloko to Kona area (USFWS 1995).

ʻAiea can be found at elevations of 590–6000 ft and typically grows in lowland dry forests and montane dry or mesic forests dominated by koa (*Acacia koa*), ʻohiʻa lehua (*Metrosideros polymorpha*), and/or lama (*Diospyros sandwicensis*). Associated species include uhiuhi (*Caesalpinia kavaiensis*) and wiliwili (*Erythrina sandwicensis*) (USFWS 1994). The ten remaining populations can be found throughout much of the species' historic range, including the nearby Kaloko site. In the later area, however, the species may have disappeared (Whistler 2006). In 1997 there were 10 known populations containing 60 individuals total (Bruegmann 1997).

Aupaka was presumed extinct for over 100 years, until 1991 when four plants were found on State-owned land on the island of Hawaiʻi northwest of the current study site. The area around their location was slated for development for residential housing and a golf course. Further searches of that site added an additional 50 to 60 plants to the known population, but due to pressure from residential and recreational development, as well as invasive species, only 15 plants were recorded during a recent survey of the site (USFWS 2001). Two small preserve have been established for this species to the north of the current study site, adjacent to Kealakehe High School (Anon. 2007).

No sensitive types of vegetation were found at the current study site. Such types of vegetation include wetlands and dryland forest. No wetland could occur here due to the dry, lava-covered surface at the site. Dryland forest with sensitive plant species is found at Kaloko to the north of the present study site, but none was encountered at the study site itself.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the survey, there are four main kinds of vegetation at the site: (1) Managed land along Palani Road, dominated by alien species; (2) *Prosopis* Woodland dominated by kiawe (*Prosopis pallida*) and koa haole (*Leucaena leucocephala*) along the southern boundary of the study site; (3) *Leucaena* Scrub dominated by koa haole (*Leucaena leucocephala*) in combination with alahe‘e (*Psydrax odoratum*) and fountain grass (*Pennisetum setaceum*) in the lower part of the study site and on soil on the upper part; and (4) *Schinus*/*Psydrax* scrub dominated by Christmas berry (*Schinus terebinthifolius*) and alahe‘e (*Psydrax odoratum*) on or near lava flows.

A total of 83 plant species were recorded from the study site. Of these, 17 are native species—11 indigenous species and 6 endemic species. None of these are federally listed as “threatened” or “endangered.” No areas of wetlands or undisturbed native vegetation occur at the site. Consequently, there are no botanical impediments to carrying out the proposed construction.

It is also recommended that some of the rare and endemic species occurring on the site or in the general area should be considered for any landscaping that will be done, such as around utility buildings and public structures. This would be a win-win situation. Some of the species make attractive ornamentals, and are already adapted to the dryland conditions at the site. Thus they require little maintenance and watering. Using rare or culturally significant species would also help to alleviate any local or governmental concerns that the project would be detrimental to the survival of these rare species. Some of these species are already being propagated by local gardeners and gardens, such as the nearby Amy Greenwell Garden. These may be available for purchase, or these individuals or gardens could be hired to do the local plant landscaping. Some species recommended for landscaping are as follows:

Alahe‘e (*Psydrax odoratum*)—A small indigenous tree or shrub fairly common at the site, to which it is well adapted. It has attractive dark green leaves, a thick canopy, and baseball-sized clusters of fragrant, attractive white flowers.

Hala pepe (*Pleomele hawaiiensis*)—A federally listed endangered endemic species. This yucca-like plant is similar to the money tree (*Dracaena marginata*) that is a popular ornamental plant in Hawai‘i. It was not found at the site, but a population of it occurs at a similar elevation to the north at Kalolo.

‘Ilima (*Sida fallax*)—An indigenous shrub common at the site. It is a popular ornamental in Hawai‘i, where the orange mallow-like flowers are fashioned into exquisite leis.

Kolomona (*Senna gaudichaudii*)—Small indigenous tree with pale yellow flowers. It is similar to the scrambled eggs tree (*Senna surattensis*) that is a popular ornamental tree in Hawai‘i.

Ko‘oko‘olau (*Bidens micrantha* ssp. *ctenophylla*)—An endemic shrub that is a candidate, federally listed endemic species. It is restricted mostly to this part of the island of Hawai‘i and has small, attractive, yellow, sunflower-like flowers.

Kukui (*Aleurites moluccana*)—This species is a Polynesian introduction to Hawai‘i rather than a native species, but it has important cultural significance since it seeds were traditionally used for night time illumination (hence its English name candlenut). Currently the seeds are used to produce massage oil and the fruits are fashioned into attractive seed leis. Its gray-green leaves and large stature make it a popular ornamental tree in Hawai‘i.

Mamane (*Sophora chrysophylla*)—An endemic small tree or shrub common on the Big Island, especially at higher elevations. It has attractive yellow, sweetpea-like flowers and an unusual, bead-necklace-like pod.

Naio (*Myoporum sandwicense*)—An indigenous small tree or shrub with small, fragrant white flowers. Its English name is false sandalwood, indicative of its fragrant wood once used like sandalwood. The plant is easily grown from cuttings.

ʻOhe (*Reynoldsia sandwicensis*)—A large, fast growing endemic tree with an open canopy.

ʻOhiʻa lehua (*Metrosideros polymorpha*)—This is the indigenous, medium-sized tree covering much of the island, and has attractive red or yellow, powderpuff-like flowers. Some varieties also have attractive gray-green leaves. It was not found at the present study site, probably because the area does not get enough rainfall to allow it to flourish, but it dominates the intact forests upslope.

Pua pilo (*Capparis sandwichiana*)—An endemic shrub or small tree with large, attractive white, fragrant flowers. It is relatively rare in Hawaiʻi, but does well on lowland lava flows.

ʻUlei (*Osteomeles anthyllidifolia*)—A sprawling indigenous shrub that makes a nice shrubby ground cover, but was not found at the site (but was reported by Char and Associates [1989] during their survey of the larger area). It has attractive but small, white, rose-like flowers (it is a member of the rose family).

Wiliwili (*Erythrina sandwicensis*)—A spreading endemic tree with showy seasonal red flowers, found in the area, but not recorded from the study site other than a few trees that appear to have been planted along Palani Road. It is a popular, long-lived, native ornamental tree in Hawaiʻi that is related to the ornamental coral tree (*Erythrina variegata*).

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TABLE 2. CHECKLIST OF PLANT SPECIES

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

For each species, the following information is provided:

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

Species	Common Names	Status
FERNS AND FERN ALLIES		
NEPHROLEPIDACEAE (Sword Fern Family)		
Nephrolepis exaltata (L.) Schott	kupukupu	I
POLYPODIACEAE (Common Fern Family)		
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	laua‘e	X
PSILOTACEAE (Psilotum Family)		
Psilotum nudum L.	moa	I
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Rhoeo spathacea (Sw.) Stearn	oyster plant	X
POACEAE (Grass Family)		
Chloris barbata (L.) Sw.	swollen fingergrass	X
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili grass	I?
Panicum maximum Jacq.	Guinea grass	X
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X

Species	Common Names	Status
	DICOTS	
ACANTHACEAE (Acanthus Family)		
Barleria cristata L.	Philippine violet	X
ANACARDIACEAE (Mango Family)		
Schinus terebinthifolius Raddi	Christmas berry	X
APOCYNACEAE (Periwinkle Family)		
Catharanthus roseus (L.) G. Don	Madagascar periwinkle	X
ARISTOLOCHIACEAE (Dutchman's Pipe Family)		
Aristolochia littoralis Parodi	pelican flower	X
ARALIACEAE		
Reynoldsia sandwicensis A. Gray	‘ohe	E
Schefflera actinophylla (Endl.) Harms	octopus tree	X
ASCLEPIADACEAE (Milkweed Family)		
Stapelia gigantea N.E. Brown	carrion flower	X
ASTERACEAE (Sunflower Family)		
Bidens cynapiifolia Kunth	West Indian beggar's-tick	X
Bidens micrantha Gaud. ssp. *ctenophylla* (Sherff) Nagatga & Ganders	----------	E
Bidens pilosa L.	beggar's-tick	X
Emilia sonchifolia (L.) DC.	pualele, emilia	X
Pluchea carolinensis (Jacq.) G. Don	pluchea	X
Tridax procumbens L.	coat buttons	X
BIGNONIACEAE (Bignonia Family)		
Jacaranda mimosifolia D. Don	jacaranda	X
Spathodea campanulata P. Beauv.	African tulip tree	X
BUDDLEIACEAE (Butterfly-bush Family)		
Buddleia asiatica Lour.	dogtail, heulo'ilio	X
CACTACEAE (Cactus Family)		
Opuntia ficus-indica (L.) Mill.	prickly pear, panini	X
CANNABACEAE (Marijuana Family)		
Cannabis sativa L.	pakalolo, marijuana	X
CAPPARACEAE (Caper Family)		
Capparis sandwichiana DC	pua pilo	E
Cleome gynandra L.	African spider flower	X
CARICACEAE (Papaya Family)		
Carica papaya L.	papaya	X
CLUSIACEAE (Mangosteen Family)		
Clusia rosea Jacq.	autograph tree	X
CONVOLVULACEAE (Morning-Glory Family)		
Ipomoea indica (J. Burm.) Merr.	koali-‘awa	I
Ipomoea obscura (L.) Ker-Gawl.	bindweed	X

Species	Common Names	Status
CRASSULACEAE (Stonecrop Family)		
Kalanchoë pinnata (Lam.) Pers.	air plant	X
Kalanchoë tubiflora (Haw.) Raym.-Hamet	chandelier plant	X
CUCURBITACEAE (Gourd Family)		
Coccinea grandis (L.) Voigt	ivy gourd	X
Momordica charantia L.	wild bittermelon	X
CUSCUTACEAE (Dodder Family)		
Cuscuta sandwichiana (Cuscutaceae)	kauna ‘oa	E
EUPHORBIACEAE (Spurge Family)		
Aleurites moluccana (L.) Willd.	candlenut, kukui	P
Chamaesyce hirta (L.) Millsp.	garden spurge	X
Euphorbia heterophylla L.	kaliko	X
Phyllanthus debilis Klein ex Willd.	phyllanthus weed	X
Ricinus communis L.	castor bean	X
FABACEAE (Pea Family)		
Abrus precatorius L.	rosary pea	X
Acacia farnesiana (L.) Willd.	klu	X
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X
Crotalaria pallida Aiton	smooth rattlepod	X
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X
Erythrina sandwicensis	wiliwili	E
Indigofera suffruticosa Mill.	indigo, ‘iniko	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Macroptilium lathyroides (L.) Urb.	cow pea	X
Pithecellobium dulce (Roxb.) Benth.	‘opiuma, Manila tamarind	X
Prosopis pallida (Humb. & Bonpl.ex Willd.) Kunth	kiawe, mesquite	X
Samanea saman (Jacq.) Merr.	monkeypod	X
Senna occidentalis (L.) Link	coffee senna	X
Sophora chrysophylla (Salisb.) Seem.	mamane	E
LAMIACEAE (Mint Family)		
Hyptis pectinata (L.) Poir.	comb hyptis	X
MALVACEAE (Mallow Family)		
Malvastrum coromandelianum (L.) Garcke	false mallow	X
Sida fallax Walp.	‘ilima	I
Sida spinosa L.	prickly sida	X
MENISPERMACEAE (Moonseed Family)		
Cocculus trilobus (Thunb.) DC.	huehue	I

Species	Common Names	Status
MORACEAE (Mulberry Family)		
Ficus microcarpa L. f.	Chinese banyan	X
Ficus rubiginosa Desf.	Port Jackson fig	X
Morus alba L.	mulberry	X
MYRTACEAE (Myrtle Family)		
Psidium guajava L.	guava	X
NYCTAGINACEAE (Four-o'-Clock Family)		
Boerhavia coccinea Mill.	----------	X
Bougainvillea glabra Choisy	bougainvillea	X
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	love-in-a-mist	X
PHYTOLACCACEAE (Pokeweed Family)		
Rivina humilis L.	rouge plant	X
PIPERACAEAE (Pepper Family)		
Peperomia leptostachya Hooker & Arnott	ʻalaʻala-wai-nui	I
PLUMBAGINACEAE (Leadwort Family)		
Plumbago zeylanica L.	ʻilieʻe	I
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	common purslane	X
Portulaca pilosa L.	ʻihi	X
Talinum triangulare (Jacq.) Willd.	talinum	X
PROTACEAE (Protea Family)		
Macadamia ternifolia F. Muell.	macadamia	X
RUBIACEAE (Coffee Family)		
Morinda citrifolia L.	Indian mulberry, noni	P
Psydrax odoratum (Forst. f.) A. C. Sm. & S. Darwin	alaheʻe	I
SAPINDACEAE (Soapberry Family)		
Dodonaea viscosa Jacq.	ʻaʻaliʻi	I
STERCULIACEAE (Cacao Family)		
Waltheria indica L.	ʻuhaloa	I
VERBENACEAE (Verbena Family)		
Lantana camara L.	lantana	X
Stachytarpheta cayennensis (Rich.) Vahl	blue rat's-tail	X

Fig. 3. *Prosopis* Woodland near Palani Road on the south side of the study site.

Fig. 4. *Leucaena* Scrub at lower elevations at the study site.

Fig. 5. *Leucaena* scrub at upper elevations of the study site.

Fig. 6. *Schinus*/*Psydrax* Scrub at the study site.

Fig. 7. A‘a lava flow at the study site.

B-2
January 2008

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

by

Art Whistler, Ph.D.
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Report prepared for

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

January 2008

INTRODUCTION

The study site comprises a parcel of land proposed for construction of a reservoir that will service the Keahuolu Affording Housing Project (Fig. 1). It is located adjacent to the northeast corner of the housing project site at an elevation of about 595 feet. Its 7.8-acre area comprises a 530 x 520 ft reservoir site and a 1100 x 50 foot access road. It is located on TMK (3) 7-4-21: portion of 014 and portion of 021. The construction of the facility requires an up-to-date botanical survey, especially since federally listed, threatened and endangered plant species occur in the general vicinity. The site is currently covered with a scrubby vegetation dominated by native and alien shrub and tree species on lava flows of various ages.

A botanical survey was carried out nineteen years ago by Char and Associates (1989) on the area adjacent to the reservoir site, and included a much larger area comprising 1100 acres, some of it extending west of the present study site and makai of the Queen Kaʻahumanu Highway. Another botanical survey was carried out in 2007 on the Keahuolu parcel (Whistler 2007), which is contiguous with the present study site.

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

METHODOLOGY

Before the fieldwork was carried out, a review of the literature was undertaken by the Principal Investigator (PI). The current status of any endangered species previously reported from the general area was checked using the official database of threatened and endangered species (USFWS 2005). This list is identical to the State of Hawaiʻi list of threatened and endangered plant species. In addition, information about threatened and endangered plant species found in the area was extracted from the Hawaiʻi Natural Heritage Program database (Anon. 2005) of federally listed plant species, and is presented here in the form of a map of these collections and sightings (Fig. 2). Topographic maps and aerial photos were studied to determine the best access points and to locate places where native species are most likely to be found (lava flows).

After the literature review, a botanical field survey was conducted at the site by a two-person botanical team consisting of the PI (Art Whistler) and a Field Assistant (Beate Neher) on 5 and 15 December 2007. The site was accessed from Keanalehu Drive, a narrow road leading from Kealakehe High School to Palani Road to the east. A walk-through survey, involving walking parallel lines through the site, was employed to study the vegetation and flora. All plant species encountered during the survey were recorded, along with an indication of their frequency. Particular care was taken in ʻaʻa areas, since this type of habitat is where native species, including threatened and endangered plants, are most likely to occur. New lists were made for each vegetation type and/or day, and these were combined into a comprehensive checklist of all plants found at the study site (see Table 2 in the Appendix). Notes were also taken on vegetation types present, indicating the dominance and frequency of the plant species found there. These were later analyzed and written up to form the vegetation section below. All of the species encountered during the fieldwork were familiar to the field team and were identified in the field.

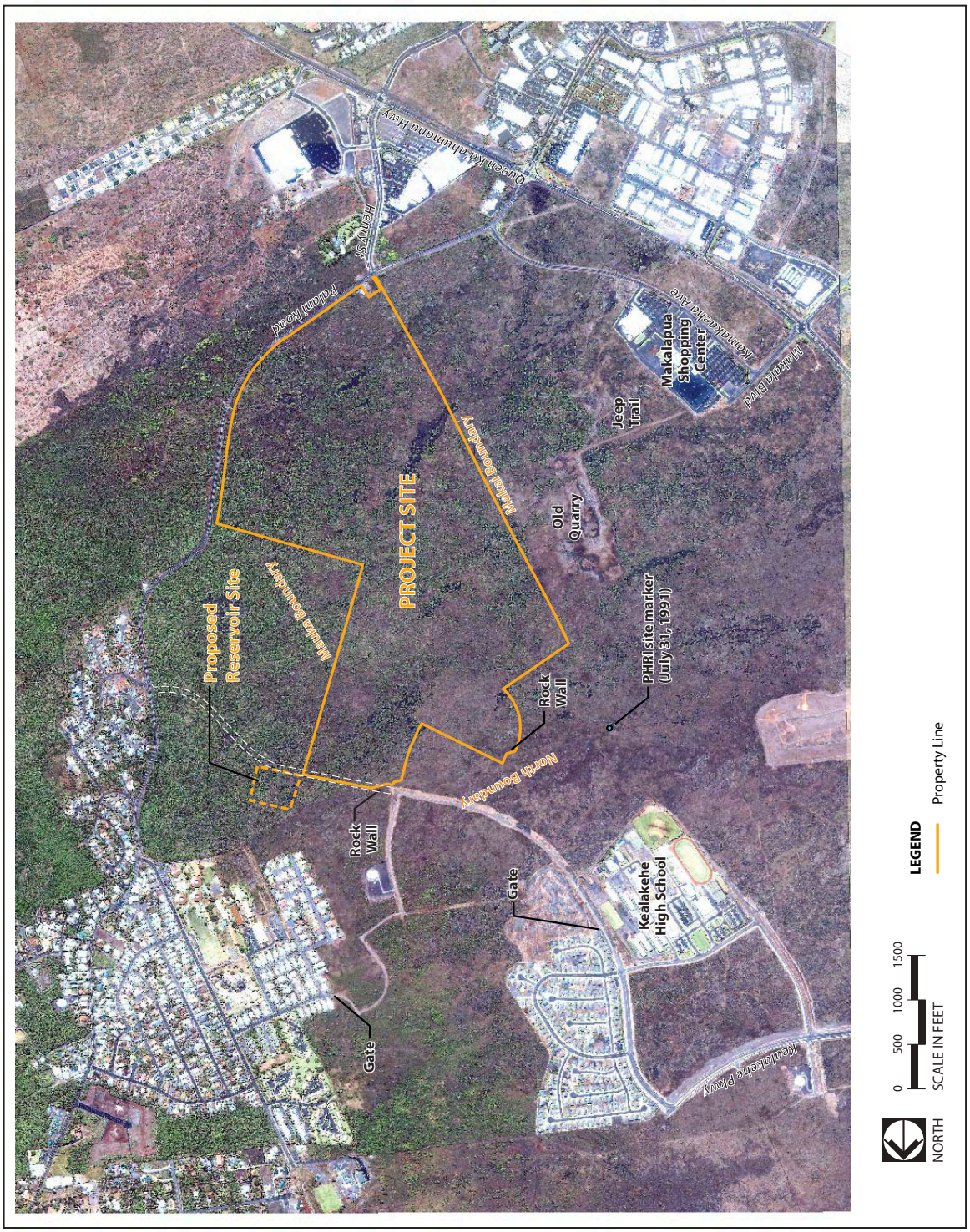

Fig. 1. The Keahuolu Affordable Housing Project Proposed Reservoir study site.

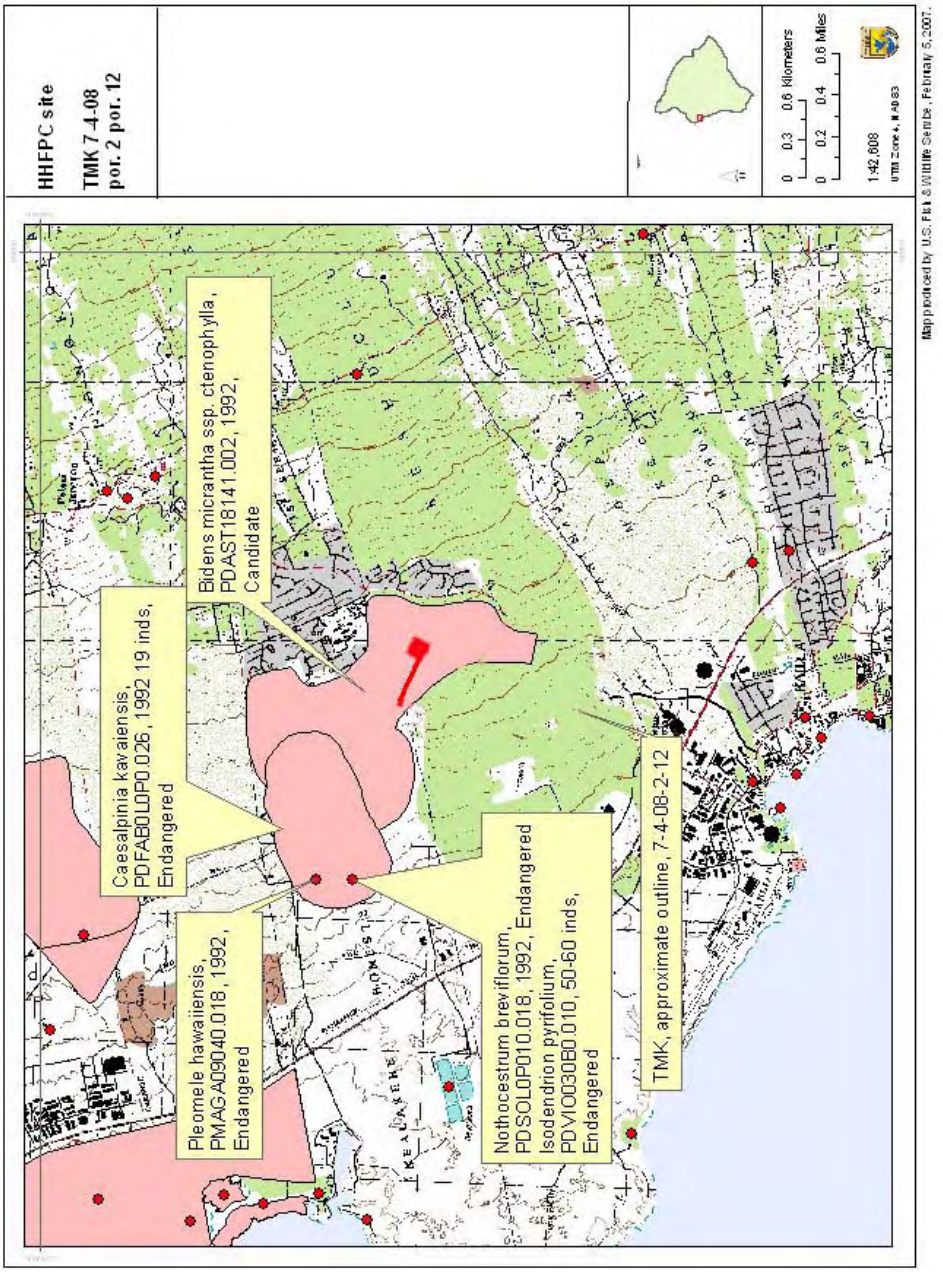

Fig. 2. Hawai‘i Natural Heritage Program map of federally listed plant species in the area, with the study site indicated in red.

Only two types of vegetation can be recognized at the study site: (1) Managed Land Vegetation; and (2) *Schinus*/*Psydrax* Scrub. These are described below.

(1) Managed Land Vegetation

This comprises land that is under periodic or frequent management, such as dirt roads or recently bulldozed tracks. It is a relatively minor component of the overall vegetation at the study site, where it consists only of a short, recently bulldozed track dominated mostly by weeds, particularly the alien subshrub coffee senna (*Senna occidentalis*), fountain grass (*Pennisetum setaceum*), koa haole (*Leucaena leucocephala*), and talinum (*Talinum triangulare*).

(2) *Schinus*/*Psydrax* Scrub

This is the type of vegetation that covers the whole reservoir site and proposed access road, and is particularly characteristic of more recent lava flows, ones that are decidedly composed of ʻaʻa lava (Fig. 3). It is the same vegetation described by Char and Associates (1989) as "*Canthium*/ Christmas Berry Shrubland" (*Canthium* is the old name for *Psydrax*). It is also the same vegetation at the Keahuolu Affordable Housing Project described by Whistler (2007) under the same name, but the amount of the alien koa haole (*Leucaena leucocephala*) present is nearly equal to that of the other two main species—the alien Christmas berry (*Schinus terebinthifolius*) and the indigenous alaheʻe (*Psydrax odoratum*).

Other less common native tree and shrub species found here include the indigenous ʻaʻaliʻi (*Dodonaea viscosa*) and ʻilima (*Sida fallax*), the endemic mamane (*Sophora chrysophylla*) and *Bidens micrantha* ssp. *ctenophylla.* Several other alien tree and shrub species are also occasional to uncommon here, including silk oak (*Grevillea robusta*), jacaranda (*Jacaranda mimosifolia*), autograph tree (*Clusia rosea*), Chinese banyan (*Ficus microcarpa*), monkey pod (*Samanea saman*), guava (*Psidium guajava*), klu (*Acacia farnesiana*), and the Polynesian-introduced noni (*Morinda citrifolia*).

The ground cover is sparse in this type of vegetation, with scattered clumps of fountain grass (*Pennisetum setaceum*) found mostly in pockets of soil or pahoehoe, and perhaps being the most common herbaceous species present (Fig. 4). The ground cover is particularly sparse under the dense canopy of the Christmas berry trees, which are sometimes spreading and cast a denser shade than most of the other species. Second in importance in the ground cover is probably the alien grass Natal redtop (*Rhynchelytrum repens*), which occurs mostly in patches. The indigenous herbaceous vine huehue (*Cocculus trilobus*) is common climbing over the low trees, and the indigenous vine kowali-ʻawa (*Ipomoea indica*) occurs in a few patches. Scattered pockets or individuals of the thorny alien shrub *Lantana camara* (lantana) are also present. Other native species present include the herbs ʻalaʻala-wai-nui (*Peperomia leptostachya*) and spurflower (*Plectranthus parviflorus*), and the subshrub ʻuhaloa (*Waltheria indica*). Other alien ground cover species include the succulent air plant (*Kalanchoë pinnatum*), partridge pea (*Chamaecrista nictitans*), and Madagascar periwinkle (*Catharanthus roseus*).

This vegetation is classified as disturbed because of the high number of alien species present. The main disturbance is caused by fires that periodically sweep through the vegetation. Additionally, goats probably occur in the area and affect its vegetation by grazing. The current vegetation somewhat matches the description of the "Lowland Dry Shrublands" noted in Wagner

et al. (1999). It was described as being open and not exceeding 10 ft in height, and as occurring in leeward situations on most of the main islands from 330 to 2000 ft elevation.

THE FLORA

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

The reservoir site contained, among its 40 recorded species, ten native plant species—two endemic and eight indigenous species. A checklist of all species found at the site is shown in Table 2 in the Appendix.

Table 1. Native species recorded at the reservoir site.

Species	Common Name
Endemic Species	
Bidens micrantha ssp. *ctenophylla*	----------
Sophora chrysophylla	mamane
Indigenous Species	
Cocculus trilobus	huehue
Dodonaea viscosa	‘a‘ali‘i
Ipomoea indica	koali-‘awa
Peperomia leptostachya	‘ala‘ala-wai-nui
Plectranthus parviflorus	spurflower
Psydrax odoratum	alahe‘e
Sida fallax	‘ilima
Waltheria indica	‘uhaloa

DISCUSSION

Based upon the survey, two main kinds of vegetation occur at the study site: (1) Managed Land Vegetation; and (2) *Schinus*/*Psydrax* Scrub. Both of these are highly disturbed. No sensitive types of vegetation are present. Sensitive vegetation types include wetlands and

dryland forest. No wetland could occur at the study site due to its dry, lava-covered surface. Dryland forest with sensitive plant species is found at Kaloko to the north of the present study site, but none was encountered at the study site itself.

Forty plant species were recorded at the reservoir site, ten of them native—two endemic and eight indigenous species. No species federally listed as threatened or endangered were found. One endemic subshrub present, *Bidens micrantha* ssp. *ctenophylla*, was at one time considered a candidate species for one of these categories, but it has no current protected status. It occurs in other places north of Kona, where it is sometimes found even in disturbed places such as quarries (Whistler 2006). It is shown in the Hawai‘i Natural Heritage Program Database map (Fig. 2) as occupying the area of the reservoir site, and this was found to be true.

Several threatened or endangered species have been reported in the area of the reservoir site, and are shown on the Hawai‘i Natural Heritage Program database map. Uhiuhi (*Caesalpinia kavaiensis*) was recorded north of the reservoir site, but it was not found during the present study nor in the larger study area surveyed for the main part of the Keahuolu housing (Whistler 2007). There is a single record of hala pepe (*Pleomele hawaiiensis*) collected in the uhiuhi area northwest of the study site in 1992, but it was not seen by Char and Associates (1989) in the larger area south of this population nor during the earlier Keahuolu study (Whistler 2007). There is a relatively large population of it at Kaloko a few miles north of the current study site (Whistler 2006). ‘Aaea (*Nothocestrum brevifolium*) was found in 1992 near the record of hala pepe, but it was not seen by Char and Associates (1989) in the larger area south of this population, nor during the earlier Keahuolu study (Whistler 2006). At about the same point, a population of about 50 to 60 individuals of aupaka (*Isodendrion pyrifolium*) was found in 1992, but this shrub was not seen by Char and Associates in the larger area south of this population, nor during the earlier Keahuolu study (Whistler 2007). Consequently, no endangered or threatened species are found at either study site.

CONCLUSIONS AND RECOMMENDATIONS

Forty plant species were recorded from the study site, 30 of them alien species and ten of them are native—two endemic and eight indigenous species. None of these are federally listed as “threatened” or “endangered.” No areas of wetlands or undisturbed native vegetation occur at the site. Consequently, there are no botanical impediments to carrying out the proposed construction.

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Whistler, A. 2007. Botanical Survey of the Proposed Keahuolu Affordable Housing Project North Kona, Island of Hawai‘i. Reported prepared by Isle Botanica for Belt Collins Hawai‘i Ltd., Honolulu. Mimeog., 18 pp.

APPENDIX

Table 3. Checklist of Plant Species at the Reservoir Site

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

For each species, the following information is provided:

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

Species	Common Names	Status[1]
FERNS AND FERN ALLIES		
POLYPODIACEAE (Common Fern Family)		
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	laua‘e	X
MONOCOTS		
CYPERACEAE (Sedge Family)		
Cyperus compressus L.	----------	X
POACEAE (Grass Family)		
Melinus minutiflora P. Beauv.	molasses grass	X
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X
DICOTS		
ANACARDIACEAE (Mango Family)		
Schinus terebinthifolius Raddi	Christmas berry	X
APOCYNACEAE (Periwinkle Family)		
Catharanthus roseus (L.) G. Don	Madagascar periwinkle	X

Species	Common Names	Status[1]
ASCLEPIADACEAE (Milkweed Family)		
Stapelia gigantea N.E. Brown	carrion flower	X
ASTERACEAE (Sunflower Family)		
Bidens micrantha Gaud. ssp. *ctenophylla* (Sherff) Nagatga & Ganders	----------	E
Bidens pilosa L.	beggar's-tick	X
BIGNONIACEAE (Bignonia Family)		
Jacaranda mimosifolia D. Don	jacaranda	X
Spathodea campanulata P. Beauv.	African tulip tree	X
CLUSIACEAE (Mangosteen Family)		
Clusia rosea Jacq.	autograph tree	X
CONVOLVULACEAE (Morning-Glory Family)		
Ipomoea indica (J. Burm.) Merr.	koali-'awa	I
CRASSULACEAE (Stonecrop Family)		
Kalanchoë pinnata (Lam.) Pers.	air plant	X
FABACEAE (Pea Family)		
Abrus precatorius L.	rosary pea	X
Acacia farnesiana (L.) Willd.	klu	X
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X
Indigofera suffruticosa Mill.	indigo, 'iniko	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Samanea saman (Jacq.) Merr.	monkeypod	X
Senna occidentalis (L.) Link	coffee senna	X
Sophora chrysophylla (Salisb.) Seem.	mamane	E
Tephrosia purpurea (L.) Pers.	auhuhu `	P
LAMIACEAE (Mint Family)		
Plectranthus parviflorus Willd.	spurflower	I
MALVACEAE (Mallow Family)		
Sida fallax Walp.	'ilima	I
MENISPERMACEAE (Moonseed Family)		
Cocculus trilobus (Thunb.) DC.	huehue	I
MORACEAE (Mulberry Family)		
Ficus microcarpa L. f.	Chinese banyan	X
MYRTACEAE (Myrtle Family)		
Psidium guajava L.	guava	X
PHYTOLACCACEAE (Pokeweed Family)		
Rivina humilis L.	rouge plant	X
PIPERACAEAE (Pepper Family)		
Peperomia leptostachya Hooker & Arnott	'ala'ala-wai-nui	I
PORTULACACEAE (Purslane Family)		
Talinum triangulare (Jacq.) Willd.	talinum	X

Species	Common Names	Status[1]	Site 1	Site 2

PROTACEAE (Protea Family)		
Grevillea robusta A. Cunn. ex R. Br.	silk oak	X
RUBIACEAE (Coffee Family)		
Morinda citrifolia L.	Indian mulberry, noni	P
Psydrax odoratum (Forst. f.) A. C. Sm. & S. Darwin	alahe‘e	I
SOLANACEAE (Nightshade Family)		
Solanum americanum Mill.	black nightshade, popolo	I?
SAPINDACEAE (Soapberry Family)		
Dodonaea viscosa Jacq.	‘a‘ali‘i	I
STERCULIACEAE (Cacao Family)		
Waltheria indica L.	‘uhaloa	I
VERBENACEAE (Verbena Family)		
Lantana camara L.	lantana	X
Stachytarpheta cayennensis (Rich.) Vahl	blue rat’s-tail	X

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

Fig. 3. A‘a flow at the study site, with the margins dominated by several tree species.

Fig. 4. Fountain grass dominating in an opening at the study site.

Appendix C

C-1
May 2008

AVIFAUNAL AND FERAL MAMMAL SURVEY OF THE PROPOSED KEAHUOLU AFFORDABLE HOUSING PROJECT AND RESERVOIR SITE, NORTH KONA, ISLAND OF HAWAII

Report prepared for:

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30 May 2008

INTRODUCTION

The purpose of this report is to present the results of a two day (27, 28, May 2008) field survey of the proposed Keahuolu Affordable Housing Project and Reservoir site [TMK (3) 7-4-021: 020], and TMK (3) 7-4-021: Por. 021]. In addition to the data obtained from the field survey pertinent published and unpublished sources are also noted in the report. These sources add a broader perspective of the wildlife resources in this region of the island. In particular data are compared with an earlier study (Bruner 1989) that I conducted in this area and surrounding lands. The goals of the survey were:

1- Document the species of birds and mammals currently on the property.

2- Examine the site for the purpose of identifying the natural resources available to wildlife in this region.

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

SITE DESCRIPTION

The property is presently covered in dense, second growth forest composed of primarily alien (non-native) species of trees, brush and grass. Surrounding lands contain residential, commercial, schools, and other similar undeveloped property (Fig. 1).

SURVEY PROTOCOL

The field survey was conducted over two consecutive days (27, 28 May 2008). Observations were made in the early morning and late in the day when birds are most active and more easily detected. The site was covered on foot and all birds seen or heard were noted. All four habitats recognized by Whistler (2007): Managed Land Vegetation, *Prosopis* Woodland, *Leucaena* Scrub, and *Schinus/Psydrax* Scrub were investigated. Observations of mammals were limited to visual sightings and evidence in the form of tracks and skeletal remains. No attempts were made to trap mammals in order to obtain relative abundance estimates. The evening of 27 May was devoted to a search for the presence of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). A Petterson Elektronic AB Ultrasound Detector D 100 was used to listen for echolocating bats at several sites on the property.

Weather during the survey was overcast. The winds were relatively light which made for easy detection of vocalizing birds. Scientific and common vernacular names used in this report follow Honacki et al. (1982), and Pyle (2002).

RESULTS AND DISCUSSION

Native land Birds:

No native land birds were observed on this survey. This was also the case in the Bruner (1989) survey. The only species that might on occasion be seen in this area are the endangered Hawaiian Hawk or ‘Io (*Buteo solitarius*)) and the Hawaiian Short-eared Owl or Pueo (*Asio flammeus sanwichensis*) (Pratt et al. 1987, Hawaii Audubon Society 2005). Pueo are not listed as endangered or threatened on the island of Hawaii, however, the State of Hawaii does list the population on Oahu as endangered. Aside from ‘Io and Pueo no other native land birds would be expected to occur on this property.

Native Waterbirds:

No native waterbirds were recorded and would not be expected on this site. No wetland habitat was found on the survey.

Seabirds:

No nesting seabirds were seen on the survey and would not be expected to nest in this area due to predators and human disturbance. Some species might on rare occasion be seen flying over the site (pers. observ.)

Migratory Birds:

No migratory shorebirds were observed. No habitat suitable for shorebirds currently occurs on this site.

Alien (Introduced) Birds:

Nineteen alien species were observed during the course of the survey. Table One notes these species along side those recorded during the Bruner (1989) survey. None of these birds are listed as threatened or endangered. The array of species was typical of what was found on recent (Bruner 2005, 2006a, 2006b) surveys in similar habitat in this region of the island.

Mammals:

Nine introduced Small Indian Mongooses (*Herpestes javanicus*) were tallied on the survey. The skeletal remains of a feral pig (*Sus scrofa*) and two live adult pigs were observed on 27 May 2008. No rats (*Rattus spp.*), mice (*Mus musculus*), or cats (*Felis catus*) were seen but likely occur on and around the property. No endangered Hawaiian Hoary Bats (*Lasiurus cinereus semotus*) were detected by the ultrasound device during a night search of the property on 27 May 2008. The Hawaiian Hoary bat generally roosts solitarily in trees. They forage for flying insects in a wide variety of habitats including forests, agricultural lands, urban areas, as well as over bays and ponds (Tomich 1986, Kepler and Scott 1990, Jacobs 1991, 1993, and Reynolds et al. 1998).

EXECUTIVE SUMMARY AND CONCLUSION

All habitats on the property were thoroughly surveyed. The birds and mammals found were those to be expected in this region of the Island of Hawaii and conformed to an earlier survey of this area and surrounding lands (Bruner 1989). The endangered ‘Io and the non-endangered Pueo occur in man- altered as well as native habitats throughout the Big Island. None were recorded on this or the Bruner (1989) survey. The endangered Hawaiian Hoary bat is frequently seen on the Island of Hawaii and Kauai but is much less common on the other islands. No bats were detected on this 2008 or the Bruner (1989) survey. The habitats on this property are not unusual or unique. Similar lands occur throughout this region. A change in land use at this site will produce some small, local increases and decreases in the populations of alien birds. Habitat for migratory shorebirds such as Pacific Golden-Plover (*Pluvialis fulva*) will become available as second growth forest is converted to lawns and residential habitat.

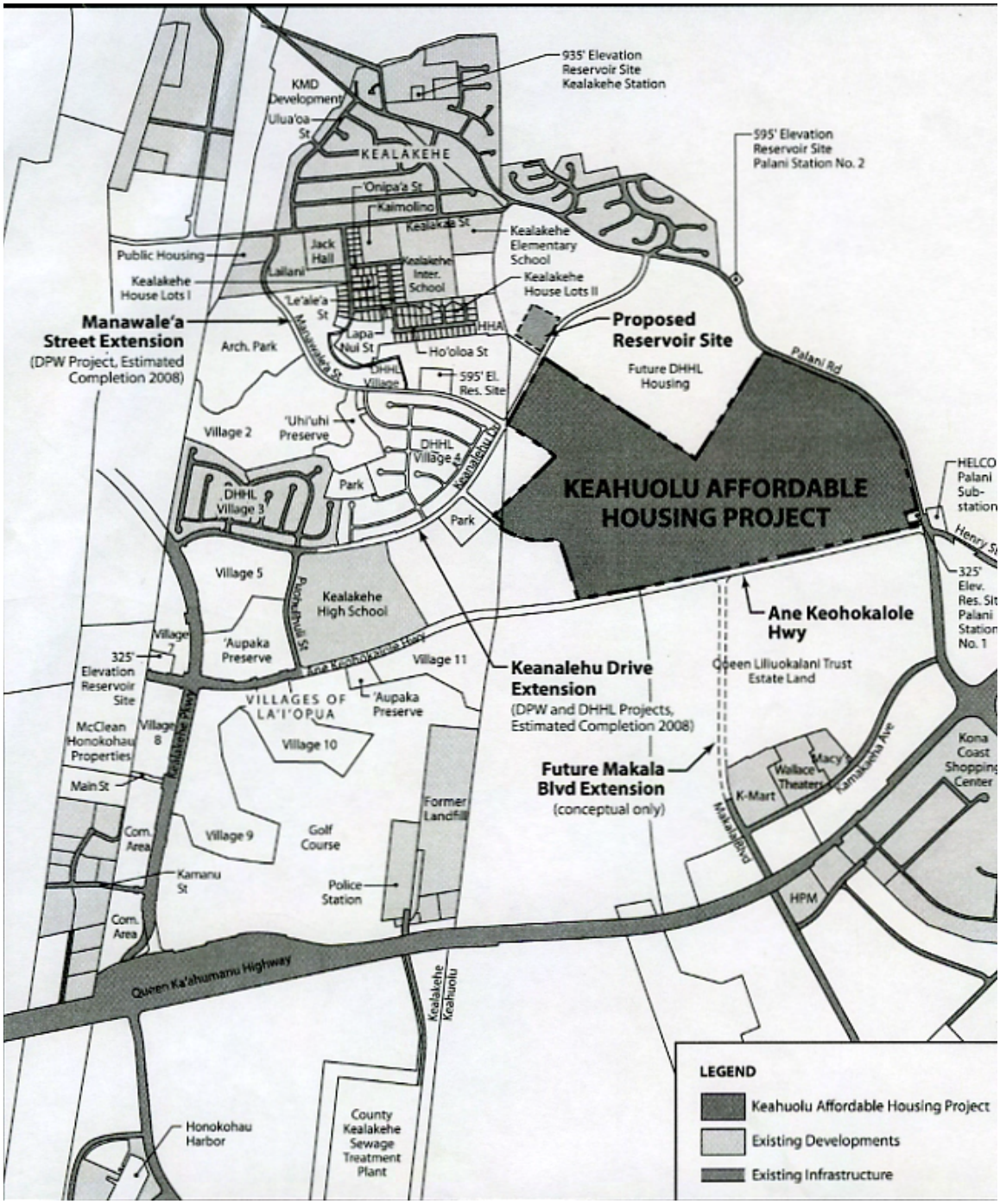

Fig. 1. Location of faunal survey at Keahuolu Affordable Housing Project and Proposed Reservoir Site.

TABLE ONE

Alien (introduced birds) found on the field survey conducted on 27, 28 May 2008 at the proposed Keahuolu Affordable Housing Project and Reservoir site, North Kona, Island of Hawaii. Alien species recorded on the Bruner (1989) survey of this area and surrounding lands are also shown for comparative purposes. An "* " indicates name change, a " +" indicates presence and a "–" not observed.

Common Name	Scientific Name	2008	1989
Gray Francolin	*Francolinus pondicerianus*	+	+
Black Francolin	*Francolinus francolinus*	+	+
Red Junglefowl *	*Gallus gallus*	+	+
Ring-necked Pheasant	*Phasianus colchicus*	-	+
Spotted Dove	*Streptopelia chinensis*	+	+
Wild Turkey	*Meleagris gallopavo*	+	-
Spotted Dove	*Streptopelia chinensis*	+	+
Zebra Dove	*Geopelis striata*	+	+
Parrot	*Psittacula spp.*	-	+
Barn Owl	*Tyto alba*	+	+
Japanese White-eye	*Zosterops japonicus*	+	+
Common Myna	*Acridotheres tristis*	+	+
Saffron Finch	*Sicalis flaveola*	+	-
Yellow-billed Cardinal	*Paroaria capitata*	+	+
Northern Cardinal	*Cardinalis cardinalis*	+	+
House Finch	*Carpodacus mexicanus*	+	+
Yellow-fronted Canary	*Serinus mozambicus*	+	-
House Sparrow	*Passer domesticus*	+	-
Lavender Finch	*Estrilda caerulescens*	-	+
African Silverbill **	*Lonchura cantans* **	+	+
Nutmeg Mannikin	*Lonchura punctulata*	+	+
Java Sparrow	*Padda oryzivora*	+	-

* Feral Chicken in 1989 study

** Warbling Silverbill in 1989 study

** *Lonchura malabarica* in 1989 study

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C-2
July 1989

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT QUEEN LILIUOKALANI TRUST PROPERTY, KAILUA, KONA, HAWAII

Prepared for

Belt Collins & Associates

By

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7 July 1989

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT QUEEN LILIUOKALANI TRUST PROPERTY, KAILUA, KONA, HAWAII

INTRODUCTION

The purpose of this report is to summarize the findings of a four day (28 June-1 July 1989) bird and mammal field survey of Queen Liliuokalani Trust Property, Kailua, Kona, Hawaii (see Fig. 1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely occur given the type of habitats available.

2- Provide some baseline data on the relative abundance of each species as well as general habitat preferences.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened". If such occur or may likely be found on the property identify what

features of the habitat may be essential for these species and suggest how those resources may best be protected.

4- Determine if the property contains any special habitats that if lost or altered by development might result in a significant impact on the fauna in this region of the island.

GENERAL SITE DESCRIPTION

The project site is located on approximately 1,100 acres at Kailua, Kona, Hawaii (see Fig. 1). Both dry coastal as well as slightly wetter higher elevation second growth forest occur on the site. The makai sections contain grasslands with a few scattered low trees (Kiawe (Prosopis pallida) and Fountain Grass (Pennisetum setaceum) are the most abundant plants. A row of Ironwood (Casuarina spp.) border one side of the makai section of the property and provide a refuge for wildlife. Small coastal patches of forest also provide important habitat. The mauka property is covered by a dense second growth forest with Christmas Berry (Schinus terebinthifolius) one of the dominant species.

Weather during the field survey was variable with

clear mornings and cloudy afternoons. Winds were also variable with both calm and gusty periods. The direction of the wind was primarily from the east.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during the peak bird activity periods of early morning and late afternoon. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity.

At various locations (see Fig.1) eight minute counts were made of all birds seen or heard. Between these counts stations walking tallys of birds seen or heard were also kept. These data provide the basis for the relative abundance estimates given in this report. Unpublished reports of birds known from similar habitat on lands elsewhere in West Hawaii were also consulted in order to acquire a more complete picture of possible avifaunal activity (Bruner 1979, 1980, 1984a, 1984b, 1984c, 1985a, 1985b, 1985c, 1988a, 1988b, 1989). Observations of feral mammals were limited to visual sightings and evidence in the form of skeletal remains, scats and tracks. No attempts were made to trap mammals

in order to obtain data on their relative abundance and distribution. Three nights were devoted to searching for the presence of owls and the Hawaiian Hoary Bat (Lasiurus cinerus semotus).

Scientific names used herein follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1984), A Field Guide to the Birds of Hawaii and the Tropical Pacific)Pratt et al. 1987) and Mammal Species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Resident Endemic (Native) Land and Water Birds:

No endemic species were recorded during the course of the field survey. The Short-eared Owl or Pueo (Asio flammeus sandwichensis) might be expected to occur on occasion at this site. This species is relatively common on Hawaii particularly at higher elevations (Berger 1972, Hawaii Audubon Society 1984, Pratt et al. 1987). The Short-eared Owl is an endemic subspecies which is listed by the State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife as "endangered" on Oahu but not elsewhere in the State. Although not recorded on this field survey Pueo have been found in similar habitat elsewhere in West Hawaii. No other endemic birds

would be expected at this site given the location and nature of the habitats available. Several small anchialine ponds located on property makai of the actual site may provide occasional foraging opportunities for the endemic and endangered Black-necked Stilt or Ae'o (Himantopus mexicanus knudseni).

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay through the summer months as well (Johnson et al. 1983, 1989). Of all the shorebird species which winter in Hawaii the Pacific Golden Plover (Pluvialis fulva) is the most abundant. Plovers prefer open areas such as mud flats, lawns, pastures, plowed fields and roadsides. They arrive in Hawaii in early August and depart to their arctic breeding grounds during the last week of April (Johnson et al. 1981). Bruner (1983) and Johnson et al. (1989) have also shown plover are extremely site-faithful on their wintering grounds and many establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years. No plover were recorded during the survey.

This result was not unexpected due to the time of year of the survey. The present nature of the habitat, however, is largely unsuitable for plover as the vegetation is much too tall and dense. It is likely that during the time of year when plover are in Hawaii that very few actually utilize this property. Two migratory species were recorded along the shoreline makai of the property, Ruddy Turnstone (Arenaria interpres) and Wandering Tattler (Heteroscelus incanus).

Resident Indigenous (Native) Birds:

No indigenous species were recorded nor would any be expected at this site. Black-crowned Night Heron (Nycticorax nycticorax) probably forage infrequently at the anchialine ponds makai of the actual property.

Resident Indigenous (Native) Seabirds:

No seabirds were observed on the property. Some seabirds nest and roost in barren lava flows in Hawaii but at a much higher elevation than the project property (Pratt et al. 1987).

Exotic (Introduced) Birds:

A total of 17 species of exotic birds were recorded during the field survey. Table One shows the relative

abundance of each species as well as general habitat preferences. The most abundant species were Japanese White-eye (Zosterops japonicus), Nutmeg Mannikin (Lonchura punctulata), and Zebra Dove (Geopelia striata). Black Francolin (Francolinus francolinus) and Gray Francolin (Francolinus pondicerianus) were also common. Given the present habitat and based on previous surveys (Bruner 1979, 1980, 1984a, 1984b, 1984c, 1985a, 1985b, 1985c, 1988a, 1988b) as well as information provided in Berger (1972), Hawaii Audubon Society (1984), and Pratt et al. (1987) the following exotic bird species might also occur on or near the property: Erckel's Francolin (Francolinus erckelii), California Quail (Callipepla californica), Japanese Quail (Coturnix japonica), and Northern Mockingbird (Mimus polyglottos). The most unexpected sightings were the Lavender Waxbill (Estrilda caerulescens) and a parrot (Psittacula spp?). The parrot,probably an escaped pet, was seen flying over the upper section of the property. The bird was all green with a long pointed tail but was too far away to determine the exact species.

Feral Mammals:

A total of 18 Small Indian Mongoose (Herpestes auropunctatus) were seen during the survey. Two cats

were also recorded along with the skeletal remains of pigs and cows. Evidence of rats and mice were also found. Although no trapping was done in order to assess the relative abundance of mammals on this property, there was no obvious indication that the feral mammals in this area were more or less numerous than elsewhere in similar habitat in West Hawaii.

Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy but the species has been reported from Hawaii (Tomich 1986). None were observed on this field survey despite three nights of observations. This species roosts solitarily in trees. Much remains to be known about the natural history of this bat and its ecological requirements here in Hawaii. Bruner (1984d) found bats on the Sheraton Waikoloa Beach Resort property located to the NW of this site.

CONCLUSION

A brief field survey can at best provide only a limited perspective of the wildlife present in any given area. Not all species will necessarily be observed and information on their use of the site must be sketched together from brief observations and the

available literature. The number of species and the relative abundance of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the faunal picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide an in depth view of the bird and mammal populations in a particular area. However, when brief field studies are coupled with data gathered from other similar habitats the value of the conclusions drawn are significantly increased.

The following are some general conclusions related to bird and mammal activity on the property.

1- The present habitat provides a limited range of living spaces which are utilized by the typical array of exotic species of birds one would expect at this elevation and in this type of environment in Hawaii. However, some species typically found in this habitat were not recorded. This could have been due to the fact that the survey was too brief or that their numbers are so low that they went undetected or a combination of these and other factors. No endemic birds or seabirds were recorded

nor would they be expected to occur on this property. The creation of open short grass habitat such as lawns will increase the usuable space for birds like Pacific Golden Plover.

2- The proposed development will create a more urban environment. Species which might increase in abundance on the site following development include: Common Myna (Acridotheres tristis) and the ubiquitous House Sparrow (Passer domesticus). This latter species is typically limited to areas of human activity. Other species such as Japanese White-eye (Zosterops japonicus), Warbling Silverbill (Lonchura malabarica) and game birds like Black Francolin (Francolinus francolinus) may decline in number.

3- In order to obtain more definitive data on mammals, a trapping program would be required. No endangered species were observed. Populations of Mongoose, mice and rats may increase slightly following the development of the property.

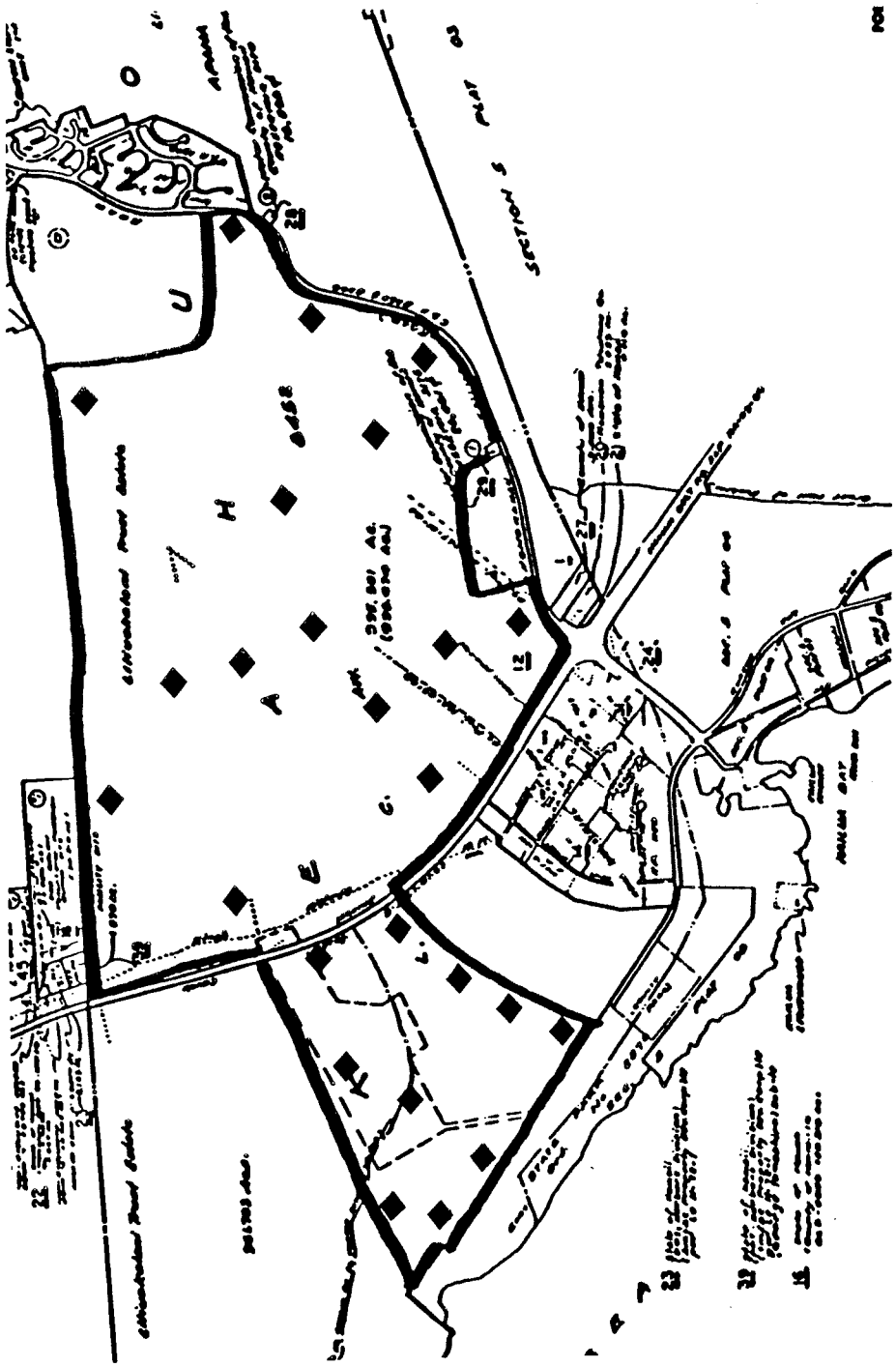

Fig. 1. Project property with eight minute count stations marked by a ◆.

TABLE 1

Exotic species of birds recorded on Queen Liliuokalani Truat Property, Kailua, Kona, Hawaii.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	HABITAT PREFERENCES*
Feral Chicken	Gallus gallus	R= 3	T,E
Ring-necked Pheasant	Phasianus colchicus	R= 2	G,E
Black Francolin	Francolinus francolinus	C= 5	G,E
Gray Francolin	Francolinus pondicerianus	C= 5	E,T
Spotted Dove	Streptopelia chinensis	U= 4	E
Zebra Dove	Geopelia striata	A= 12	E
Common Barn Owl	Tyto alba	R= 1	G,E
Parrot	Psittacula spp.	R= 1	T
Common Myna	Acridotheres tristis	C= 8	E
Yellow-billed Cardinal	Paroaria capitata	C= 6	T
Northern Cardinal	Cardinalis cardinalis	C= 7	T
Japanese White-eye	Zosterops japonicus	A= 18	T,E
Nutmeg Mannikin	Lonchura punctulata	A= 11	G,E
Warbling Silverbill	Lonchura malabarica	C= 6	G,E
Lavender Waxbill	Estrilda caerulescens	R= 15	E,G
House Finch	Carpodacus mexicanus	C= 8	T,E
House Sparrow	Passer domesticus	C= 9	E

* (See page 13 for key to symbols)

KEY TO TABLE 1

RELATIVE ABUNDANCE= Number of times observed during survey or average number on eight minute counts in appropriate habitat.

A = abundant (ave. 10+) Number which follows is average of data from all survey days

C = common (ave. 5-10) Number which follows is average of data from all survey days

U = uncommon (ave. less than 5) Number which follows is average of data from all survey days

R = recorded (seen or heard at times other than on 8 min. counts. Number which follows is the actual number seen or heard).

HABITAT PREFERENCE = habitat type most frequently recorded in during survey. If more than one then listed in descending order of usage.

G = grassland

T = thickets of brush and trees

E = edge habitat: roadsides, forest edge

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Appendix D

Report 2667-

Archaeological Survey and Cultural Impact Assessment in Support of an EIS for the Kona Non-Ceded Lands

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

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

Report 2667-101907

Archaeological Survey and Cultural Impact Assessment in Support of an EIS for the Kona Non-Ceded Lands

Land of Keahuolu, North Kona District Island of Hawai'i TMK:3-7-4-21:020,Por.014,Por.021)

BY

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DECEMBER 2007

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SUMMARY

At the request of Ms. Sue Sakai of Belt Collins Hawaii, Ltd., on behalf of the Hawai'i Housing Finance & Development Corporation, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey and prepared a cultural impact assessment (CIA) in connection with preparation of an Environmental Impact Statement (EIS) for the Kona Non-Ceded Lands project area, for which is planned an approximately 272-acre community of affordable housing. The parcel is bounded on the north by the *ahupua'a* of Kealakehe, on the east by land belonging to the Department of Hawaiian Home Lands, on the south and southeast by Palani Road, and on the west by Keahuolu *ahupua'a* land.

The archaeological survey was conducted in general accordance with the appropriate standards of the Hawai'i State Historic Preservation Division (SHPD) as contained in the SHPD Administrative Rules Chapter 275: *Rules Governing Procedures for Historic Preservation Review for Government Projects Covered Under Sections 6E-7 and 6E-8, HRS*; Hawai'i Administrative Rules; Title 13, DLNR; Subtitle 13, SHPD (effective December 2003), and, in connection with development planning and permit applications, complies with all current and appropriate historic preservation requirements of the SHPD and the Hawaii County Planning Department. The basic purpose of the cultural impact assessment study was to comply with the requirements of Chapter 343 (Haw. Rev. Stat.), as amended by H.B. No. 2895 H.D. 1 of the Hawai'i State Legislature (2000) and approved by the Governor as Act 50 on April 26, 2000.

During the archaeological survey, 12 archaeological sites were re-identified and re-located. The 12 sites had been previously identified during an archaeological survey conducted in 1990, during which time significance assessments and recommendations for the sites were presented. The assessments and recommendations were reiterated in an archaeological mitigation plan for the project area. The final significance assessments and recommendations are summarized in this report. One of the sites, Site 13396, a platform, was not re-located and apparently was destroyed by construction of a firebreak road corridor subsequent to the original project area inventory survey.

The Cultural Impact Assessment (CIA) portion for this project initially involved compiling a list of potential informants for Keahuolu Ahupua'a. This was done by contacting informants known for the area through past projects, and inquiries with various departments and cultural specialists. A list containing over thirty potential informants was compiled and the informants were preliminarily assessed as to their potential to provide information. From this list, a few informants were selected for further interviews.

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INTRODUCTION

BACKGROUND

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PURPOSE AND OBJECTIVES

Archaeological Survey

The archaeological survey was conducted in general accordance with the appropriate standards of the Hawai'i State Historic Preservation Division (SHPD) as contained in the SHPD Administrative Rules Chapter 275: *Rules Governing Procedures for Historic Preservation Review for Government Projects Covered Under Sections 6E-7 and 6E-8, HRS*; Hawai'i Administrative Rules; Title 13, DLNR; Subtitle 13, SHPD (effective December 2003), and, in connection with development planning and permit applications, complies with all current and appropriate historic preservation requirements of the SHPD and the Hawai'i County Planning Department. The specific objectives of the survey were fourfold: (a) to identify all potentially significant archaeological remains present within the corridor study area; (b) to collect information sufficient to evaluate and document the potential significance of all identified remains; (c) to evaluate the potential impacts of any proposed development upon any identified significant remains; and (d) to recommend appropriate measures that would mitigate any adverse impacts upon identified significant remains.

Cultural Impact Assessment

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

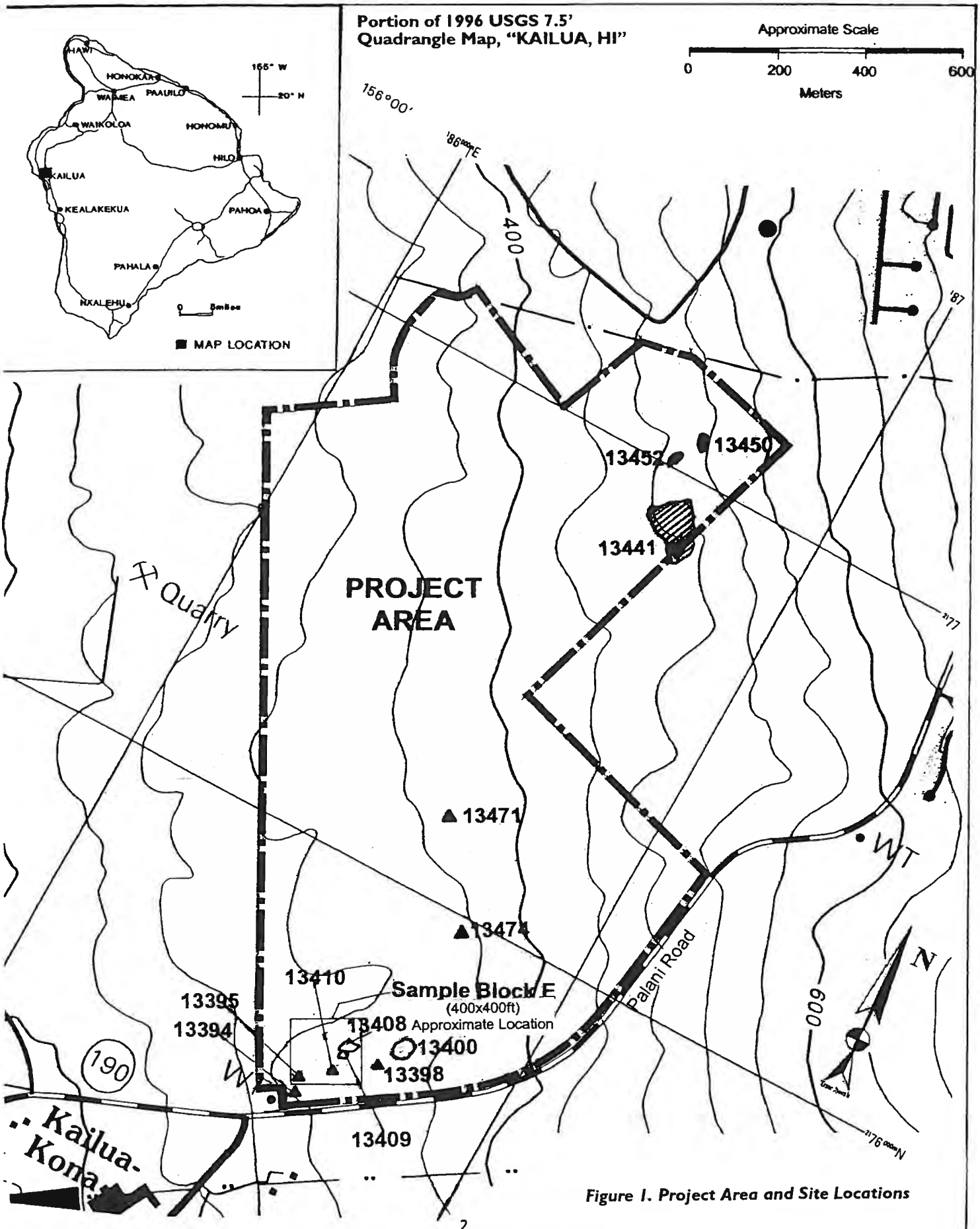

Figure 1. Project Area and Site Locations

The specific objectives of the cultural impact assessment study were to determine the following: (a) if the project area is currently being accessed by native Hawaiian cultural practitioners, or individuals of any other cultural groups, for any traditional and customary cultural uses; (b) if the proposed project would have any adverse impacts upon any identified current native Hawaii or other cultural group uses of the area; and (c) what measures might be proposed to mitigate any adverse impacts the proposed project might have upon any identified current native Hawaiian or other cultural group uses of the area.

SCOPE OF WORK

Based on (a) project specifications provided by Ms. Sue Sakai of Belt Collins Hawaii, (b) prior PHRI work within the Lands of Keahuolu and Kealakehe, and (c) our familiarity with both the general project area and the current regulatory review requirements of the SHPD and the HCPD, the following tasks were determined to constitute an adequate and appropriate scope of work for the historic preservation aspects of the project area:

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

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

3. Mobilization – including fieldwork preparations, field crew travel, and demobilization;

4. Fieldwork – Site relocation, clearing vegetation, detailed recording (including photography, plan view drawings, updating of written descriptions, etc.) for c. 70 sites;

5. Fieldwork – test excavations of selected archaeological sites/features;

6. Post-field data analyses;

7. Preparation of draft and final reports (including reformatting, upgrading of information, drafting of location map, plan maps and profiles, photographs, formatting, editing, and submission of completed final report);

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

Subsequent to preparation of this scope of work it was decided, in discussions between PHRI and Belt Collins representatives, that further data collection, as expressed in points 4 and 5 above, will be done as a separate data recovery program. The current scope of work is therefore limited to site re-location (using GPS equipment) and re-identification, with further data recovery work to be conducted at a later time on those sites recommended for further work. Recommended general treatments for previously discovered sites, re-identified and re-located as part of the current project, have been presented in the SHPD-approved Archaeological Inventory Survey (Donham 1990a)(SHPD approval letter of 2/17/93, Log 6839, Doc. 9302RC34;see *Appendix*), and Archaeological Mitigation Program (Jensen et al. 1992)(SHPD approval letter of 10/21/93, Log 10361, Doc. 9312RC02;see *Appendix*), which were amended in a subsequent letter (PHRI Letter 1152-052493) to Dr. Don Hibbard, then Administrator of DLNR (the assessments and recommendations in the amendment letter supersede those made in Donham (1990a) and Jensen et al. (1992).

PROJECT AREA DESCRIPTION

Keahuolu and Kealakehe lie along the western slope of Mt. Hualalai. Hualalai Series flows form the surface mantle. These flows are composed primarily of alkalic olivine basalt (Macdonald, Abbott, and Peterson 1983:366). Specifically, the flows consist of *pāhoehoe* flats, fissures, and upthrusts, with collapsed blisters and tubes interspersed with fingers of *'a'ā* that are generally oriented east-west. There are three soil/substrate types in the project area: (a) bare *pahoehoe* lava flows (rLW), (b) bare *'a'ā* lava flows (rLV), and (c) Punaluu extremely rocky peat (6-20% slopes), representing the Punaluu series of well-drained, thin organic soils that have developed over *pāhoehoe* lava bedrock; they are found on uplands and are rapidly permeable, with slow run-off, and a slight erosion hazard (Sato et al. 1973:48). Types rLV and rLW predominate. Although the topography of the flows is rough in places, the overall aspect is a gradual slope from east to west. Elevation in the project area increases from approximately 300 feet in the west to 500 feet on the eastern boundary. Annual median rainfall within the project area is approximately 500-1,000 mm (20-40 inches).

Predominant tree species within the general area include *kiawe* (*Prosopis pallida*), *koa-haole* (*Leucaena leucocephala*), *alahe'e* (*Canthium odoratum*), and Christmas-berry (*Schinus terebinthifolius*). Understory plants consist predominantly of lantana (*Lantana camara*), *kolu* (*Acasis farnesiana*), *'ilima* (*Sida cordifollia*), fountain grass (*Pennisetum setaceum*), California grass, (*Brachiaria mutica*), Jamaica vervain (*Stachytarpheta jamaicensis*), and airplant (*Bryophyllum pinnatum*).

PREVIOUS ARCHAEOLOGICAL RESEARCH

Much archaeological work has been done in the *ahupua'a* of Keahuolu, including reconnaissance surveys, inventory surveys and excavations, and data recovery excavations.

Coastal Keahuolu

Several *heiau* were recorded by early investigators along the coast. Stokes (1919) described three coastal *heiau* sites in Keahuolu: Halepua, Kawaluna, and Palihiolo (at or very near the Keahuolu/Lanihau boundary). Halepua was described by Stokes as a *ko'a*, or fishing shrine, near the shore in a coconut grove. Reinecke located structural remains at Halepua, consisting of a house site of coral and remains of a pen around it, but he did not identify the *heiau* per se. He also identified an enclosure, a short distance to the north, paved with coral. This enclosure may actually be the *ko'a* of Stokes; however, Stokes places the *ko'a* in a coconut grove, whereas Reinecke places the enclosure in an oasis of pools, *kiawe*, and grass (1930:6).

Kawaluna Heiau was described by Stokes as a rebuilt enclosure located on the beach at Pawai Bay. It was identified as a *heiau* by a local informant, who stated that it was where an old fisherman made offerings (Stokes 1919). The interior of the enclosure was filled with loose stones. Interestingly, the informant also mentioned Halepa'u Heiau as being a *ko'a*, although Kawaluna Heiau was (apparently) not a *ko'a*, although fish were offered there (c.f. Stokes 1919). In 1930, Reinecke identified four house platforms, enclosure ruins, and an unidentifiable ruin at Pawai Bay, but again he did not identify any remains as specifically a *heiau*. A later survey of the Pawai Bay area by Neighbor Island Consultants in 1973 failed to identify Kawaluna Heiau, although they did note an enclosure with historic period burials.

The Heiau of Palihiolo was described by Stokes as being at or near the Keahuolu/Lanihau boundary, and consisting of an enclosure with coral paving. According to Stokes' informants, this *heiau* was used for human sacrifice, and King Kalakaua had it rebuilt prior to his departure from Hawai'i. Reinecke, although not identifying the *heiau*, did identify an enclosure associated with house platforms in the vicinity. Newman tentatively identified this *heiau* but located it in Lanihau (Newman 1970b).

During his survey, Reinecke located 12 sites in Keahuolu and eight sites in Lanihau (Reinecke 1930:4-8). The Keahuolu sites, located on a flat north of Keahuolu Point, consisted primarily of habitation platforms and enclosed yards. Within the 12 sites Reinecke listed 41 platforms, most of which were interpreted as house sites, and seven enclosures. Another concentration of seven house sites was identified at the Keahuolu/Lanihau boundary. Reinecke also identified petroglyphs, modified pools, burials, and a canoe landing. The eight Lanihau sites included 15 platforms, nine of which Reinecke interpreted as house sites. Eight of the house platforms were concentrated in what is called the Makeo complex, which also includes a modified fishpond and several modified anchialine pools. Petroglyphs, enclosures, and burials were also identified.

In 1970, Emory mentioned the two Keahuolu *heiau* sites in his inventory of archaeological and historical sites in the districts of Kona, Ka'u, and Anaehoomalu (1970). Newman in 1970 surveyed the old Kona Airport grounds, which later became a State Park, and described three sites in Lanihau, and one in Keahuolu consisting of historic period burials and a cluster of ground "bait cups" (Newman 1970b).

In 1975 Sinoto surveyed a road corridor in coastal Keahuolu, north of the current project area. He identified seven sites, all small, semi-permanent or temporary structures associated with coastal marine activities (Sinoto 1975:3).

Several additional reconnaissance surveys were completed between 1973 and 1980 in conjunction with development of the old Kona Airport State Park in Keahuolu and Lanihau (Neighbor Island Consultants 1973; Fuke and Goldstein 1978; Estioko-Griffin and Lovelace 1980; Neller 1980). The most frequently identified site types were caves, petroglyphs, burials, and house sites (Estioko-Griffin and Lovelace 1980:iii).

In 1978, a reconnaissance survey of all Keahuolu lands between the shoreline and Queen Ka'ahumanu Highway was undertaken by Ching. He identified 59 sites containing 140 component features, the most frequent of which were salt pans (29), cave shelters (25), pavings (21), and cairns (21) (Ching 1978:32).

Another reconnaissance and testing survey was performed in selected coastal Keahuolu parcels by Folk in 1980 (Folk 1980). His reconnaissance revealed no sites; however, in test excavating a *kipuka* near the shoreline, he found seven pavements, three caves, two platforms, four historic/recent campsites, a burial or shrine, a historic animal enclosure, and three habitation areas (Folk 1980::21-22).

Inland Keahuolu

Numerous archaeological projects have been conducted in the vicinity of the project area, within the *ahupua'a of* Keahuolu. Two projects have included the current project area. In 1983, Rosendahl (1983) surveyed a 100-acre parcel located east of Queen Ka'ahumanu Highway and along the north side of Palani Road. He identified seven sites/site complexes, of which two (Complexes D and E) appear to extend into

the current project area. Complex D was described as consisting of a large low platform, mounds, alignments, modified outcrops and cleared areas, while Complex E consisted of numerous walls, platforms, enclosures, caves, pavements and alignments. In 1989, Donham conducted a survey of the 1,100-acre Queen Lili'uokalani Trust Property project, an area which includes the entire current project area (Donham 1990a). She relocated Rosendahl's Complexes D and E, and separated the component features into eight sites (Sites 13370-13376, 13381 and 13382). Two of these, Sites 13372 and 13373, appear to have been within the current project area. Site 13372 appears to have been destroyed by earth-moving equipment subsequent to Donham's survey. These sites comprise over 21 features, including platforms, enclosures, cairns, mounds, *pâhoehoe* excavations and terraces, and the sites have functions ranging from agriculture and habitation to possible ceremonial and possible burial. The sites were assessed as important for information content and as excellent examples of site types, and all were recommended for preservation within an archaeological preserve area.

Donham's 1989-1990 survey and excavations identified 239 sites with 1,810+ component features at the c. 1,100 acre proposed Queen Liliuokalani Trust Property project area. The predominant feature types identified were *pāhoehoe* quarry and agricultural excavations, rock mounds, and modified blisters or outcrops. These together comprised 76% of all features (1,374 of 1,810) and were interpreted as agricultural features. Other features identified included small terraces, low platforms, C-shapes, enclosures, and rubble walls, which constituted another 9 to 14 % of the project's total features (Donham 1990a).

In 1989, PHRI conducted an inventory survey of the proposed Kealakehe Planned Development, which included a 150-acre parcel in Keahuolu east of the current project area (Burgett and Rosendahl 1993), and immediately east of the area Donham surveyed in 1989 and 1990. Sites and features identified were similar to those found during the 1989-1990 Donham survey. Donham concluded that the predominance of these features such as modified outcrops, terraces, small enclosures, and low mounded walls indicated relatively intensive use of the area for agriculture.

In 1990, PHRI conducted an archaeological inventory survey of a portion of the proposed Palani Road Improvements project area, adjacent and south of Palani Road, opposite the lower portion of the current project area. During this survey, 32 sites containing 44 component features were identified. Agricultural/boundary-related components account for up to 30 of the 44 features identified; the remaining 14 components include a single special-purpose cave (14218, cache), 13 features believed to represent temporary habitation, including one small cave, five bedrock outcrops which appear to have been modified for habitation use, and seven surface features (four C-shapes and three irregular- and U-shaped enclosures (Jensen 1990).

In 1993, O'Hare and Rosendahl (1993) surveyed an approximately 100-acre parcel south of Donham's project – the Queen Liliuokalani Trust KIS Expansion Site. She recorded 18 sites with 38 component features consisting of modified outcrops, *pāhoehoe* excavations, filled depressions, alignments, mounds, terraces, walls, hearths, walled overhangs, an enclosure, a kerbstone trail, a modified depression, a cairn, a cave shelter, and a burial cave. These features had the following functions: agriculture, temporary habitation, temporary habitation/possibly ceremonial, ceremonial (burial), historic dump, transportation, quarry, marker, and indeterminate.

Also in 1993, a field inspection was conducted by PHRI. The project area extended from the junction of Palani Road and Queen Ka'ahumanu Highway east for c. 1,157 ft, and was c. 20-36.5 m wide with the northern edge of Palani Road as the southern boundary and Site 1445-17 (temporary site number) located near the western boundary of the current project area. Sixteen of the sites were located inside the previously mentioned archaeological preserve (established during the Donham 1990a project, discussed above)(Sites 1445-1 to 1445-16, with Site 1445-16 being located on the very western edge of this preserve). This latter

site was assigned a permanent site number by the SHPD (Site 19763). This site contained seven features consisting of Feature A (platform), Feature B (rock mound), and several other mounds and agricultural features. Feature B, upon excavation, was found to contain a human burial, which was left in place (PHRI 1994). The remaining Sites (1445-1 to 1445-15) are in the general area of Donham's Sites 13372, 13373, and 13382 (Donham 1990a) and generally correspond to the Donham sites in formal and functional types. These three sites had not been fully recorded by Donham, due to the fact they are located within the archaeological preserve, and were to be subsequently inventoried in detail as part of the archaeological preserve program. The majority of the Donham features, those assigned an agricultural function, are considered part of the Kona Field System (Goodfellow and Walker 1993).

HISTORICAL BACKGROUND

The area of North Kona between Kailua Bay and Keauhou Bay to the south is generally recognized as containing the population core and the most fertile agricultural area of North Kona (Kirch 1985:166;Kelly 1983). To the north of Kailua Bay, beginning at Honokōhau, is the relatively dry Kekaha district of North Kona, with its barren lava inlands and coastal fishponds (Springer 1986:121). Keahuolu is situated in the transition zone between these two contrasting environmental districts, and is immediately north of Kailua Bay, a center of both political and economic activities since before Western contact.

The southern boundary of Keahuolu, at the shoreline, is located at Mahaihale, approximately 1.8 km north of Kukailimoku Point, named after the deity of victory in battle. Between Kukailimoku Point and the Keahuolu boundary is a narrow strip of coastal land that is within Lanihau *ahupua'a* (where much of the old Kona Airport is located). Consequently, the shoreline of Keahuolu is considerably narrower than expected, given the width of the *ahupua'a* less than 1.00 km inland of the coast. About 2.0 km of Keahuolu lands (N-S) are fronted by Lanihau along the shoreline.

Kukailimoku Point and the coastal sand dunes to the north and south were apparently repeatedly used during the prehistoric and early historic periods as burial grounds. Jackson's 1883 survey map locates graves at Kukailiomoku and a relatively large burial ground at Kaliliki Point to the south. Jackson referred to one massive masonry tomb as "Kamehameha's Tomb" (Neller 1980:5). Reinecke located additional graves in Lanihau and Keahuolu in 1930, and more recently Neller reported on exposed human remains at nine different locations along the coast, five in Lanihau and four at the Lanihau/Keahuolu boundary (Neller 1980:11-13). Historic period burials were also recently identified at Pawai Bay by Neighbor Island Consultants (1973).

According to Ellis:

> The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potatoe (sic), the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots (Ellis 1963:31).

The *ahupua'a* of Keahuolu was awarded to Ane Keohokalole during the Mahele of 1848. According to testimony documented during the Mahele, two walled houselots in Keahuolu had been held by Keohokalole's ancestors "from very ancient times" (Foreign Testimony 3:573). At least one of these lots was located along the shoreline. Keohokalole sold portions of her 15,000-20,000-acre grant to the government and other parties, with the balance being transferred to her heir, Liliuokalani.

There is little historic information concerning traditional Hawaiian land use for the inland portion of the project area in Keahuolu, and no *kuleana* grants were awarded there. Nineteenth century descriptions of inland Keahuolu by government surveyors reflect the same general environmental conditions present in the barren lava lands of Kekaha to the north. Emerson surveyed the area in the 1880s, and his map (Reg. Map 1280) denotes "rough *pāhoehoe*, little vegetation" in the Keahuolu *ahupua'a*. David Kalakaua (1869) described the lower inland portions of Keahuolu as being suitable for livestock grazing (*Appendix B*), an assessment found in numerous nineteenth century descriptions of North Kona *kula* lands.

No historic references specifically describing traditional agricultural activities in inland Keahuolu have been located; but, it is apparent from the archaeological record observed at Keahuolu, Kealakehe, and Honokohau 2nd, that agricultural activities (apparently prehistoric) were relatively intense in the area designated historically as grazing land.

Comparisons by Kelly (1983) between the *kuleana* lands claimed and lands actually awarded in North Kona indicate to her that dryland agriculture was being conducted historically until the time of the Mahele, when vast expanses of *Kula* lands were granted to *konohiki*, who utilized it as livestock grazing land (Kelly 1983:67). Kelly found that garden land claims located in the *Kula* zone were generally not awarded to the claimants.

The forested upland area of Keahuolu was historically the primary agricultural zone and the location of *kuleana* grants. In a letter dated July 8, 1869, from David K. Kalakaua to his sister, Lili'uokalani, a detailed description of Keahuolu is provided. Kalakaua writes:

> This land is situated in the District of North Kona, bounded by the *ahupua'a* of Lanihau (in Kailua) belonging to Prince Lunalilo on the Ka'u side, and on the Kohala side, by Kealakehe, a government land and Honokohaniki belonging to Ke'elikolani. Keahuolu runs clear up to the mountains and includes a portion of nearly one half of Hualalai mountains. On the mountains the koa, kukui and 'ohi'a abounds in vast quantities. The upper land or inland is arable, and suitable for growing coffee, oranges, taro, potatoes, bananas etc. Breadfruit trees grow wild as well as the Koli oil seed. The lower land is adopted for grazing cattle, sheep, goat, &c. The fishery is very extensive and a fine grove of cocoanut trees of about 200 to 300 grows on the beach. The flat land near the sea beach is composed chiefly of lava, but herbs and shrubbery grows on it and [it is] suitable for feed of sheep and goats. It is estimated at 15,000 to 20,000 acres or more.

During Emerson's 1880 Government Survey of North Kona, he identified the *makai* (seaward) edge of a forest zone, which he described as "lava covered with scattering forest and dense masses of *ki* root" (Kelly 1983:58). The land below this forest edge was described as "rocks covered with long grass" (Kelly 1983:58). According to Kelly's estimations, the forest edge occurred at an average elevation of 550 to 650 ft around Kailua and to the south (1983:58). However, it appears that the forest edge was somewhere between 750 and 800 ft elevation in Keahuolu (see reproduction of Emerson's map in Kelly 1983:59). This approximation places the nineteenth century forest edge very close to the eastern (*mauka*) boundary of the entire QLT project area. According to Emerson's documentation of nineteenth century vegetation, the project area would be within the *Kula* zone.

It was shortly after the systematic delineation of *Kula* lands as grazing land that Kuakini Wall was constructed. This wall extends from Kahalu'u Bay to the southern portion of Keahuolu, at an average distance of 1.6 km from the coastline. At the northern end in Keahuolu, the wall is at an elevation of 220 ft; further to the south, its average elevation is 160 ft. The purpose of the wall, as proposed by Kelly (1983:75), was to keep the free-ranging livestock contained within the *Kula* zone, and out of the coastal

settlements and gardens. Kuakini Wall does not cross Keahuolu, but extends 183.00 m north of Palani Road, at which point it turns west (or a later western extension was added) for a distance of approximately 380.00 m. Why the wall ends where it does, rather than at an *ahupua'a* boundary, trail, or some type of land division feature, is unknown. There is a definite concentration of habitation and agricultural features at the end of the wall, to the south of the western extension.

Sometime during the late 1890s, a sisal mill was established in Keahuolu along the south side of the old Palani Road corridor. This mill location is shown on a 1924 USGS topographic map, at 428 ft AMSL . Kelly reports that a 500-acre tract of land was cultivated in sisal, and was known as the McWayne sisal tract (Kelly 1983:89). Recent informant interviews conducted by Wong-Smith indicate that as much as 1,000 acres may have been in sisal cultivation in Keahuolu and Kealakehe. According to informant Mr. Minoru Inaba, the mill was surrounded by sisal fields and was in operation until 1924.

The location of the sisal tract is yet to be determined; if, however, it surrounded the mill, as indicated by Mr. Inaba, it would have been near the current project area. There are scattered clumps of sisal near the project area, and a very concentrated growth along a section of the old Palani Roadbed, at 600 ft AMSL. In the area of the concentrated sisal are a series of walled enclosures and ramps that abut the old roadbed (SIHP Site 13435). This site is apparently at too high an elevation to correlate with the mill; it may, however, be associated with the sisal transport operations.

In comparing Keahuolu land use with Kealakehe to the north, it appears that Keahuolu was exposed to far less livestock grazing than Kealakehe. Lands in Kealakehe between 200 and 600 ft AMSL appear to have been used in this manner for about a century. The absence of ranching features and the relatively good preservation of most surface features in Keahuolu attests to a more limited use of the area for cattle.

REGIONAL SETTLEMENT PATTERN

Several general settlement pattern models have been generated by researchers such as Cordy (1981, 1995, 2000), Newman (1970a), Kelly (1983), and others. Though differing in detail, these models generally divide up the region into five basic environmental zones: the Shoreline, Kula, Kalu'ulu, 'Apa'a, and 'Ama'u.

The Shoreline zone extends, typically, from the high-tide line inland approximately 200 meters. In Kailua this is the area from the shore to approximately Ali'i Drive. In this zone, permanent settlement began in Kona c. A.D. 1000-1200 (Cordy 2000:248). Several large and densely populated royal centers were situated at several locations along the shoreline between Kailua and Hōnaunau (Cordy 1981;1995) such as Kailua, Hōlualoa, Kahalu'u, and Kealakekua (Cordy 2000:248). These included dwellings for rulers, chiefs, and the supporting populace, places of refuge, and other structures. Within these residential areas, large and small *heiau*, sporting areas, and burial clusters, are present. These may extend beyond the shoreline zone. Burials occur in caves, within finely built platforms, rock mounds, and houses in the shoreline, and are more often to be found in the near-shore Kula zone (Cordy 1995; Haun et al. 1998; Schilt 1984; Tainter 1973). Fishing and farming, of course, were the major exploitation avenues, with clearings in the forest uplands and small garden plots in the Kula zone. Thus, trails existed to facilitate transportation between the shoreline and the upper regions.

The Kula zone consists primarily of dry and open land with few trees and considerable grass cover. Soil development in Central Kona is limited however, with a fair amount of exposed lava bedrock. This land was planted primarily in scattered sweet potato patches. However, behind Kailua, breadfruit, taro, and forest banana were also grown in this zone (Cordy 2000:255), at least in the historic period. Use of this zone appears to have occurred as early as AD 1000s to 1300s. It is considered to extend to the 500 ft elevation mark, although it may extend further, to approximately the 600-800 ft elevation, the 40-50 inch rainfall line (c.f. Cordy 1995:17). Archaeologically, this zone is characterized by stone planting/clearing mounds, terraces, small soil clearings, and planting pits. Some permanent habitations are found, but at a much lower density than at the shore. Permanent habitation may have first started in the 1400's to 1600's, at least in the adjacent *ahupua'a* of Pua'a (Cordy 2000:255).

The Kalu'ulu is zone is referred to as the breadfruit zone. Early explorers described this zone as breadfruit with sweet potatoes and *wauke* (paper mulberry) underneath (cf. Menzies 1920:75-76). It may have been perhaps one-half mile wide (Kelly 1983:62). Here walled fields occur at the 600-800 ft elevation, which may be start of this breadfruit zone in this area.

The 'Āpa'a zone is described as a dryland taro and sweet potato zone. In historic accounts it is described as an area divided by low stone and earth walls into cleared rectangular fields in which sweet potato and dryland taro were planted. On the edges of the walls, sugarcane and ti were planted (cf. Menzies 1920:75-76). Also, bananas and *wauke* were present (cf. Ellis 1963:32). Newman estimated that this zone began at the 1,000 ft elevation and extended to the 2,500 ft elevation, although recent archaeological research has found formal walled fields beginning more commonly at the 600-800 ft elevation. In reality, it has been found that there is much variation within the Kona Field System (cf. Cordy 1995:10-13).

The 'Ama'u zone is the banana zone, which may extend from the 2,000 ft elevation to 3,000 ft, and is characterized by bananas and plantains being grown in cleared forest areas.

Chronology

This brief chronology uses terminology developed by Burtchard (1993) and Haun et al. (1998).

The Kona Field System was not brought to Kona as a fully developed system. Rather, it grew out of, and integrated with, the evolving socio-political structure and increasing population in the island chain. The first inhabitants of Hawai'i Island probably arrived by at least AD 600, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1993; Kirch 1985; Hommon 1976). To date, there is no archaeological evidence for occupation of the Kona region during this initial, or Colonization (AD 300 to 600) stage of island occupation.

There is also little indication that during the subsequent period, Early Expansion (AD 600 to 1100), much activity was taking place in Kona (Burtchard 1993: Table 3-3). Through the first half of the Early Expansion Period, permanent habitation was still concentrated on the windward side. It is likely that windward residents traveled to the leeward Kona coast to fish and collect other resources (Cordy 1995). By the latter half of the Early Expansion Period, permanent habitation was beginning in Kona (Cordy 1981, 1995; Schilt 1984). Habitation was concentrated along the shoreline and lowland slopes, and informal fields were probably situated in the *Kula* and higher elevations, areas with higher rainfall.

Agricultural fields and habitation areas expanded across the slopes and coastal area of Hualālai during the Late Expansion Period (AD 1100 to 1400) (Burtchard 1993; Cordy 1995). The earliest fields may have been located in the southern portion of the system (Schilt 1984; Wolforth and Rosendahl 1998), with new fields expanding northward over time (Haun et al. 1998).

The development of the extensive formal walled fields sometime during the initial stages of the Intensification Period (AD 1400 to 1600) is taken as a mark of the initiation of the Kona Field System (Schilt 1984). The development of formal walled fields may be in part a by-product of the need to extract more subsistence resources from an increasingly limited agricultural base, since the population in Kona had increased dramatically during this period. Radiocarbon dates from habitation structures, shelter caves, and agricultural soils are plentiful from this period (Burtchard 1995; Haun et al. 1998; Schilt 1984). During this period, the stratified chiefdom structure becomes clearly developed in the archaeological record. Large residential complexes and *heiau* reflect the segregation of places and power for the growing hierarchy of high and lower chiefs, and ceremonial stewards (Cordy 1981; Haun et al. 1998; Hommon 1976). The produce from the formal walled fields was distributed to higher chiefs through a hierarchy of lower chiefs responsible for management and collection of the cultivated and wild resources.

By the time of the Competition Period (AD 1600 to 1800), the chiefly centers and larger *heiau* were in place, reflecting the growth in power of the rulers and chiefs in the region (Barrera 1971; Hammatt and Folk 1980). Resources may have reached their maximum carrying capacity, resulting in social stress between neighboring groups. Hostility between groups is reflected archaeologically with the development of refuge caves during this period (Schilt 1984). This volatile period was probably accompanied by internal rebellion and territorial annexation (Hommon 1986; Kirch 1985). It is thought by some researchers that population declined during this period, but several researchers, e.g. Cordy (1995), contend that population continued to grow up to the time of European contact (Burtchard 1993). Afterwards, during the next time period, that of the last of the ruling chiefs (1800 to 1819), settlement and land use patterns stayed primarily the same as previously. But the next period, the period of the merchants and missionaries, 1820 to 1847, saw the introduction of foreign ideas, plants, animals, diseases, religion, and trade, and the end of the *kapu* system. The royal centers were no longer functioning as focal points for religious and political activity, and the population at the royal centers and the population of the commoners dropped overall. During the next period, the Great Mahele and Its Legacy, 1848-1899, the implementation of privately owned land resulted in major changes to the settlement and land use patterns in Kona. By the end of this period, foreign landowners and business people had greater control over broad land use practices. The upland agricultural fields were modified to coffee growing, and permanent habitations were built with modern materials upland and along the shore. The population, due to disease, reached a low during this period, but began to climb as foreign laborers and more business people arrived. Finally, during the last period 1900-1959, the Territorial Period, the population remained relatively stable and lowland occupation was concentrated in the small villages of Kailua and Keauhou, with permanent residences with gardens and pens scattered along the shoreline, while upland habitation was associated with agricultural and ranching pursuits (Haun et al. 1998).

ARCHAEOLOGICAL SURVEY

FIELD METHODS

The archaeological field survey began on March 1, 2007 and concluded on July 9, 2007. Conducting the survey were PHRI Supervisory Archaeologist Alan B. Corbin, M.A., assisted by Field Technician Leonard Kubo, B.A. The initial stage of site re-location involved the study of previously compiled site inventory maps, overall project maps, and aerial photos in order to determine the probable locations of sites that had been previously identified during the inventory stage. If the site was not found at its probable location, a further methodology was employed. Using office-compiled distance and bearing from known points in the landscape, compass and tape were used in the field to estimate the site's probable location. If the site was not found at that location, a circular grid was established at that point, and surveyors walked 33-50.0 meter transects that radiated in all directions out from that point. In this manner, despite extremely overgrown and dense vegetation that limited visibility to under ten feet at times, all sites were eventually located. All re-located sites were flagged with white-and-red stripped flagging. Subsequent to the re-location and flagging, all re-located sites were located using GPS equipment and personnel provided by Tom Dye & Associates. Sites were located with GPS as single points for smaller, single-feature sites, or by multiple points that established a polygonal area.

FINDINGS AND CONCLUSION

During the course of the survey, 12 archaeological sites were re-identified and re-located within the project area (*Table 1 and Figure 1*). These sites had been previously identified during the course of an archaeological survey conducted in 1990, during which time significance assessments and recommendations for the sites were presented (Donham 1990) (SHPD approval letter of 2/17/93, Log 6839, Doc. 9302RC34; see *Appendix*). The assessments and recommendations were reiterated in an archaeological mitigation plan for the project area (Jensen et al. 1992)(SHPD approval letter of 12/21/93, Log 10361, Doc. 9312RC02; see *Appendix*); later the plan was amended by PHRI Letter Report 1152-052493, which outlined the sampling block methodology to be used during mitigation (dated June 10, 1993; PHRI Letter 1152-052493, to D. Hibbard, SHPD, from A. Walker, PHRI; SHPD approval letter dated 7/28/1993, Log 8976, Doc 9307RC40; see *Appendix*). The final significance assessments and recommendations are summarized in *Table 1*.

One of the sites slated for preservation and interpretive development, Site 13396, a platform originally located a short distance west of Sites 13394 and 13395, was not relocated during the course of the survey and apparently was destroyed by construction of a firebreak road corridor subsequent to the original Donham survey.

Four sites (Sites 13395, 13408, 13409 and 13410) are located within Block E (*Figure 1*). This block was established as a sample block of the Queen Liliuokalani Trust mitigation plan (Jensen et al. 1992). The block, 400 ft by 400 ft, was chosen so that data collected from it could be compared with similar-sized blocks on the Queen Liliuokalani Trust Property (Blocks A-D, and F). These results in turn could then be compared to similar sized blocks placed on the adjacent *ahupua'a* of Kealakehe. The blocks were placed so that they would, as a group, incorporate a wide variety of the site and feature types, and would incorporate various soil and bedrock types at different elevation levels. During future data recovery work, each feature within Block E is to be recorded in detail, and sites within the block are to undergo further data collection. Further data collection at Sites 13395, 13408, and 13409 will include testing features to determine whether human skeletal remains are present.

Table 1. Summary of General Significance Assessments and Recommended General Treatments

SIHP Site Number	Formal Site Type	Functional Interpretation	Significance Category					General Recommendations			
			A	B	C	D	E	FDC	NFW	PID	PAI
13394	Alignment	Agriculture	-	-	-	+	-	+	-	-	+
13395	Platform	Habitation/possible burial	-	-	+	+	*	+	-	+	*
13398	Platform, wall, cairn	Habitation/agricultural	-	-	+	+	-	+	-	+	-
13400	Wall, enclosure	Agricultural/land division	-	-	+	+	-	+	-	+	-
13408	Platform, terrace, five walls, two enclosures, 10+ *pahoehoe* excavations	Habitation/agricultural/possible burial	-	-	+	+	*	+	-	+	*
13409	Three platforms, two walls, an enclosure, and three terraces	Habitation/agricultural/possible burial	-	-	+	+	*	+	-	+	*
13410	Platform	Habitation	-	-	+	+	-	+	-	+	-
13441	Seven platforms, five terraces, wall remnant, wall, mound, cave, enclosure	Habitation/agriculture	-	-	+	+	-	-	+	+	-
13450	Steppingstone trail	Transportation	-	-	-	+	-	+	-	-	-
13452	Paved trail	Transportation	-	-	-	+	-	+	-	-	-
13471	Upright, platform, cave	Habitation/agricultural/ceremonial	-	-	-	+	-	+	-	-	-
13474	Cave	Habitation	-	-	-	+	-	+	-	-	-

General Significance Categories:
A = Important for historical contribution to significant events and/or broad patterns of history
B = Important for association with the lives of important individuals in history
C = Excellent example of site type at local, region, island, State, or National level
D = Important for information content
E = Culturally significant

Recommended General Treatments:
FDC = Further data collection necessary (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations)
NFW = Nor 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 further data collection necessary
**=Provisional assessment; definite assessment pending completion of further data collection*

CULTURAL IMPACT ASSESSMENT STUDY

PURPOSE, BACKGROUND, AND OBJECTIVES

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

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

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

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

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

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

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

Traditional cultural property claims would be those which lie within the purview of the current historic preservation review process (DLNR 2001a,b); that is, they are claims involving the traditional practices and beliefs of a local ethnic community or members of that community that (a) are associated with a definable physical property (an entity such as a site, building, structure, object, or district), (b) are founded in the history of the local community, (c) contribute to the maintenance of the cultural identity of the community, and (d) demonstrate a historical continuity of practice or belief up to the present–through either actual practice or historical documentation. Furthermore, to qualify as a legitimate traditional cultural property within the historic preservation context, a potential traditional cultural property must be able to demonstrate its historical significance in terms of established evaluation criteria, such as those of the National Register of Historic Places and/or the Hawai'i Register of Historic Places.

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

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

While traditional cultural property claims, as defined above, would certainly fall within the general domain of traditional and customary cultural practice claims, not all traditional and customary cultural practice claims would necessarily qualify as traditional cultural property claims. Traditional and customary cultural practice claims subsume a broad range of cultural practices and beliefs associated with a general geographical area or region, rather than a clearly definable property or site–for example, the gathering of marine resources from along a section of shoreline for traditional subsistence or ceremonial purposes, in contrast to the gathering of a specific marine resource species for a specific use by current generation members of a family that had obtained the same resource from the same recognized site for several generations.

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

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

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

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

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

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

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

CULTURAL IMPACT ASSESSMENT AND OEQC GUIDELINES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BASIC GUIDANCE DOCUMENTS

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

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

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

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

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

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

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

7. Recently approved versions of the State Historic Preservation Division (SHPD) administrative rules (effective December 11, 2003), including Chapter 275: Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS (DLNR 2002a), and Chapter 284: Rules Governing Procedures for Historic Preservation Review to Comment on Chapter 6E-42, HRS, Projects (2002b), as well as an earlier draft Chapter 284--Rules Governing Procedures for Ethnographic Inventory Surveys, Treatment of Traditional Cultural Properties, and Historical Data Recovery (DLNR n.d.).

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

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

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

PRESENT STUDY SCOPE AND METHODOLOGY

The scope of work and methodology for the current project is based on the general assumption that the level of study effort appropriate in any project-specific context should involve the consideration of several factors, the most relevant of which are the following: (a) the probable number and significance of known or

suspected cultural properties, features, practices, or beliefs within or associated with the specific project area; (b) the potential number of individuals (potential informants) with cultural knowledge of the specific project area; (c) the availability of historical and cultural information on the specific project area or immediately adjacent lands; (d) the physical size, configuration, and natural and human modification history of the specific project area; and (e) the potential effects of the project on known or expected cultural properties, features, practices, or beliefs within or related to the specific project area.

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

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

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

CIA STUDY BY HELEN WONG-SMITH

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

The informant research for this project initially involved compiling a list of potential informants for the Keahuolu project area (TMK:3-7-4-21:020). Later, at the request of Belt Collins Hawaii, the study was expanded to include an additional small reservoir site in Keahuolu (TMK:3-7-4-21:020,Por.14,Por.21). *Figure 2* depicts the areas covered by this CIA study. The list of potential informants was compiled by contacting informants known through past projects, and through inquiries with departments and cultural specialists such as Kepā Maly, OHA, Ruby McDonald, and Keola Lindsey, formerly of the Hawaii Island SHPD office. One contact usually led to another until a list of over thirty potential informants was compiled (*Table 2*). The potential informants were contacted by phone and e-mail and those responsive were interviewed preliminarily to assess their potential to and willingness to provide information. To further assess informants, informants were asked to fill out written forms to answer some preliminary questions such as: Who are in your immediate family? What was your previous occupation and education? What is your family background? What are your residential ties? Do you know of any specific historic/cultural properties, practices, and/or beliefs relevant to the project area? This was followed up with phone conversations. Historical Researcher and Cultural Specialist Helen Wong-Smith was then contracted to conduct further interviews with a few selected individuals who had potential to provide further information, and to provide further documentary information on the Keahuolu project area. Ms. Wong-Smith's CIA study is presented in its entirety in *Appendix B*.

The historical documentary study by Helen Wong-Smith suggests limited cultural activity within the project area. Most of the events and documentary evidence concerns the more seaward portion of Keahuolū. Texts indicate that the shoreline area was a rich marine resource. The coastal area also in included springs, and brackish water ponds from which people harvested, among other things, shrimp. *Heiau* were located near the shore: Kawaluna, Palihiolo, and Halepana. Inland areas were used primarily for agriculture. Planting evidently was widespread and took place wherever there was a little soil. Even rocky areas were planted with crops such as sweet potatoes, which could thrive in small pockets of soil and mulch.

The Helen Wong-Smith informant study, despite considerable effort, yielded only limited information. Pili grass (*Heteropogon contortus*) was apparently harvested from the project area at some time in the past. Clarence Medeiros, Jr. states that he continues to gather pilo (*Capparis sandwichiana*) for medicinal uses. Mahealani Pai indicates that the project area contains plants such as *alahe'e*, *kauila*, and *uhiuhi*, which were important, useful plants in pre-Contact times. No informant, however, had knowledge of any other cultural/traditional use of the project area.

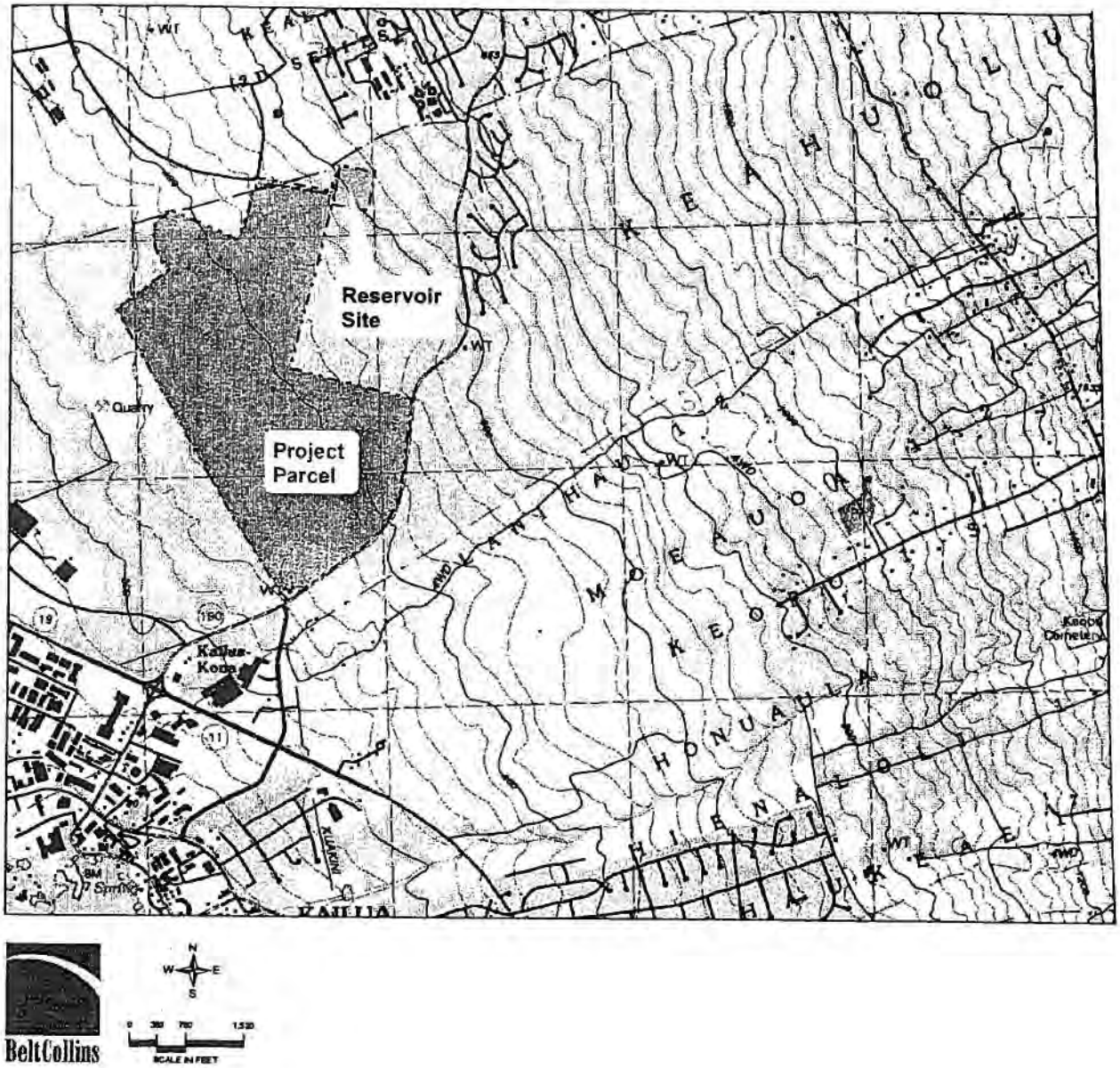

Figure 2. CIA Study Area

Table 2. List of Potential Informants

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

TABLE KEY:

Affiliation:

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

CURRENT HISTORIC PRESERVATION STATUS

At the time of this writing, SHPD has approved the archaeological inventory survey (Donham 1990a) and the archaeological mitigation plan for the project area (Jensen et al. 1992). The SHPD reviewed the Donham (1990a) report and approved it via a letter dated 2/17/93, Log 6839, Doc. 9302RC34. The SHPD reviewed an amended PHRI Archaeological Mitigation Plan and approved it via a letter dated July 28, 1993, Log 8976, Doc 9307RC40. Copies of the SHPD approval letters are in *Appendix A*.

The archeological mitigation plan outlines all of the data recovery work that remains to be done in the project area. Data recovery work (detailed recording, surface collections, possible excavations) needs to take place at eleven sites in the project area. In addition, the entire Sample Block E needs to be recorded in detail (definition of the block, vegetation clearing, and detailed mapping of the entire block). A report on the data recovery work would have to be written and would have to be approved by the SHPD.

The data recovery works would also include burial testing at Sites 13395, 13408, and 13409. If human skeletal remains are found at any of the sites, a burial treatment plan for the project area will have to be prepared and implemented. This plan will be prepared in consultation with the SHPD and the Hawai'i Island Burial Council, and also requires the final approval of these two agencies. The plan will include a search for lineal and cultural descendents, detailed descriptions of each burial and burial treatments, including preservation buffers and possible structural protection measures.

For the sites currently recommended for preservation "as is" or with some level of interpretive development (other than burials), a preservation plan detailing preservation treatments (preservation buffer zones, interpretation measures, maintenance, etc.) will have to be prepared, approved by the SHPD, and implemented.

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